



nesbitt engineering, inc.
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227 North Upper Street
Lexington, KY 40507-1016

General and Technical Specifications

**Contract 1 Distribution System
KY 315/28 Waterline Project
Breathitt County Water District
Jackson, Kentucky**



November, 2016

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ADVERTISEMENT FOR BIDS

Breathitt County Water District
1137 Main Street
Jackson, KY 41339

Sealed bids for: **KY 315/28 Waterline Extension Phase 1, Contract 1 – Waterlines and Contract 2 – Water Storage Tank** will be received by the **Breathitt County Water District** at the Breathitt County Court House until **November 14, 2016 at 11:00 am local time** at which time the Bids received will be publicly opened and read aloud. Bids will be received for a single prime Contract. Bids shall be on a unit price basis.

Contract #1

Work is to include installation of approximately 17,680 LF of 8-inch, 22,320 LF of 6-inch, 20,640 LF of 4-inch, 6,800 LF of 3-inch and 3,630 LF of 2-inch waterline with 3,100 LF of various sized directionally drilled creek/river crossings and other appurtenances, Installation of two (2) duplex pump stations, a pressure reducing vault, a hydro pneumatic pump station, telemetry and electrical service and 117 service connections.

Contract #2

Work is to include installation of a 109,000 gallon ground storage tank – KY 315 and a 33,000 gallon ground storage tank – KY 28, Valve Vault at KY 315 tank, Access Road improvement, Excavation, final grading, site restoration and Fencing

The Plans and Specifications and other contract documents may be examined at the following locations:

Breathitt County Water District
1137 Main Street
Jackson, KY 41339

Builders Exchange
1035 Strader Dr Suite 100
Lexington, KY 40505

Bidding Documents may be obtained at the office of **Lynn Imaging, Inc.,** located at **328 East Vine Street, Lexington, KY 40507, 859-255-1021,** upon payment of **\$150.00** non-refundable for each set. The owner reserves the right to waive any informality or to reject any or all bids.

Questions regarding this project must be received by Nesbitt Engineering, Inc. (859-233-3111, msteen@nei-ky.com) in writing no later than **5:00 pm on November 8, 2016.**

This contract will be funded by Abandoned Mine Lands. Bidders must comply with Title VI of the Civil Rights Act of 1964, the Anti-Kickback Act, Non segregated facilities order 32FR 7439, and the Contract Work Hours Standard Act. This project will be in compliance with, and bidders must comply with Executive Order No. 11246 (EEO) as amended, prohibiting discrimination in employment regarding race, creed, color, sex or national origin. Contractors/subcontractors will comply with 41 CFR 60-4, (affirmative action), to insure equal opportunity to females and minorities and will apply the time tables and goal set forth in 41 CFR 60-4. This contract is subject to state and federal wage rates. Bidders will make positive efforts to use small, minority, women owned and disadvantaged businesses. DBE's are encouraged to bid.

No bidder may withdraw his bid within **90** days after the actual date of the opening thereof. Bid award will be made to the lowest, responsive, responsible bidder.

11/3/16
(Date)

Bobby Thorpe, Jr
Chairman

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

SUGGESTED INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACTS

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly By



PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
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American Council of Engineering Companies
1015 15th Street, N.W., Washington, DC 20005

American Society of Civil Engineers
1801 Alexander Bell Drive, Reston, VA 20191-4400

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ARTICLE 1 - DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. *Issuing Office*--The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.

ARTICLE 2 - COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents in the number and for the deposit sum, if any, stated in the Advertisement or Invitation to Bid may be obtained from the Issuing Office. The deposit will be refunded to each document holder of record who returns a complete set of Bidding Documents in good condition within 30 days after opening of Bids.

2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not confer a license or grant for any other use.

ARTICLE 3 - QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder's qualifications to perform the Work, within five days of Owner's request, Bidder shall submit written evidence such as financial data, previous experience, present commitments, and such other data as may be called for below.

A. Refer to Section 00420 Bidder's Qualification Statement.

ARTICLE 4 - EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA, AND SITE

4.01 On request, Owner will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates.

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

A. examine and carefully study the Bidding Documents, the other related data identified in the Bidding Documents, and any Addenda;

B. visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy Bidder as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work;

D. obtain and carefully study (or accept consequences of not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and

Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto;

E. agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents;

F. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;

G. correlate the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents;

H. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder; and

I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.

4.08 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

ARTICLE 5 - PRE-BID CONFERENCE

5.01 A pre-Bid conference will not be held for this project.

ARTICLE 6 - SITE AND OTHER AREAS

6.01 The Site is identified in the Bidding Documents. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Bidding Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by Contractor.

ARTICLE 7 - INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by Engineer as having received the Bidding Documents. Questions received less than ten days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by Owner or Engineer.

ARTICLE 8 - BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5 percent of Bidder's maximum Bid price and in the form of a certified check or bank money order or a Bid bond (on the form attached) issued by a surety meeting the requirements of Paragraphs 5.01 and 5.02 of the General Conditions.

8.02 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may annul the Notice of Award and the Bid security of that Bidder will be forfeited. The Bid security of other Bidders whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Agreement or 91 days after the Bid opening, whereupon Bid security furnished by such Bidders will be returned.

8.03 Bid security of other Bidders whom Owner believes do not have a reasonable chance of receiving the award will be returned within seven days after the Bid opening.

ARTICLE 9 - CONTRACT TIMES

9.01 The number of days within which, or the dates by which, [Milestones are to be achieved and] the Work is to be substantially completed and ready for final payment are set forth in the Agreement.

ARTICLE 10 - LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, are set forth in the Agreement.

ARTICLE 11 - SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration of possible substitute or "or-equal" items. Whenever it is specified or described in the Bidding Documents that a substitute or "or-equal" item of material or equipment may be furnished or used by Contractor if acceptable to Engineer, application for such acceptance will not be considered by Engineer until after the Effective Date of the Agreement.

ARTICLE 12 - SUBCONTRACTORS, SUPPLIERS, AND OTHERS

12.01 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for

which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity if requested by Owner. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute, without an increase in the Bid.

12.02 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, individuals, or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to revocation of such acceptance after the Effective Date of the Agreement as provided in Paragraph 6.06 of the General Conditions.

12.03 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.

ARTICLE 13 - PREPARATION OF BID

13.01 The Bid Form is included with the Bidding Documents.

13.02 All blanks on the Bid Form shall be completed by printing in ink or by typewriter and the Bid signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each [section, Bid item, alternative, adjustment unit price item, and unit price item] listed therein.

13.03 A Bid by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown below the signature.

13.04 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown below the signature.

13.05 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown below the signature.

13.06 A Bid by an individual shall show the Bidder's name and official address.

13.07 A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid Form. The official address of the joint venture shall be shown below the signature.

13.08 All names shall be typed or printed in ink below the signatures.

13.09 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.

13.10 The address and telephone number for communications regarding the Bid shall be shown.

13.11 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the Contract. Bidder's state contractor license number, if any, shall also be shown on the Bid Form.

ARTICLE 14 - BASIS OF BID; COMPARISON OF BIDS

14.01 Unit Price

- A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the Bid schedule.
- B. The total of all estimated prices will be the sum of the products of the estimated quantity of each item and the corresponding unit price. The final quantities and Contract Price will be determined in accordance with Paragraph 11.03 of the General Conditions.
- C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

14.02 The Bid price shall include such amounts as the Bidder deems proper for overhead and profit on account of cash allowances, if any, named in the Contract Documents as provided in Paragraph 11.02 of the General Conditions.

14.03 Bid prices will be compared after resolution of discrepancies, if any, as described above.

ARTICLE 15 - SUBMITTAL OF BID

15.01 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the Advertisement or Invitation to Bid and shall be enclosed in an opaque sealed envelope plainly marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate envelope plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid shall be addressed to the client at the address provided in the "advertisement for bids".

ARTICLE 16 - MODIFICATION AND WITHDRAWAL OF BID

16.01 A Bid may be modified or withdrawn by an appropriate document duly executed in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.

16.02 If within 24 hours after Bids are opened, any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned.

ARTICLE 17 - OPENING OF BIDS

17.01 Bids will be opened at the time and place indicated in the Advertisement or Invitation to Bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 18 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to not be responsible. Owner may also reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to that Bidder. Owner also reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.

19.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

19.03 In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.

19.04 In evaluating Bidders, Owner will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted as provided in the Supplementary Conditions.

19.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities to perform the Work in accordance with the Contract Documents.

19.06 If the Contract is to be awarded, Owner will award the Contract to the Bidder whose Bid is in the best interests of the Project.

ARTICLE 20 - CONTRACT SECURITY AND INSURANCE

20.01 Article 5 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it shall be accompanied by such bonds.

ARTICLE 21 - SIGNING OF AGREEMENT

21.01 When Owner gives a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents which are identified in the Agreement as attached thereto. Within 15 days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within ten days thereafter, Owner shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.

This document has important consequences; consultation with an attorney is encouraged with respect to its completion or modification. This document should be adapted to the particular circumstances of the contemplated Project and the Controlling Law.

SUGGESTED BID FORM FOR CONSTRUCTION CONTRACTS

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

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BID FORM

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ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

**Breathitt County Water District
1137 Main Street
Jackson, KY 41339**

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER'S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 90 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged.

<u>Addendum No.</u>	<u>Addendum Date</u>
---------------------	----------------------

_____	_____
_____	_____
_____	_____

B. Bidder has visited the Site and become familiar with and is satisfied as to the general, local and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress and performance of the Work.

D. Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.

E. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder.

- F. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.

ARTICLE 4 – FURTHER REPRESENTATIONS

4.01 Bidder further represents that:

- A. this Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

ARTICLE 5 – BASIS OF BID

- 5.01** Bidder will complete the Work in accordance with the Contract Document for the price(s) as shown on the Bid Schedule following Article 9.01 of this Section 00410 of these Specifications.
- 5.02** Unit prices have been computed in accordance with Paragraph 11.03.B of the General Conditions.
- 5.03** Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

ARTICLE 6 – TIME OF COMPLETION

- 6.01** Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 14.07.B of the General Conditions within the number of calendar days indicated in the Agreement.
- 6.02** Bidder accepts the provisions of the Agreement as to Liquidated Damages in the event of failure to complete the Work within the Contract Time.

ARTICLE 7 – ATTACHMENTS TO THIS BID

- 7.01** The following documents are attached to and made a part of this Bid:
- A. Required Bid security in the form of 5%
 - B. List of Proposed Subcontractors
 - C. List of Proposed Suppliers
 - D. List of Project References for the last 5 years.

E. Required Bidder Qualification Statement with Supporting Data

ARTICLE 8 – DEFINED TERMS

8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions and the Supplementary Conditions.

ARTICLE 9 – BID SUBMITTAL

THIS BID SUBMITTED BY:

If Bidder is:

An Individual

Name (typed or printed): _____

By: _____ (SEAL)
(Individual's signature)

Doing business as: _____

A Partnership

Partnership Name: _____ (SEAL)

By: _____
(Signature of general partner -- attach evidence of authority to sign)

Name (typed or printed): _____

A Corporation

Corporation Name: _____ (SEAL)

State of Incorporation: _____

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

By: _____
(Signature -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____
(CORPORATE SEAL)

Attest _____

Date of Authorization to do business in [State Where Project is Located] is ____/____/____.

A Joint Venture

Name of Joint Venture: _____

First Joint Venturer Name: _____ (SEAL)

By: _____
(Signature of first joint venture partner -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Second Joint Venturer Name: _____ (SEAL)

By: _____
(Signature of second joint venture partner -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

(Each joint venturer must sign. The manner of signing for each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above.)

Bidder's Business Address _____

Phone No. _____ Fax No. _____

SUBMITTED on _____, 20____.

State Contractor License No. _____. (If applicable)

Breathitt County Water District, KY 315/28 Waterline Extension Project Phase 1, Contract 1 - Waterlines

Base Bid Schedule

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	8" PVC SDR 17 Waterline	LF	3,150	\$	\$
2	8" PVC DR 14 Waterline	LF	4,150	\$	\$
3	8" D.I. Class 350 Waterline	LF	9,980	\$	\$
4	8" D.I. Class 350 Waterline With Nitrile Gaskets	LF	400	\$	\$
5	6" PVC DR 14 Waterline	LF	16,320	\$	\$
6	6" D.I. Class 350 Waterline	LF	5,500	\$	\$
7	6" D.I. Class 350 Waterline With Nitrile Gaskets	LF	500	\$	\$
8	4" PVC DR 14 Waterline	LF	15,610	\$	\$
9	4" PVC SDR 17 Waterline	LF	4,780	\$	\$
10	4" D.I. Class 350 Waterline With Nitrile Gaskets	LF	250	\$	\$
11	3" PVC SDR 17 Waterline	LF	6,800	\$	\$
12	2" PVC SDR 17 Waterline	LF	2,250	\$	\$
13	8" D.I.M.J. Gate Valve & Box	EA	11	\$	\$
14	6" D.I.M.J. Gate Valve & Box	EA	9	\$	\$
15	4" D.I.M.J. Gate Valve & Box	EA	13	\$	\$
16	3" D.I.M.J. Gate Valve & Box	EA	3	\$	\$
17	2" D.I.M.J. Gate Valve & Box	EA	0	\$	\$
18	Flush Hydrant Assembly, Type 1	EA	15	\$	\$
19	Flush Hydrant Assembly, Type 3	EA	17	\$	\$
20	5/8" x 3/4" Radio Read Meters	EA	117	\$	\$
21	Tandem Meter Setter w/ IPRV	EA	117	\$	\$
22	1" PE CL250 Service Tubing	LF	2,680	\$	\$
23	3/4" PE CL250 Service Tubing	LF	3,650	\$	\$
24	3/4" Type K copper Service Tubing	LF	2,000	\$	\$
25	Pressure Reducing Valve & Vault	EA	1	\$	\$
26	Combination Air Relief Valve Assembly	EA	6	\$	\$
27	Flow Monitor Pit Assembly	EA	5	\$	\$
28	10" DR 9 HDPE PE 4710 Directional Drill W/ Leak Detection, Plan sheet C-2	LS	1	\$	\$
29	10" DR 9 HDPE PE 4710 Directional Drill W/ Leak Detection, Plan sheet C-44	LS	1	\$	\$
30	10" DR 9 HDPE PE 4710 Directional Drill	LF	600	\$	\$
31	8" DR 9 HDPE PE 4710 Directional Drill	LF	800	\$	\$
32	6" DR 9 HDPE PE 4710 Directional Drill	LF	600	\$	\$
33	4" DR 9 HDPE PE 4710 Directional Drill	LF	200	\$	\$
34	HWY X-ing Bore & Jack 10.75" STL Casing w. Carrier Pipe	LF	60	\$	\$
35	HWY X-ing Bore & Jack 14" STL Casing w. Carrier Pipe	LF	227	\$	\$
36	Waterline Marker	EA	40	\$	\$
37	KY 28 Duplex Pump Station	LS	1	\$	\$
38	Town Hill Duplex Pump Station	LS	1	\$	\$
39	Scada Telemetry Package and 3 Phase Electrical Service	LS	1	\$	\$
40	Hydro Pneumatic Pump Station	LS	1	\$	\$
Total Base Bid - (items numbered 1 - 40) =					\$
Total Base Bid (written) =					
dollars _____ cents					

Note No change in material and/or equipment will be approved prior to bids being received. Materials/equipment shall be bid as specified in plans and specifications. Any claim for price increase due to the contractor bidding a different material/equipment will be denied. Contracts will be awarded based upon the total base bid amounts. The owner reserves the right to adjust bid items and quantities so as to award the contract within the limits of available funding (see section 810-2.2)

SECTION 00420

BIDDER'S QUALIFICATION STATEMENT

Submitted by:

Name of Organization _____

Name of Individual _____

Title _____

Address _____

Telephone () - _____

Email Address _____

Business Organization: ____ Corporation ____ Partnership ____ Joint Venture
____ Sole Proprietorship

Name of surety company and name, address & telephone number of agent:

Project Name: _____

Tables: (These tables must be submitted with the bid form.)

Table A – list construction projects completed by this organization in the past five (5) years.

Table B – list construction projects that are currently under construction by this organization.

Table C – Details of construction experience of the principal individuals of your organization involved with construction operations.

Table D – list all subcontractors to be used on this project.

Table A – Construction Project (Past 5 years)

Reference Name (phone & address)						
Date Complete						
Contract Price						
Design Engineer						
Description of Project						
Owner						
Project Name						

00420-2

Table B – Current Construction Project(s)

Reference Name (phone & address)						
Percent Complete						
Contract Price						
Design Engineer						
Description of Project						
Owner						
Project Name						

00420-3

Table C – Personal Experience

Prior position and experience in construction						
Date started in construction						
Date started with this organization						
Position						
Name						

00420-4

Table D – Subcontractor Listing

Dollar amount						
Type of work						
Contact Information Phone #, address						
Subcontractor Name						

Signature

(BIDDING CONTRACTOR)

Title

Date

END OF SECTION

00420-5

Solicitation/Contract #: _____

REQUIRED AFFIDAVIT FOR BIDDERS, OFFERORS AND CONTRACTORS

PAGE 1 OF 2

FOR BIDS AND CONTRACTS IN GENERAL:

I. Each bidder or offeror swears and affirms under penalty of perjury, that:

- a. In accordance with KRS 45A.110 and KRS 45A.115, neither the bidder or offeror as defined in KRS 45A.070(6), nor the entity which he/she represents, has knowingly violated any provisions of the campaign finance laws of the Commonwealth of Kentucky; and the award of a contract to the bidder or offeror or the entity which he/she represents will not violate any provisions of the campaign finance laws of the Commonwealth.
- b. The bidder or offeror swears and affirms under penalty of perjury that, to the extent required by Kentucky law, the entity bidding, and all subcontractors therein, are aware of the requirements and penalties outlined in KRS 45A.485; have properly disclosed all information required by this statute; and will continue to comply with such requirements for the duration of any contract awarded.
- c. The bidder or offeror swears and affirms under penalty of perjury that, to the extent required by Kentucky law, the entity bidding, and its affiliates, are duly registered with the Kentucky Department of Revenue to collect and remit the sales and use tax imposed by KRS Chapter 139, and will remain registered for the duration of any contract awarded.
- d. The bidder or offeror swears and affirms under penalty of perjury that the entity bidding is not delinquent on any state taxes or fees owed to the Commonwealth of Kentucky and will remain in good standing for the duration of any contract awarded.

FOR "NON-BID" CONTRACTS (I.E. SOLE-SOURCE; NOT-PRACTICAL OR FEASIBLE TO BID; OR EMERGENCY CONTRACTS, ETC):

II. Each contractor further swears and affirms under penalty of perjury, that:

- a. In accordance with KRS 121.056, and if this is a non-bid contract, neither the contractor, nor any member of his/her immediate family having an interest of 10% or more in any business entity involved in the performance of any contract awarded, have contributed more than the amount specified in KRS 121.150 to the campaign of the gubernatorial slate elected in the election last preceding the date of contract award.
- b. In accordance with KRS 121.330(1) and (2), and if this is a non-bid contract, neither the contractor, nor officers or employees of the contractor or any entity affiliated with the contractor, nor the spouses of officers or employees of the contractor or any entity affiliated with the contractor, have knowingly contributed more than \$5,000 in aggregate to the campaign of a candidate elected in the election last preceding the date of contract award that has jurisdiction over this contract award.

Solicitation/Contract #: _____

REQUIRED AFFIDAVIT FOR BIDDERS, OFFERORS AND CONTRACTORS

PAGE 2 OF 2

c. In accordance with KRS 121.330(3) and (4), and if this is a non-bid contract, to the best of his/her knowledge, neither the contractor, nor any member of his/her immediate family, his/her employer, or his/her employees, or any entity affiliated with any of these entities or individuals, have directly solicited contributions in excess of \$30,000 in the aggregate for the campaign of a candidate elected in the election last preceding the date of contract award that has jurisdiction over this contract.

As a duly authorized representative for the bidder, offeror, or contractor, I have fully informed myself regarding the accuracy of all statements made in this affidavit, and acknowledge that the Commonwealth is reasonably relying upon these statements, in making a decision for contract award and any failure to accurately disclose such information may result in contract termination, repayment of funds and other available remedies under law.

Signature

Printed Name

Title

Date

Company Name

Address

Subscribed and sworn to before me by _____
(Affiant) (Title)

Of _____ this _____ day of _____, 20____
(Company Name)

Notary Public

(seal of notary)

My commission expires: _____

BID BOND

Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

BIDDER (Name and Address): _____

SURETY (Name and Address of Principal Place of Business): _____

OWNER (Name and Address): _____

BID

Bid Due Date: _____

Project (Brief Description Including Location): _____

BOND

Bond Number: _____

Date (Not later than Bid due date): _____

Penal sum _____

(Words)

(Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Bid Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

BIDDER**SURETY**

(Seal
)

(Seal)

Bidder's Name and Corporate Seal

Surety's Name and Corporate Seal

By: _____
Signature and Title

By: _____
Signature and Title
(Attach Power of Attorney)

Attest: _____
Signature and Title

Attest: _____
Signature and Title

Note: Above addresses are to be used for giving required notice.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Surety's liability.
2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation shall be null and void if:
 - 3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
 - 3.2. All Bids are rejected by Owner, or
 - 3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default by Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from Bid due date without Surety's written consent.
6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after Bid due date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

Notice of Award

Dated xxx

Project: KY 315/28 Waterline Extension Phase 1	Owner: Breathitt County Water District	Owner's Contract No.:
Contract: Contract 1 Waterlines		Engineer's Project No.: 998-34
Bidder:		
Bidder's Address: (send Certified Mail, Return Receipt Requested)		

You are notified that your Bid dated xxx for the above Contract has been considered. You are the Successful Bidder and are awarded a Contract for **KY 315/28 Waterline Phase 1, Contract 1**

Work is to include installation of approximately 17,765 LF of 8-inch, 13,640 LF of 6-inch, 22,845 LF of 4-inch, 6,800 LF of 3-inch and 2,000 LF of 2-inch waterline with 2,250 LF of various sized directionally drilled creek/river crossings and other appurtenances, Installation of two (2) duplex pump stations, a pressure reducing vault, a hydro pneumatic pump station and 110 service connections.

The Contract Price of your Contract is **xxx Dollars and zero cents (\$ 0.00).**

1 copies of each of the proposed Contract Documents (except Drawings) accompany this Notice of Award.

2 sets of the Drawings will be delivered separately or otherwise made available to you immediately.

You must comply with the following conditions precedent within [10] days of the date you receive this Notice of Award.

1. Deliver to the Owner [6] fully executed counterparts of the Contract Documents.
2. Deliver with the executed Contract Documents the Contract security [Bonds] as specified in the Instructions to Bidders (Article 20), [and] General Conditions (Paragraph 5.01) [and Supplementary Conditions (Paragraph SC-5.01).]
3. Other conditions precedent:

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award and declare your Bid security forfeited.

Within ten days after you comply with the above conditions, Owner will return to you one fully executed counterpart of the Contract Documents.

Breathitt County Water District
Owner
By: _____
Authorized Signature

Chairman

Title

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

**SUGGESTED FORM OF AGREEMENT
BETWEEN OWNER AND CONTRACTOR FOR
CONSTRUCTION CONTRACT (STIPULATED PRICE)
FUNDING AGENCY EDITION**

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly By



PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
a practice division of the
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

AMERICAN COUNCIL OF ENGINEERING COMPANIES

AMERICAN SOCIETY OF CIVIL ENGINEERS

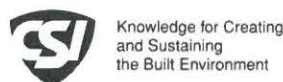
This document has been approved and endorsed by

The Associated General Contractors of America



and the

Construction Specification Institute



This document has been accepted by
United States Department of Agriculture

Rural Utilities Service, Water and Waste Programs

This Suggested Form of Agreement has been prepared for use with the Standard General Conditions of the Construction Contract, Funding Agency Edition (No. C-710, 2002 Edition). Their provisions are interrelated, and a change in one may necessitate a change in the other. The language contained in the Suggested Instructions to Bidders (No. C-200, 2002 Edition) is also carefully interrelated with the language of this Agreement. Their usage is discussed in the Commentary on EJCDC Construction Documents. See also Guide to the Preparation of Supplementary Conditions (No. C-800, 2002 Edition).

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**SUGGESTED FORM OF AGREEMENT
BETWEEN OWNER AND CONTRACTOR
FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)
FUNDING AGENCY EDITION**

THIS AGREEMENT is by and between The Breathitt County Water District ("Owner") and
____ ("Contractor").

Owner and Contractor, in consideration of the mutual covenants hereinafter set forth, agree as follows:

ARTICLE 1 – WORK

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

WORK IS TO INCLUDE INSTALLATION OF APPROXIMATELY 17,765 LF OF 8-INCH, 13,640 LF OF 6-INCH, 22,845 LF OF 4-INCH, 6,800 LF OF 3-INCH AND 2,000 LF OF 2-INCH WATERLINE WITH 2,250 LF OF VARIOUS SIZED DIRECTIONALLY DRILLED CREEK/RIVER CROSSINGS AND OTHER APPURTENANCES, INSTALLATION OF TWO (2) DUPLEX PUMP STATIONS, A PRESSURE REDUCING VAULT, A HYDRO PNEUMATIC PUMP STATION AND 110 SERVICE CONNECTIONS.

ARTICLE 2 – THE PROJECT

- 2.01 The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows:

KY 315/28 Waterline Extension Phase 1, Contract 1 Waterlines

ARTICLE 3 – ENGINEER

- 3.01 The Project has been designed by Nesbitt Engineering, Inc., who is to act as Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 – CONTRACT TIMES

4.01 *Time of the Essence*

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

4.02 *Days to Achieve Substantial Completion and Final Payment*

- A. The Work will be substantially completed within **210** days after the date when the Contract Times commence to run as provided in Paragraph 2.03 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 14.07 of the General Conditions within **210** days after the date when the Contract Times commence to run.

4.03 *Liquidated Damages*

- A. Contractor and Owner recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay Owner **\$750.00** for each day that expires after the time specified in Paragraph 4.02 for Substantial Completion until the Work is substantially complete. After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by Owner, Contractor shall pay Owner **\$750.00** for each day that expires after the time specified in Paragraph 4.02 for completion and readiness for final payment until the Work is completed and ready for final payment.

ARTICLE 5 – CONTRACT PRICE

- 5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to Paragraphs 5.01.A below:

- A. For all Unit Price Work, as shown on the attached “Base Bid Schedule”

All specific cash allowances are included in the above price and have been computed in accordance with paragraph 11.02 of the General Conditions.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

- A. Contractor shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

- A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor’s Applications for Payment on or about the 10th day of each month during performance of the Work as provided in Paragraphs 6.02.A.1 and 6.02.A.2 below. All such payments will be measured by the schedule of values established as provided in Paragraph 2.07.A of the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements:
1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Engineer may determine or Owner may withhold, including but not limited to liquidated damages, in accordance with Paragraph 14.02 of the General Conditions:
 - a. 95 percent of Work completed (with the balance being retainage); and
 - b. 95 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).
 2. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 95 percent of the Work completed, less such amounts as Engineer shall determine in accordance with Paragraph 14.02.B.5 of the General Conditions.

6.03 *Final Payment*

- A. Upon receipt of the final Application for Payment accompanied by Engineer's recommendation of payment in accordance with Paragraph 14.07 of the General Conditions, Owner shall pay Contractor as provided in Paragraph 14.07 of the General Conditions the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 14.07, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages.

ARTICLE 7 – INTEREST

- 7.01 All moneys not paid when due as provided in Article 14 of the General Conditions shall bear interest at the maximum legal rate.

ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS

- 8.01 In order to induce Owner to enter into this Agreement Contractor makes the following representations:
 - A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.
 - B. Contractor has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
 - C. Contractor is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.
 - D. Contractor does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.
 - E. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
 - F. Contractor has correlated the information known to Contractor, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.
 - G. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
 - H. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 *Contents*

- A. The Contract Documents consist of the following:
 - 1. This Agreement (pages 1 to 6, inclusive).
 - 2. Performance bond (pages 610-1 to 610-3, inclusive).

3. Payment bond (pages 615-1 to 615-3, inclusive).
 4. Other bonds (pages 620-1 to 620-2, inclusive).
 - a. _____ (pages _____ to _____, inclusive).
 - b. _____ (pages _____ to _____, inclusive).
 - c. _____ (pages _____ to _____, inclusive).
 5. General Conditions (pages 710-1 to 710-58, inclusive).
 6. Supplementary Conditions (pages 800-1 to 800-5, inclusive).
 7. Specifications as listed in the table of contents of the Project Manual.
 8. Drawings consisting of 15 sheets with each sheet bearing the following general title KY 315/28 Waterline Extension Phase 1, Contract 1 Waterlines.
 9. Addenda (numbers 0 to 0, inclusive).
 10. Exhibits to this Agreement (enumerated as follows):
 - a. Contractor's Bid (pages 300-1 to 300-8, inclusive).
 - b. Documentation submitted by Contractor prior to Notice of Award (pages 420-1 to 420-6, inclusive).
 - c. _____.
 11. The following which may be delivered or issued on or after the Effective Date of the Agreement and may not be attached hereto:
 - a. Notice to Proceed (pages 530-1 to 530-1, inclusive).
 - b. Work Change Directives.
 - c. Change Order(s).
- B. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 9.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in Paragraph 3.04 of the General Conditions.

ARTICLE 10 – MISCELLANEOUS

10.01 Terms

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

10.02 *Assignment of Contract*

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

10.03 *Successors and Assigns*

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

10.04 *Severability*

- A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

10.05 *Other Provisions*

- A. None.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement in four copies. One counterpart each has been delivered to Owner, Contractor, Engineer, and Agency. All portions of the Contract Documents have been signed, initialed, or identified by Owner and Contractor or identified by Engineer on their behalf.

NOTE(S) TO USER

See I-21 and correlate procedures for format and signing between the two documents.

This Agreement is dated xxx. This Agreement shall not be effective unless and until Agency's designated representative concurs.

OWNER:

CONTRACTOR

Breathitt County Water District

By: _____

By: _____

Title: Chairman

Title: _____

[CORPORATE SEAL]

[CORPORATE SEAL]

Attest: _____

Attest: _____

Title: _____

Title: _____

Address for giving notices:

Address for giving notices:

Breathitt County Water District

1137 Main St

Jackson, KY 41339

Agent for service of process:

(If Contractor is a corporation or a partnership, attach evidence of authority to sign.)

Notice to Proceed

Dated xxx

Project: KY 315/28 Waterline Ext. Phase 1	Owner: Breathitt County Water District	Owner's Contract No.:
Contract: Contract 1 Waterlines		Engineer's No.: 998-34
Contractor:		
Contractor's Address: [send Certified Mail, Return Receipt Requested]		

You are notified that the Contract Times under the above contract will commence to run on xxx. On or before that date, you are to start performing your obligations under the Contract Documents. In accordance with Article 4 of the Agreement, the date of Substantial Completion is xxxx, and the date of readiness for final payment is 8xxx. Before you may start any Work at the Site, Paragraph 2.01.B of the General Conditions provides that you and Owner must each deliver to the other (with copies to Engineer and other identified additional insureds) certificates of insurance which each is required to purchase and maintain in accordance with the Contract Documents.

Also, before you may start any Work at the Site, you must [add other requirements]:

	Breathitt County Water District
(Contractor)	Owner
Received by:	Given by:
	Authorized Signature
	Chairman
(Title)	Title
(Date)	Date

p:\breathitt\998-34 ky 315-28 am\specs\phase 1\contract 1\general\08 00530.doc

00530-1

EJCDC No. C-550 (2002 Edition)

Prepared by the Engineers' Joint Contract Documents Committee and endorsed by the
Associated General Contractors of America and the Construction Specifications Institute.

PERFORMANCE BOND

Any singular reference to Contractor, Surety, Owner, or other party shall considered plural where applicable.

CONTRACTOR (*Name and Address*): _____ SURETY (*Name, and Address of Principal Place of Business*): _____

OWNER (*Name and Address*): _____

CONTRACT

Effective Date of Agreement: _____

Amount: _____

Description (*Name and Location*): _____

BOND

Bond Number: _____

Date (*Not earlier than Effective Date of Agreement*): _____

Amount: _____

Modifications to this Bond Form: _____

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

SURETY

Contractor's Name and Corporate Seal (Seal)

Surety's Name and Corporate Seal (Seal)

By: _____
Signature

By: _____
Signature (Attach Power of Attorney)

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
Signature

Title

Title

Note: Provide execution by additional parties, such as joint venturers, if necessary.

Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner for the performance of the Contract, which is incorporated herein by reference.

1. If Contractor performs the Contract, Surety and Contractor have no obligation under this Bond, except to participate in conferences as provided in Paragraph 2.1.
2. If there is no Owner Default, Surety's obligation under this Bond shall arise after:
 - 2.1 Owner has notified Contractor and Surety, at the addresses described in Paragraph 9 below, that Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with Contractor and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If Owner, Contractor, and Surety agree, Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Owner's right, if any, subsequently to declare a Contractor Default; and
 - 2.2 Owner has declared a Contractor Default and formally terminated Contractor's right to complete the Contract. Such Contractor Default shall not be declared earlier than 20 days after Contractor and Surety have received notice as provided in Paragraph 2.1; and
 - 2.3 Owner has agreed to pay the Balance of the Contract Price to:
 1. Surety in accordance with the terms of the Contract; or
 2. Another contractor selected pursuant to Paragraph 3.3 to perform the Contract.
3. When Owner has satisfied the conditions of Paragraph 2, Surety shall promptly, and at Surety's expense, take one of the following actions:
 - 3.1 Arrange for Contractor, with consent of Owner, to perform and complete the Contract; or
 - 3.2 Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or
 - 3.3 Obtain bids or negotiated proposals from qualified contractors acceptable to Owner for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Owner and contractor selected with Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Contract, and pay to Owner the amount of damages as described in Paragraph 5 in excess of the Balance of the Contract Price incurred by Owner resulting from Contractor Default; or
 - 3.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:
 1. After investigation, determine the amount for which it may be liable to Owner and, as soon as practicable after the amount is determined, tender payment therefor to Owner; or
 2. Deny liability in whole or in part and notify Owner citing reasons therefor.
4. If Surety does not proceed as provided in Paragraph 3 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Owner to Surety demanding that Surety perform its obligations under this Bond, and Owner shall be entitled to enforce any remedy available to Owner. If Surety proceeds as provided in Paragraph 3.4, and Owner refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Owner shall be entitled to enforce any remedy available to Owner.
5. After Owner has terminated Contractor's right to complete the Contract, and if Surety elects to act under Paragraph 3.1, 3.2, or 3.3 above, then the responsibilities of Surety to Owner shall not be greater than those of Contractor under the Contract, and the responsibilities of Owner to Surety shall not be greater than those of Owner under the Contract. To the limit of the amount of this Bond, but subject to commitment by Owner of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:

- 5.1 The responsibilities of Contractor for correction of defective Work and completion of the Contract;
- 5.2 Additional legal, design professional, and delay costs resulting from Contractor's Default, and resulting from the actions of or failure to act of Surety under Paragraph 3; and
- 5.3 Liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of Contractor.

6. Surety shall not be liable to Owner or others for obligations of Contractor that are unrelated to the Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than Owner or its heirs, executors, administrators, or successors.

7. Surety hereby waives notice of any change, including changes of time, to Contract or to related subcontracts, purchase orders, and other obligations.

8. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the Work or part of the Work is located, and shall be instituted within two years after Contractor Default or within two years after Contractor ceased working or within two years after Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

9. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the address shown on the signature page.

10. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

11. Definitions.

- 11.1 Balance of the Contract Price: The total amount payable by Owner to Contractor under the Contract after all proper adjustments have been made, including allowance to Contractor of any amounts received or to be received by Owner in settlement of insurance or other Claims for damages to which Contractor is entitled, reduced by all valid and proper payments made to or on behalf of Contractor under the Contract.
- 11.2 Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.
- 11.3 Contractor Default: Failure of Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.
- 11.4 Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or otherwise comply with the other terms thereof.

FOR INFORMATION ONLY – (*Name, Address and Telephone*)

Surety Agency or Broker:

Owner's Representative (*Engineer or other party*):

PAYMENT BOND

Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

CONTRACTOR (*Name and Address*):

SURETY (*Name, and Address of Principal Place of Business*):

OWNER (*Name and Address*):

CONTRACT

Effective Date of Agreement:

Amount:

Description (*Name and Location*):

BOND

Bond Number:

Date (*Not earlier than Effective Date of Agreement*):

Amount:

Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

SURETY

Contractor's Name and Corporate Seal

Surety's Name and Corporate Seal

By: _____
Signature

By: _____
Signature (Attach Power of Attorney)

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
Signature

Title

Title

Note: Provide execution by additional parties, such as joint venturers, if necessary.

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner to pay for labor, materials, and equipment furnished by Claimants for use in the performance of the Contract, which is incorporated herein by reference.
2. With respect to Owner, this obligation shall be null and void if Contractor:
 - 2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants, and
 - 2.2 Defends, indemnifies, and holds harmless Owner from all claims, demands, liens, or suits alleging non-payment by Contractor by any person or entity who furnished labor, materials, or equipment for use in the performance of the Contract, provided Owner has promptly notified Contractor and Surety (at the addresses described in Paragraph 12) of any claims, demands, liens, or suits and tendered defense of such claims, demands, liens, or suits to Contractor and Surety, and provided there is no Owner Default.
3. With respect to Claimants, this obligation shall be null and void if Contractor promptly makes payment, directly or indirectly, for all sums due.
4. Surety shall have no obligation to Claimants under this Bond until:
 - 4.1 Claimants who are employed by or have a direct contract with Contractor have given notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.
 - 4.2 Claimants who do not have a direct contract with Contractor:
 1. Have furnished written notice to Contractor and sent a copy, or notice thereof, to Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials or equipment were furnished or supplied, or for whom the labor was done or performed; and
 2. Have either received a rejection in whole or in part from Contractor, or not received within 30 days of furnishing the above notice any communication from Contractor by which Contractor had indicated the claim will be paid directly or indirectly; and
 3. Not having been paid within the above 30 days, have sent a written notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Contractor.
5. If a notice by a Claimant required by Paragraph 4 is provided by Owner to Contractor or to Surety, that is sufficient compliance.
6. When a Claimant has satisfied the conditions of Paragraph 4, the Surety shall promptly and at Surety's expense take the following actions:
 - 6.1 Send an answer to that Claimant, with a copy to Owner, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.
 - 6.2 Pay or arrange for payment of any undisputed amounts.
7. Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by Surety.
8. Amounts owed by Owner to Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any performance bond. By Contractor furnishing and Owner accepting this Bond, they agree that all funds earned by Contractor in the performance of the Contract are dedicated to satisfy obligations of Contractor and Surety under this Bond, subject to Owner's priority to use the funds for the completion of the Work.

9. Surety shall not be liable to Owner, Claimants, or others for obligations of Contractor that are unrelated to the Contract. Owner shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

10. Surety hereby waives notice of any change, including changes of time, to the Contract or to related subcontracts, purchase orders, and other obligations.

11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the Work or part of the Work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Paragraph 4.1 or Paragraph 4.2.3, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, Owner, or Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

13. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.

14. Upon request of any person or entity appearing to be a potential beneficiary of this Bond, Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

15. Definitions

15.1 Claimant: An individual or entity having a direct contract with Contractor, or with a first-tier subcontractor of Contractor, to furnish labor, materials, or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Contract, architectural and engineering services required for performance of the Work of Contractor and Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

15.2 Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.

15.3 Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract, or to perform and complete or otherwise comply with the other terms thereof.

FOR INFORMATION ONLY – (*Name, Address, and Telephone*)

Surety Agency or Broker:

Owner's Representative (*Engineer or other*):

SECTION 00620

INSURANCE CERTIFICATE

Certificate of Insurance shall be provided in accordance with the General Conditions, this Division, Section 00710.

END OF SECTION

U.S. DEPARTMENT OF AGRICULTURE

**Certification Regarding Debarment, Suspension, Ineligibility
and Voluntary Exclusion - Lower Tier Covered Transactions**

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 7 CFR part 3017, Section 3017.510, Participants' responsibilities. The regulations were published as Part IV of the January 30, 1989, Federal Register (pages 4722-4733). Copies of the regulations may be obtained by contacting the Department of Agriculture agency with which this transaction originated.

(BEFORE COMPLETING CERTIFICATION, READ INSTRUCTIONS ON REVERSE)

- (1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.
- (2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Organization Name

PR/Award Number or Project Name

Name(s) and Title(s) of Authorized Representative(s)

Signature(s)

Date

Form AD-1048 (1/92)

00630-1

Instructions for Certification

1. By signing and submitting this form, the prospective lower tier participant is providing the certification set out on the reverse side in accordance with these instructions.
2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.
3. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
4. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.
5. The prospective lower tier participant agrees by submitting this form that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.
6. The prospective lower tier participant further agrees by submitting this form that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transaction," without modification, in all lower tier covered transaction and in all solicitations for lower tier covered transactions.
7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List.
8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

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

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT FUNDING AGENCY EDITION

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly By



PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
a practice division of the
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

AMERICAN COUNCIL OF ENGINEERING COMPANIES

AMERICAN SOCIETY OF CIVIL ENGINEERS

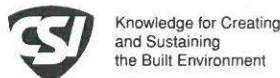
This document has been approved and endorsed by

The Associated General Contractors of America



and the

Construction Specification Institute



These General Conditions have been prepared for use with the Suggested Forms of Agreement Between Owner and Contractor Funding Agency Edition No. C-521 (2002 Edition). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the EJCDC Construction Documents, General and Instructions (No. C-001, 2002 Edition). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (No. C-800, 2002 Edition).

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GENERAL CONDITIONS

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda* – Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agency* – The Federal or state agency named as such in the Agreement.
 3. *Agreement* – The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.
 4. *Application for Payment* – The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 5. *Asbestos* – Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.
 6. *Bid* – The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 7. *Bidder* – The individual or entity who submits a Bid directly to Owner.
 8. *Bidding Documents* – The Bidding Requirements and the proposed Contract Documents (including all Addenda).
 9. *Bidding Requirements* – The Advertisement or Invitation to Bid, Instructions to Bidders, bid security of acceptable form, if any, and the Bid Form with any supplements.
 10. *Change Order* – A document recommended by Engineer which is signed by Contractor and Owner and Agency and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.
 11. *Claim* – A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.
 12. *Contract* – The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.
 13. *Contract Documents* – Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor's submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

14. *Contract Price* – The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).
15. *Contract Times* – The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any, (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.
16. *Contractor* – The individual or entity with whom Owner has entered into the Agreement.
17. *Cost of the Work* – See Paragraph 11.01.A for definition.
18. *Drawings* – That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.
19. *Effective Date of the Agreement* – The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.
20. *Engineer* – The individual or entity named as such in the Agreement.
21. *Field Order* – A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.
22. *General Requirements* – Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.
23. *Hazardous Environmental Condition* – The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto in connection with the Work.
24. *Hazardous Waste* – The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.
25. *Laws and Regulations; Laws or Regulations* – Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
26. *Liens* – Charges, security interests, or encumbrances upon Project funds, real property, or personal property.
27. *Milestone* – A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.
28. *Notice of Award* – The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.
29. *Notice to Proceed* – A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.
30. *Owner* – The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

31. *PCBs* – Polychlorinated biphenyls.
32. *Petroleum* – Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.
33. *Progress Schedule* – A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.
34. *Project* – The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.
35. *Project Manual* – The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.
36. *Radioactive Material* – Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.
37. *Related Entity* – An officer, director, partner, employee, agent, consultant, or subcontractor.
38. *Resident Project Representative* – The authorized representative of Engineer who may be assigned to the Site or any part thereof.
39. *Samples* – Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
40. *Schedule of Submittals* – A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.
41. *Schedule of Values* – A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.
42. *Shop Drawings* – All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
43. *Site* – Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.
44. *Specifications* – That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.
45. *Subcontractor* – An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.
46. *Substantial Completion* – The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for

which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

- 47. *Successful Bidder* – The Bidder submitting a responsive Bid to whom Owner makes an award.
- 48. *Supplementary Conditions* – That part of the Contract Documents which amends or supplements these General Conditions.
- 49. *Supplier* – A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or any Subcontractor.
- 50. *Underground Facilities* – All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
- 51. *Unit Price Work* – Work to be paid for on the basis of unit prices.
- 52. *Work* – The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.
- 53. *Work Change Directive* – A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and Agency upon recommendation of the Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 Terminology

- A. The following words or terms are not defined but, when used in the Bidding Requirements or Contract Documents, have the following meaning.
- B. *Intent of Certain Terms or Adjectives*
 - 1. The Contract Documents include the terms "as allowed," "as approved," "as ordered", "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action or determination will be solely to evaluate, in general, the Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day*

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. does not conform to the Contract Documents, or
 - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents, or
 - c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
 2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
 3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
 4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.
- F. Unless stated otherwise in the Contract Documents, words or phrases which have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

- A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. *Evidence of Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Contract Times; Notice to Proceed*

- A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement.

2.04 *Starting the Work*

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

2.05 *Before Starting Construction*

- A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:
 - 1. a preliminary Progress Schedule;
 - 2. a preliminary Schedule of Submittals; and
 - 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 *Preconstruction Conference*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, Agency, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

2.07 *Initial Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.
 - 1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
 - 2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
 - 3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be provided whether or not specifically called for at no additional cost to Owner.
- C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 *Reference Standards*

A. *Standards, Specifications, Codes, Laws, and Regulations*

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

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

- 1. *Contractor's Review of Contract Documents Before Starting Work:* Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor may discover and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.
- 2. *Contractor's Review of Contract Documents During Performance of Work:* If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code, or of any instruction of any Supplier, Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.
- 3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor knew or reasonably should have known thereof.

B. Resolving Discrepancies

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:
 - a. the provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or
 - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.
- B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:
 1. A Field Order;
 2. Engineer's approval of a Shop Drawing or Sample; (Subject to the provisions of Paragraph 6.17.D.3) or
 3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

- A. Contractor and any Subcontractor or Supplier shall not:
 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or Engineer's consultants, including electronic media editions; or
 2. reuse any of such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaption by Engineer.
- B. The prohibition of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

- A. Copies of data furnished by Owner or Engineer to Contractor or Contractor to Owner or Engineer that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.
- B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or

procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

- C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

- A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
 - 1. those reports of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Contract Documents; and
 - 2. those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) that Engineer has used in preparing the Contract Documents.
- B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their Related Entities with respect to:
 - 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
 - 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
 - 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition at or contiguous to the Site that is uncovered or revealed either:

1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or
2. is of such a nature as to require a change in the Contract Documents; or
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer's Review:* After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.

C. *Possible Price and Times Adjustments*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and
 - b. with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:
 - a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or
 - b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or
 - c. Contractor failed to give the written notice as required by Paragraph 4.03.A.
3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, Owner and Engineer, and any of their Related Entities shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of

engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data; and
2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
 - a. reviewing and checking all such information and data,
 - b. locating all Underground Facilities shown or indicated in the Contract Documents,
 - c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction, and
 - d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer

whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site*

- A. *Reports and Drawings:* Reference is made to the Supplementary Conditions for the identification of those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that have been utilized by the Engineer in the preparation of the Contract Documents.
- B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their Related Entities with respect to:
 - 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
 - 2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
 - 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.
- D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any.
- E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered to Contractor written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.
- F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in

Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.

- G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06. H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.
- B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent must be accompanied by a certified copy of the agent's authority to act.
- C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

- A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the

jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 *Certificates of Insurance*

- A. Contractor shall deliver to Owner, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.
- B. Owner shall deliver to Contractor, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.

5.04 *Contractor's Liability Insurance*

- A. Contractor shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:
 - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;
 - 2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;
 - 3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;
 - 4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:
 - a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or
 - b. by any other person for any other reason;
 - 5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and
 - 6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.
- B. The policies of insurance required by this Paragraph 5.04 shall:
 - 1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, partners, employees, agents, consultants and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;
3. include completed operations insurance;
4. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;
5. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);
6. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and
7. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment.
 - a. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

5.05 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

5.06 *Property Insurance*

- A. Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (Contractor shall be responsible for any deductible or self-insured retention.). This insurance shall:
 1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, consultants and subcontractors of any of them, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured;
 2. be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions;
 3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);

4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;
 5. allow for partial utilization of the Work by Owner;
 6. include testing and startup; and
 7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other additional insured to whom a certificate of insurance has been issued.
- B. Contractor shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured.
- C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.
- D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

5.07 *Waiver of Rights*

- A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or additional insureds thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insured or additional insured (and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Contractor as trustee or otherwise payable under any policy so issued.
- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and
 2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

- A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Contractor and made payable to Contractor as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Contractor shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof.
- B. Contractor as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Contractor's exercise of this power. If such objection be made, Contractor as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Contractor as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Contractor as fiduciary shall give bond for the proper performance of such duties.

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

- A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

- A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 *Substitutes and "Or-Equals"*

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

1. *"Or-Equal" Items:* If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that:

- 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
- 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
- 3) it has a proven record of performance and availability of responsive service; and

b. Contractor certifies that, if approved and incorporated into the Work:

- 1) there will be no increase in cost to the Owner or increase in Contract Times, and
- 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items*

- a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.
- b. Contractor shall submit sufficient information as provided below to allow Engineer to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.
- c. The procedure requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented in the General Requirements and as Engineer may decide is appropriate under the circumstances.
- d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

ARTICLE 6 – CONTRACTOR’S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances. The superintendent will be Contractor’s representative at the Site and shall have authority to act on behalf of Contractor. All communications given to or received from the superintendent shall be binding on Contractor.

6.02 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner’s written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 *Services, Materials, and Equipment*

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

6.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.
 - 1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

- 1) shall certify that the proposed substitute item will:
 - a) will perform adequately the functions and achieve the results called for by the general design,
 - b) be similar in substance to that specified, and
 - c) be suited to the same use as that specified;
 - 2) will state:
 - a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time;
 - b) whether or not use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and
 - c) whether or not incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;
 - 3) will identify:
 - a) all variations of the proposed substitute item from that specified , and
 - b) available engineering, sales, maintenance, repair, and replacement services;
 - 4) and shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.
- B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.
- C. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by either a Change Order for a substitute or an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.
- D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- E. *Engineer's Cost Reimbursement:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute item so proposed or submitted by Contractor, Contractor shall reimburse Owner for the charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

- F. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.
- B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.
- C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:
1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity, nor
 2. shall anything in the Contract Documents create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.
- D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.
- E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.
- F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, and Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes

of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 *Patent Fees and Royalties*

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

6.08 *Permits*

- A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 *Taxes*

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

6.11 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.
2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.
3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

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

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

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

6.12 *Record Documents*

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

6.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work;
2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.
- C. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or , or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- D. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 *Hazard Communication Programs*

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

6.16 *Emergencies*

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

6.17 *Shop Drawings and Samples*

- A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the acceptable Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. *Shop Drawings*

- a. Submit number of copies specified in the General Requirements.
 - b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.
2. *Samples*
- a. Submit number of Samples specified in the Specifications.
 - b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.
- B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.
- C. *Submittal Procedures*
1. Before submitting each Shop Drawing or Sample, Contractor shall have determined and verified:
 - a. all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 - b. the suitability of all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;
 - c. all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto; and
 - d. shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.
 2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.
 3. With each submittal, Contractor shall give Engineer specific written notice of any variations, that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.
- D. *Engineer's Review*
1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. *Resubmittal Procedures*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.18 *Continuing the Work*

- A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its Related Entities shall be entitled to rely on representation of Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
 1. observations by Engineer;
 2. recommendation by Engineer or payment by Owner of any progress or final payment;
 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 4. use or occupancy of the Work or any part thereof by Owner;
 5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;

6. any inspection, test, or approval by others; or
7. any correction of defective Work by Owner.

6.20 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.
- B. In any and all claims against Owner or Engineer or any of their respective consultants, agents, officers, directors, partners, or employees by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.
- C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, partners, employees, agents, consultants and subcontractors arising out of:
 1. the preparation or approval of, or the failure to prepare or approve, maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 *Delegation of Professional Design Services*

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.
- B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.
- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design

concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.

- E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

- A. Owner may perform other work related to the Project at the Site with Owner's employees, or via other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:
 - 1. written notice thereof will be given to Contractor prior to starting any such other work; and
 - 2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.
- B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and shall properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering their work and will only cut or alter their work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.
- C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:
 - 1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;
 - 2. the specific matters to be covered by such authority and responsibility will be itemized; and
 - 3. the extent of such authority and responsibilities will be provided.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 *Legal Relationships*

- A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.
- B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's actions or inactions.
- C. Contractor shall be liable to Owner and any other contractor for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's action or inactions.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

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

8.02 *Replacement of Engineer*

- A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.

8.03 *Furnish Data*

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

8.04 *Pay When Due*

- A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

- A. Owner's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site that have been utilized by Engineer in preparing the Contract Documents.

8.06 *Insurance*

- A. Owner's responsibilities, if any, in respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

- A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

- A. Owner's responsibility in respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 *Limitations on Owner's Responsibilities*

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

8.10 *Undisclosed Hazardous Environmental Condition*

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 *Evidence of Financial Arrangements*

- A. If and to the extent Owner has agreed to furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents, Owner's responsibility in respect thereof will be as set forth in the Supplementary Conditions.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

- A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents and will not be changed without written consent of Owner and Engineer.

9.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Project Representative*

- A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and

authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Authorized Variations in Work*

- A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

9.05 *Rejecting Defective Work*

- A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 *Shop Drawings, Change Orders and Payments*

- A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.
- B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.
- C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.
- D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

9.08 *Decisions on Requirements of Contract Documents and Acceptability of Work*

- A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.
- B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believe that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.

- C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.
- D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.
- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, subject to written approval by Agency at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).
- B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.B.

10.03 *Execution of Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:
1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;
 2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and
 3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 *Notification to Surety*

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

10.05 *Claims*

- A. *Engineer's Decision Required:* All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.
- B. *Notice:* Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Time shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).
- C. *Engineer's Action:* Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:
1. deny the Claim in whole or in part,
 2. approve the Claim, or
 3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

- D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.
- E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.
- F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

- A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items, and shall not include any of the costs itemized in Paragraph 11.01.B.
 - 1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time at the Site. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.
 - 2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.
 - 3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.
 - 4. Costs of special consultants (including but not limited to Engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
 - 5. Supplemental costs including the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

- b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
 - d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, imposed by Laws and Regulations.
 - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
 - f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.
 - g. The cost of utilities, fuel, and sanitary facilities at the Site.
 - h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, expressages, and similar petty cash items in connection with the Work.
 - i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.
- B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:
- 1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.
 - 2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
 - 3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
 - 4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A and 11.01.B.
- C. **Contractor's Fee:** When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.
- D. **Documentation:** Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 Allowances

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

11.03 Unit Price Work

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

- D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:
1. the Bid price of a particular item of Unit Price Work amounts to more than 5 percent of the Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by Contractor differs by more than 25 percent from the estimated quantity of such item indicated in the Agreement; and
 2. there is no corresponding adjustment with respect to any other item of Work; and
 3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:
1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or
 2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or
 3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).
- C. Contractor's Fee: The Contractor's fee for overhead and profit shall be determined as follows:
1. a mutually acceptable fixed fee; or
 2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;
 - b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;
 - c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraph 12.01.C.2.a is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

- d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;
- e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
- f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 *Delays*

- A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.
- B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.B.
 - 1. delays caused by or within the control of Contractor; or
- D. Owner, Engineer and the Related Entities of each of them shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of Engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.
- E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects*

- A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. All defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work*

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

13.03 *Tests and Inspections*

- A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.
- B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:
 - 1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;
 - 2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in said Paragraph 13.04.C; and
 - 3. as otherwise specifically provided in the Contract Documents.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.
- E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, it must, if requested by Engineer, be uncovered for observation.
- F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

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

- B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.
- C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.
- D. If, the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

- A. Promptly after receipt of notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).
- B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. repair such defective land or areas; or
 - 2. correct such defective Work; or

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.
- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 *Owner May Correct Defective Work*

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and

equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

- C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

- A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

A. *Applications for Payments*

- 1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.
- 2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
- 3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. *Review of Applications*

- 1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
- 2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations on the Site of the executed Work as an

experienced and qualified design professional and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

- a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and to any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
- a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or
 - b. that there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
- a. to supervise, direct, or control the Work, or
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
 - d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:
- a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or

- d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

D. *Reduction in Payment*

1. Owner may refuse to make payment of the full amount recommended by Engineer because:
 - a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;
 - b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
 - c. the Contractor's performance or furnishing of the Work is inconsistent with funding Agency requirements;
 - d. there are other items entitling Owner to a set-off against the amount recommended; or
 - e. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.
2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor corrects to Owner's satisfaction the reasons for such action.
3. If it is subsequently determined that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1.

14.03 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

14.04 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.
- B. Promptly after Contractor's notification, Owner, Agency, Contractor, and Engineer shall make a prefinal inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate

or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will within 14 days after submission of the tentative certificate to Owner notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will within said 14 days execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.

- D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.
- E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to complete or correct items on the tentative list.

14.05 *Partial Utilization*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions.
 - 1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor will certify to Owner and Engineer that such part of the Work is substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
 - 2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
 - 3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
 - 4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

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

14.07 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.
2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.7;
 - b. consent of the surety, if any, to final payment;
 - c. a list of all Claims against Owner that Contractor believes are unsettled; and
 - d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner or Owner's property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

B. *Engineer's Review of Application and Acceptance*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Payment Becomes Due*

1. Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

14.08 *Final Completion Delayed*

- A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims. The remaining balance of any sum included in the final Application for Payment but held by OWNER for Work not fully completed and accepted will become due when the Work is fully completed and accepted.

14.09 *Waiver of Claims*

- A. The making and acceptance of final payment will constitute:
1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and
 2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will justify termination for cause:
1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);
 2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;
 3. Contractor's disregard of the authority of Engineer; or
 4. Contractor's violation in any substantial way of any provisions of the Contract Documents.
- B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:

1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion),
 2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and
 3. complete the Work as Owner may deem expedient.
- C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph Owner shall not be required to obtain the lowest price for the Work performed.
- D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.
- E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.
- F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B, and 15.02.C.

15.03 *Owner May Terminate For Convenience*

- A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;
 3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and
 4. reasonable expenses directly attributable to termination.
- B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

- A. Owner and Contractor may mutually request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association. Timely submission of the request shall stay the effect of Paragraph 10.05.E.
- B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.
- C. If the claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:
 - 1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions, or
 - 2. agrees with the other party to submit the Claim to another dispute resolution process, or
 - 3. gives written notice to the other party of their intent to submit the Claim to a court of competent jurisdiction.

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

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

17.02 *Computation of Times*

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

17.03 *Cumulative Remedies*

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

17.04 *Survival of Obligations*

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

17.05 *Controlling Law*

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

17.06 *Headings*

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

ARTICLE 18 – FEDERAL REQUIREMENTS

18.01 *Agency Not a Party*

- A. This Contract is expected to be funded in part with funds provided by Agency. Neither Agency, nor any of its departments, entities, or employees is a party to this Contract.

18.02 *Contract Approval*

- A. Owner and Contractor will furnish Owner's attorney such evidence as required so that Owner's attorney can complete and execute the following "Certificate of Owner's Attorney" (Exhibit GC-A) before Owner submits the executed Contract Documents to Agency for approval.
- B. Concurrence by Agency in the award of the Contract is required before the Contract is effective.

18.03 *Conflict of Interest*

- A. Contractor may not knowingly contract with a supplier or manufacturer if the individual or entity who prepared the plans and specifications has a corporate or financial affiliation with the supplier or manufacturer.
- B. Owner's officers, employees, or agents shall not engage in the award or administration of this Contract if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when: (i) the employee, officer or

agent; (ii) any member of their immediate family; (iii) their partner or (iv) an organization that employs, or is about to employ, any of the above, has a financial interest in Contractor. Owner's officers, employees, or agents shall neither solicit nor accept gratuities, favors or anything of monetary value from Contractor or subcontractors.

18.04 *Gratuities*

- A. If Owner finds after a notice and hearing that Contractor, or any of Contractor's agents or representatives, offered or gave gratuities (in the form of entertainment, gifts, or otherwise) to any official, employee, or agent of Owner or Agency in an attempt to secure this Contract or favorable treatment in awarding, amending, or making any determinations related to the performance of this Contract, Owner may, by written notice to Contractor, terminate this Contract. Owner may also pursue other rights and remedies that the law or this Contract provides. However, the existence of the facts on which Owner bases such findings shall be an issue and may be reviewed in proceedings under the dispute resolution provisions of this Contract.
- B. In the event this Contract is terminated as provided in paragraph 18.04.A, Owner may pursue the same remedies against Contractor as it could pursue in the event of a breach of this Contract by Contractor. As a penalty, in addition to any other damages to which it may be entitled by law, Owner may pursue exemplary damages in an amount (as determined by Owner) which shall not be less than three nor more than ten times the costs Contractor incurs in providing any such gratuities to any such officer or employee.

18.05 *Audit and Access to Records*

- A. For all negotiated contracts and negotiated modifications (except those of \$10,000 or less), Owner, Agency, the Comptroller General, or any of their duly authorized representatives, shall have access to any books, documents, papers, and records of the Contractor, which are pertinent to the Contract, for the purpose of making audits, examinations, excerpts and transcriptions. Contractor shall maintain all required records for three years after final payment is made and all other pending matters are closed.

18.06 *Small, Minority and Women's Businesses*

- A. If Contractor intends to let any subcontracts for a portion of the work, Contractor shall take affirmative steps to assure that small, minority and women's businesses are used when possible as sources of supplies, equipment, construction, and services. Affirmative steps shall consist of: (1) including qualified small, minority and women's businesses on solicitation lists; (2) assuring that small, minority and women's businesses are solicited whenever they are potential sources; (3) dividing total requirements when economically feasible, into small tasks or quantities to permit maximum participation of small, minority, and women's businesses; (4) establishing delivery schedules, where the requirements of the work permit, which will encourage participation by small, minority and women's businesses; (5) using the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U.S. Department of Commerce; (6) requiring each party to a subcontract to take the affirmative steps of this section; and (7) Contractor is encouraged to procure goods and services from labor surplus area firms.

18.07 *Anti-Kickback*

- A. Contractor shall comply with the Copeland Anti-Kickback Act (18 USC 874 and 40 USC 276c) as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Buildings or Public Works Financed in Whole or in Part by Loans or Grants of the United States"). The Act provides that Contractor or subcontractor shall be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public facilities, to give up any part of the compensation to which they are otherwise entitled. Owner shall report all suspected or reported violations to Agency.

18.08 *Clean Air and Pollution Control Acts*

- A. If this Contract exceeds \$100,000, Contractor shall comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 USC 7401 *et seq.*) and the Federal Water Pollution Control Act as amended (33 USC 1251 *et seq.*). Contractor will report violations to the Agency and the Regional Office of the EPA.

18.09 *State Energy Policy*

- A. Contractor shall comply with the Energy Policy and Conservation Act (P.L. 94-163). Mandatory standards and policies relating to energy efficiency, contained in any applicable State Energy Conservation Plan, shall be utilized.

18.10 *Equal Opportunity Requirements*

- A. If this Contract exceeds \$10,000, Contractor shall comply with Executive Order 11246, "Equal Employment Opportunity," as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and as supplemented by regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."
- B. Contractor's compliance with Executive Order 11246 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative active obligations required by the Standard Federal Equal Employment Opportunity Construction Contract Specifications, as set forth in 41 CFR Part 60-4 and its efforts to meet the goals established for the geographical area where the Contract is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the Contract, and in each trade, and 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 Contractor's goals shall be a violation of the Contract, the Executive Order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.
- C. 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; estimated dollar amount of subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the Contract is to be performed.

18.11 *Restrictions on Lobbying*

- A. Contractor and each subcontractor shall comply with Restrictions on Lobbying (Public Law 101-121, Section 319) as supplemented by applicable Agency regulations. This Law applies to the recipients of contracts and subcontracts that exceed \$100,000 at any tier under a Federal loan that exceeds \$150,000 or a Federal grant that exceeds \$100,000. If applicable, Contractor must complete a certification form on lobbying activities related to a specific Federal loan or grant that is a funding source for this Contract. 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, or an employee of a member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 USC 1352. Each tier shall disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Certifications and disclosures are forwarded from tier to tier up to the Owner. Necessary certification and disclosure forms shall be provided by Owner.

18.12 *Environmental Requirements*

- A. When constructing a project involving trenching and/or other related earth excavations, Contractor shall comply with the following environmental constraints:
1. Wetlands – When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert wetlands.
 2. Floodplains – When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert 100 year floodplain areas delineated on the latest Federal Emergency Management Agency Floodplain Maps, or other appropriate maps, i.e., alluvial soils on NRCS Soil Survey Maps.
 3. Historic Preservation – Any excavation by Contractor that uncovers an historical or archaeological artifact shall be immediately reported to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the State Historic Preservation Officer (SHPO).
 4. Endangered Species – Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of Contractor, Contractor will immediately report this evidence to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the U.S. Fish and Wildlife Service.

EXHIBIT GC-A

Certificate of Owner's Attorney

I, the undersigned, _____, the duly authorized and acting legal representative of _____, do hereby certify as follows:

I have examined the attached Contract(s) and performance and payment bond(s) and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements is adequate and has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with the terms, conditions, and provisions thereof.

Date: _____

Supplementary Conditions

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract Funding Agency Edition (No. C-710, 2002 Edition) and other provisions of the Contract Documents as indicated below. All provisions not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions will have the meanings indicated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

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SC-1.01.A.2. Add the following language to the end of Paragraph 1.01.A.2:

The Project is financed in whole or in part by Abandoned Mine Lands pursuant to the Consolidated Farm and Rural Development Act (7 USC Section 1921 et seq.). *{add other funding sources and modify when necessary.}*

SC-1.01.A.4. Add the following language to the end of Paragraph 1.01.A.4:

The Application for Payment form to be used on this Project is Form RD 1924-18. The Agency must approve all Applications for Payment before payment is made.

SC-1.01.A.10. Add the following language to the end of Paragraph 1.01.A.10:

The Change Order form to be used on this Project is Form RD1927-7. Agency approval is required before Change Orders are effective.

SC-1.01.A.15. Delete in it's entirety and replace with the following:

Contract Times: The number of days or date stated in the Agreement to achieve substantial completion. Final completion date will be determined by Contractor, Owner, and Engineer, after substantial completion, based on remaining work, weather and market conditions.

SC-2.03.A. Delete Paragraph 2.03.A in its entirety and insert the following in its place:

- A. The Contract Times will commence on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 10 days after the Effective Date of the Agreement.

~~{SC-4.02. Add the following new paragraphs immediately after Paragraph 4.02.B:~~

~~C. In the preparation of Drawings and Specifications, Engineer relied upon the following reports of exploration and tests of subsurface conditions at the Site:~~

~~1. See EJCDC No. C-800 for examples.~~

- ~~D. In the preparation of Drawings and Specifications, Engineer relied upon the following drawings of physical conditions in or relating to existing surface and subsurface structures (except Underground Facilities) which are at or contiguous to the Site:~~

~~1. See EJCDC No. C-800 for examples.~~

- ~~E. Copies of reports and drawings itemized in SC 4.02.C and SC 4.02.D that are not included with Bidding Documents may be examined at _____ during regular business hours. These reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which the Contractor may rely as identified and established above are incorporated therein by reference. Contractor is not entitled to rely upon other information and data utilized by Engineer in the preparation of the Drawings and Specifications.~~

{OR}

SC-4.02. Delete Paragraphs 4.02.A and 4.02.B in their entirety and insert the following:

- A. No reports or explorations or tests of subsurface conditions at or contiguous to the Site are known to the Owner or Engineer.}

~~{SC-4.06. Add the following new paragraphs immediately after Paragraph 4.06.A:~~

- ~~1. In the preparation of Drawings and Specifications, Engineer relied upon the following reports of Hazardous Environmental Conditions at the Site:~~

~~a. See EJCDC No. C-800 for examples.~~

- ~~2. In the preparation of Drawings and Specifications, Engineer relied upon the following drawings of Hazardous Environmental Conditions which are at or contiguous to the Site:~~

~~a. See EJCDC No. C-800 for examples.~~

- ~~3. Copies of reports and drawings itemized in SC 4.06.A.1 and SC 4.06.A.2 that are not included with Bidding Documents may be examined at _____ during regular business hours. These reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which the Contractor may rely as identified and established above are incorporated therein by reference. Contractor is not entitled to rely upon~~

other information and data utilized by Engineer in the preparation of the Drawings and Specifications.

{OR}

SC-4.06. Delete Paragraphs 4.06.A and 4.06.B in their entirety and insert the following:

- A. No reports or explorations or tests of subsurface conditions at or contiguous to the Site are known to the Owner or Engineer.
- B. {Not used.}

SC-5.03. Add the following new paragraph immediately after Paragraph 5.03.B:

- C. Failure of the Owner to demand such certificates or other evidence of full compliance with these insurance requirements or failure of the Owner to identify a deficiency from evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

{The amounts of coverage for each type of insurance under paragraph 5.04 are recommended amounts that should be used to provide the Owner adequate protection. These amounts should be reviewed in the context of the specific project and adjusted accordingly.}

SC-5.04. Add the following new paragraph immediately after Paragraph 5.04.B:

- C. The limits of liability for insurance required by Paragraph 5.04 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:
 - 1. Workers' Compensation, and related coverages under Paragraphs 5.04.A.1 and A.2 of the General Conditions:
 - a. State: Statutory
 - b. Applicable Federal (e.g., Longshoremen's) Statutory
 - c. Employer's Liability {\$ 500,000}
 - 2. Contractor's General Liability under Paragraphs 5.04.A.3 through A.6 of the General Conditions which shall include completed operations and product liability coverages and eliminate the exclusion with respect to property under the care, custody, and control of the Contractor:
 - a. General Aggregate {\$ 2,000,000}
 - b. Products – Completed Operations Aggregate {\$ 1,000,000}
 - c. Personal and Advertising Injury {\$ 1,000,000}
 - d. Each Occurrence (Bodily Injury and Property Damage) {\$ 1,000,000}
 - e. Property Damage liability insurance will provide Explosion, Collapse, and Underground coverages where

applicable.

- f. Excess or Umbrella Liability
 - 1) General Aggregate {\$ 5,000,000}
 - 2) Each Occurrence {\$ 5,000,000}

3. Automobile Liability under Paragraph 5.04.A.6 of the General Conditions:

- a. Bodily Injury:
 - Each Person {\$ 1,000,000}
 - Each Accident {\$ 1,000,000}
- b. Property Damage:
 - Each Accident {\$ 1,000,000}
- c. Combined Single Limit of {\$ 1,000,000}

4. The Contractual Liability coverage required by paragraph 5.04.B.4 of the General Conditions shall provide coverage for not less than the following amounts:

- a. Bodily Injury:
 - Each Person {\$ 2,000,000}
 - Each Accident {\$ 2,000,000}
- b. Property Damage:
 - Each Accident {\$ 2,000,000}
 - Annual Aggregate {\$ 2,000,000}

{5. List additional types and amounts of insurance that may be required by Owner.}

{6. List by name other persons or entities to be included on policy as additional insureds.}

{SC-5.06.A. In the case of multiple prime contractors on a single Site (multiple prime contractors for the Project may each need to provide property insurance), it is necessary to define the Contractor responsible for providing the Property Insurance. If there is only one contractor on the site, do not modify paragraph 5.06.A of the General Conditions.}

{SC-5.06.A.1. List by name other persons or entities to be included on policy as additional insureds.}

SC-6.06 Add a new paragraph immediately after Paragraph 6.06.G:

- H. The Contractor shall not award work valued at more than fifty (50%) percent of the Contract Price to Subcontractor(s), without prior written approval of the Owner.

{When multiple prime contractors are working on a single Site, the following modification should be made.}

SC-7.02.A.1. Delete paragraphs 7.02.A.1-3 in their entirety and insert the following:

1. The _____ Contractor shall have the authority and be responsible for coordination of the activities among the other prime contractors and subcontractors on the Site to ensure a safe, efficient working environment. This authority covers scheduling delivery of materials, storage of materials, sequencing of construction involving different crafts, resolving interface issues between crafts, scheduling testing, and all other aspects of the Work that do not impact the design or function of the Work.

SC-9.03.A. Add the following language at the end of paragraph 9.03.A:

The Engineer will provide Resident Project Representative services for this project. The Duties, Responsibilities, and Limitations of Authority of the Resident Project Representative will be as stated in

Exhibit D of the Agreement Between Owner and Engineer, E-510, 2002 Edition, as amended and executed for this specific Project.
{If anyone other than the Engineer is providing the Resident Project Representative, this language must be modified.}

SC-14.02.A.3 Add the following language at the end of paragraph 14.02.A.3:

No payments will be made that would deplete the retainage prior to substantial completion, nor place in escrow any funds that are required for retainage, or invest the retainage for benefit.

SC-14.02.C.1. Delete Paragraph 14.02.C.1 in its entirety and insert the following in its place:

1. The Application for Payment with Engineer's recommendations will be presented to the Owner and Agency for consideration. If both the Owner and Agency find the Application for Payment acceptable, the recommended amount less any reduction under the provisions of Paragraph 14.02.D will become due thirty days after the Application for Payment is presented to the Owner, and the Owner will make payment to the Contractor.

SC-18.08 Delete paragraph 18.08.A in its entirety and insert the following in its place:

A. If this Contract exceeds \$100,000, the Contractor shall comply with all applicable standards, orders, or requirements issued under Section 306 of the Clean Air Act (42 USC §1857(h)), Section 508 of the Clean Water Act (33 USC §1368), Executive Order 11738, and Environmental Protection Agency regulations (40 CFR Part 15).

SECTION 00810

SPECIAL CONDITIONS

1. DESIGNATION OF OWNER AND ENGINEER

All references to the OWNER in SPECIFICATIONS, CONTRACT DOCUMENTS and DRAWINGS shall mean the **Breathitt County Water District**.

All references to the ENGINEER in the specifications, CONTRACT DOCUMENTS and DRAWINGS shall mean Nesbitt Engineering, Inc.

2. AVAILABLE FUNDS

2.1 The BIDDER'S attention is invited to the financing of this project, which is by means of:

- **Abandoned Mine Lands**

2.2 In the event the total cost of the construction and appurtenant WORK should exceed the amount of money available, the OWNER in making awards of CONTRACT to the successful BIDDER, may reject certain items of WORK or reduce the quantities of BID items so as to award CONTRACT within the limits of available funds. In making an award of CONTRACT to a successful BIDDER, no CONTRACTOR will be allowed any claim for loss of any anticipated profits involving any items of WORK that have been reduced or eliminated by the OWNER. Successful BIDDERS will be determined before consideration of reductions or additions to the original BID.

3. TIME OF COMPLETION

The time allowed for completion of this CONTRACT is as follows:

KY 315/28 Waterline Extension Phase 1 - 180 Calendar Days

The time allowed for completion shall begin at midnight, local time, ten (10) calendar days from the date on which the OWNER, or its authorized representative instructs the CONTRACTOR in writing to start WORK. In case of awarding more than one CONTRACT to a CONTRACTOR, periods of construction are not additive, but will run concurrently. The same applies to divisions within a CONTRACT.

4. WEATHER DAYS

4.1 The CONTRACT completion time stipulated above includes an allowance for an average number of inclement weather days as follows:

	J	F	M	A	M	J	J	A	S	O	N	D
PRECIPITATION	10	9	9	7	8	7	12	9	7	9	6	9
FREEZE TEMP.	6	4	2	0	0	0	0	0	0	0	2	2

The number of days shown above are an average recorded over the last three years for each month's recorded weather conditions for the Jackson Weather Station and provided by the University of Kentucky Agricultural Weather Center.

When number of days (including Saturdays, Sundays, and Holidays) of precipitation in excess of 0.1" per day or maximum daily temperatures of 32° F exceed those shown above in any month, the CONTRACTOR shall be entitled to an equal number of additional days for CONTRACT completion.

- 4.2 If, in the ENGINEER'S opinion, sustained bad weather conditions prevent satisfactory performance of the WORK, the ENGINEER may suspend operations for an extended period until weather conditions are favorable. In this event, CONTRACT completion time shall be extended an equal number of days. Upon suspension of the WORK by the ENGINEER, the CONTRACTOR shall properly protect his WORK during the suspension period.

5. LIQUIDATED DAMAGES

It is understood that time is the essence of this CONTRACT, and that the OWNER will sustain damages, monetary and otherwise, in the event of delay in completion of the WORK hereby CONTRACTED.

Therefore, if the CONTRACTOR shall neglect, fail or refuse to complete the WORK within the time herein specified, or any proper extension thereof granted by the OWNER, then the CONTRACTOR does hereby agree, as a part consideration for the awarding of this CONTRACT, to pay to the OWNER the amount specified in the CONTRACT, not as a penalty but as liquidated damages for such breach of CONTRACT as hereinafter set forth, for each and every calendar day the CONTRACTOR shall be in default after the time stipulated in the CONTRACT for completing the WORK.

The said amount is fixed and agreed upon by and between the CONTRACTOR and the OWNER because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the OWNER would in such event sustain, and said amount is agreed to be the amount of damages which the OWNER should sustain and said amount shall be retained from time to time by the OWNER from current periodical estimates.

Liquidated damages are fixed at the following amount per calendar day of overrun beyond the date set for completion or authorized extension thereof for the CONTRACT:

\$750.00 Per Calendar Day

00810-2

6. INSURANCE

The minimum amount of insurance to be furnished by the CONTRACTOR shall be in accordance with the more stringent requirements of Paragraphs 21 and 28 of the RD and CDBG General Conditions, respectively, and this Section 5. Said insurance shall be for the joint protection of the CONTRACTOR, OWNER, and ENGINEER. Insurance against all damage from blasting shall be included in the policies.

All policies written for and applicable to the CONTRACT of which this specification is a part shall provide for a minimum of thirty (30) days advance written notice by certified mail of cancellation or any material change. Notice shall be given both to the OWNER and the ENGINEER. The minimum amounts:

- (1) Worker's Compensation: The CONTRACTOR shall procure and shall maintain during the life of the CONTRACT, Worker's Compensation Insurance for all of CONTRACTOR'S employees to be engaged in the WORK under this CONTRACT, and in case where the WORK is sublet, the CONTRACTOR shall require the SUBCONTRACTOR similarly to provide Worker's Compensation Insurance. Worker's Compensation Insurance shall include Broad Form All States Endorsement and Voluntary Compensation.

Each Accident	\$100,000.00
Disease - Policy Limit	\$500,000.00
Disease - Each Employee	\$100,000.00

- (2) Comprehensive General Liability: The CONTRACTOR shall procure and shall maintain during the life of the CONTRACT, such Comprehensive General Liability and Broad Form Property Damage Insurance as shall protect CONTRACTOR and any SUBCONTRACTOR performing WORK from claims for damages for bodily injury, including accidental death, as well as from claims for property damages, which may arise from operations under the CONTRACT, whether such operations are by the CONTRACTOR or by any SUBCONTRACTOR or by anyone directly or indirectly employed by either of them. The amount of insurance shall not be less than the following:

General Aggregate	\$1,000,000.00
Products Comp/Ops Aggregate	\$1,000,000.00
Personal and Advertising Injury	\$1,000,000.00
Each Occurrence	\$1,000,000.00
Fire Damage (Any one fire)	\$ 50,000.00
Medical Expenses (Any one person)	\$ 5,000.00

The insurance shall include coverage of the following hazards:

Underground
Explosion/Collapse

For the purpose of insurance coverage, each detonation of blasting is a single occurrence.

00810-3

- (3) OWNER'S and CONTRACTOR'S Protective Liability: The CONTRACTOR shall maintain during the life of the CONTRACT, OWNER'S and CONTRACTOR'S Protective Liability Insurance with the same limits as the Comprehensive General Liability.
- (4) Automobile Liability: The CONTRACTOR shall procure and shall maintain during the life of the CONTRACT Agreement, Comprehensive Automobile Liability Insurance. The insurance shall include coverage for owned, non-owned and hired vehicles. Amounts shall not be less than the following:
- | | |
|-----------------------------------|----------------|
| Comprehensive Single Limits (CSL) | \$1,000,000.00 |
|-----------------------------------|----------------|
- (5) Builder's Risk: The CONTRACTOR shall procure and shall maintain during the life of the CONTRACT, Builder's Risk Insurance to protect the interests of the OWNER, CONTRACTOR, and SUBCONTRACTORS against loss by fire, vandalism, malicious mischief, and all hazards included in a standard special form cover. The amount of the insurance shall at all times equal or exceed the full amount of the CONTRACT. The policies shall be in the names of the OWNER and the CONTRACTOR and SUBCONTRACTOR.
- (6) Umbrella Excess Liability \$1,000,000.00 Per Occurrence (With no aggregate except products completed operations).
- (7) Certificates of Insurance: Certificates acceptable to the OWNER shall be attached to the signed CONTRACT DOCUMENTS when they are transmitted to the OWNER for execution. These certificates shall contain the statement that "Coverages afforded under the policies will not be canceled unless at least thirty (30) days prior to cancellation written notice has been given to the OWNER and ENGINEER, as evidenced by receipts of registered or certified mail." The OWNER shall be a named insured.

7. PERFORMANCE AND PAYMENT BONDS

The CONTRACTOR shall furnish separate performance and payment BONDS (forms included elsewhere in these Specifications) issued by an approved bonding company, in an amount at least equal to one-hundred percent (100%) of the CONTRACT PRICE, as security for the faithful performance of this CONTRACT and for the payment of persons performing labor and furnishing materials in connection with this CONTRACT. These BONDS shall be executed by a surety authorized to do business in the Commonwealth of Kentucky.

A Performance Bond and a Payment Bond on any other form than the ones attached will not be acceptable. The Surety Bond will and ensure payment of all unemployment contributions required under the Unemployment Insurance laws of the Commonwealth of Kentucky and of the Federal Government.

8. METHOD OF BIDDING

00810-4

The method of bidding under this CONTRACT shall be by lump sum and/or unit price as shown on the Proposal form.

9. PERMISSION TO USE PROPERTY OTHER THAN THAT PROVIDED BY OWNER

Should the CONTRACTOR desire or elect to use, pass over and/or encroach on private property other than that provided by the OWNER, either by fee simple title or right-of-way for a specific purpose, the CONTRACTOR shall obtain such rights and permission from the legal owner of said private property at his own expense and risk.

10. ROCK SOUNDING

Excavation is unclassified. The CONTRACTOR shall be responsible for the determination of the amount of rock excavation required.

11. OWNER FURNISHED EQUIPMENT AND MATERIALS

There will be no OWNER furnished equipment or materials for installation in this CONTRACT.

12. SUBCONTRACTOR LISTING

In the event the CONTRACTOR contemplates subletting WORK on the CONTRACT, he shall list the SUBCONTRACTOR names and addresses on the attachment provided with the BID form.

Failure on the part of the bidding CONTRACTOR to list SUBCONTRACTORS or write the WORK "None" (if no SUBCONTRACTOR is to be used) may, at the option of the OWNER be cause for rejection of the CONTRACTOR'S BID. SUBCONTRACTOR, as listed by the CONTRACTOR on his bidding form, may not be changed without approval of the OWNER.

13. SCHEDULING OF CONSTRUCTION ACTIVITIES

The CONTRACTOR shall, in writing, closely schedule all construction activities of the WORK with a representative of the OWNER specifically designated to provide the customers of the OWNER a minimum five-working-day notification of the impending construction activities of the CONTRACTOR. The CONTRACTOR and the representative of the OWNER shall meet on a daily basis to review the completion progress of previously scheduled construction activities and to estimate specific locations of the CONTRACTOR'S construction activity for the subsequent five (5) working day period. No unscheduled construction activities shall be performed by the CONTRACTOR unless otherwise directed by the OWNER.

Where the WORK requires construction activities adjacent to existing treatment or pumping facilities, the CONTRACTOR shall not interrupt the operation of these facilities and shall provide the OWNER'S operations staff continuous, safe access to such parts of the affected facilities.

00810-5

The CONTRACTOR will comply with OSHA (P.L. 91-596), the CONTRACT WORK hours and the Safety Standards Act (P.L. 91-54).

14. RESPONSIBILITY REGARDING EXISTING UTILITIES AND STRUCTURES

14.1 The existence and location of underground utilities indicated on the PLANS are not guaranteed and shall be investigated and verified in the field by the CONTRACTOR before starting WORK. Excavation in the vicinity of existing structures and utilities shall be carefully done by hand labor.

14.2 The CONTRACTOR shall be held responsible for any damage to, and for maintenance and protection of, existing utilities and structures.

15. ACCIDENTS

The CONTRACTOR must promptly report, in writing, to the ENGINEER all accidents whatsoever arising out of, or in connection with, the performance of the WORK, whether on, or adjacent to, the site which caused death, personal injury, or property damages, giving full details and statements of witnesses. In addition if death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger to both the ENGINEER and the OWNER.

16. FINAL PAYMENT

16.1 Within thirty (30) days after final inspection and acceptance of the WORK by the ENGINEER and the OWNER, the final estimate for all WORK done, including all retained percentage, shall be compiled by the ENGINEER and furnished to the OWNER. Upon the latter's approval, either in whole or in part, the amount of money thus found due the CONTRACTOR, after all previous payments and other claims, if any are deducted, will be certified for payment, but before final payment is made to any CONTRACTOR on any OWNER or portion thereof, the CONTRACTOR will be required to satisfy the OWNER to the effect that all claims for labor done on the CONTRACT and all material put into the WORK have been fully paid or satisfactorily secured; and the OWNER shall be held harmless by the CONTRACTOR and the SURETY on his BOND from the payment of any money paid under the belief that said claims for labor and materials are not to be prejudiced by any mistaken payment. The acceptance by the CONTRACTOR of payment of the said final estimate shall operate as and shall be a release to the OWNER.

17. RIGHTS OF WAY

17.1 Rights of way and easements will be provided by the OWNER.

18. PROTECTION OF THE PROPERTY OF LANDOWNERS

- 18.1 The CONTRACTOR and all his employees shall exercise care and consideration in traveling over the lands of private property owners from whom rights-of-way and easements were obtained
- 18.2 The CONTRACTOR should likewise use existing roads as much as possible to transport pipe, other materials, and workmen to and from the job.
- 18.3 Carelessness on the part of the CONTRACTOR or any of his employees in leaving gates open, parking cars, trucks or vehicles in such a way as to interfere with farming operations will not be tolerated.
- 18.4 The CONTRACTOR shall deliver materials to the site of the WORK and so conduct his operations in such a manner as to cause no damage to trees, buildings, outbuildings, and other property of landowners.
- 18.5 Trees, fences, poles, and all other property shall be protected unless their removal is authorized by the ENGINEER. Any damaged property shall be restored to as near original condition as possible by the CONTRACTOR.
- 18.6 Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with tree dressing.

19. TEMPORARY UTILITIES

CONTRACTORS shall provide for all utilities, including water, needed during construction.

20. CONTRACTOR'S RESPONSIBILITY FOR MATERIALS

- 20.1 Responsibility for Materials Furnished by CONTRACTOR: The CONTRACTOR shall be responsible for all material furnished by him. All such material which is defective in manufacture or has been damaged in transit or in delivery shall be replaced by the CONTRACTOR at his expense.
- 20.2 Responsibility for Materials Furnished by OWNER: The CONTRACTOR'S responsibility for material furnished by the OWNER shall begin upon CONTRACTOR'S acceptance at the point of delivery to him. All such material shall be examined and material defective in manufacture, or damaged in shipment, and/or otherwise damaged, shall be rejected by the CONTRACTOR at the time and place of delivery to him and replaced by the OWNER. Material furnished by the OWNER which is accepted by the CONTRACTOR, but which is discovered prior to acceptance of the WORK (1) to be defective in manufacture shall be

replaced by the OWNER, (2) to have been damaged before or after acceptance by the CONTRACTOR, shall be replaced by the CONTRACTOR. Once accepted by the CONTRACTOR at the point of delivery to him, all defective and/or damaged material discovered prior to final acceptance of the WORK shall be removed by the CONTRACTOR. In such case, the CONTRACTOR shall furnish all labor, equipment and material incidental to replacement and necessary for the completion of the WORK to the satisfaction of the ENGINEER.

- 20.3 **Responsibility for Safe Storage:** The CONTRACTOR shall be responsible for the safe storage of all material furnished to or by him and accepted by him until it has been incorporated in the completed project.

21. **MINIMUM WAGE RATES**

State and Federal wage rates are applicable on this project.

22. **PROJECT SIGNS**

Two (2) project signs shall be provided by the CONTRACTOR as described at the end of the supplemental General Conditions section. The sign layout shall be approved by the ENGINEER and shall be placed where directed by the ENGINEER in the field.

23. **Certificate of Good Standing from the Secretary of State's (SOS) Office -**
A printed copy from the web site of the SOS (<http://www.sos.state.ky.us/corporate2/entityname.asp>), which indicates the corporation/partnership, has a Standing of **Good** shall be submitted with the bid.

24. **Pipe Cover** - Per the Kentucky Transportation Cabinets (KTC) Encroachment Permit, all lines constructed within State Right-of-Way (ROW), shall have a minimum cover of 42" above the top of the pipe. Also, the boring pit shall be constructed according to KTC requirements. In areas off the KTC ROW the minimum cover shall be thirty inches (30") unless specifically shown otherwise on the plan sheets.

25. **Encroachment Permit Bond** – The successful CONTRACTOR SHALL obtain the encroachment bond and then the OWNER will reimburse the CONTRACTOR for the KTC Encroachment Bond upon submittal of a copy of the bond and check paying for the bond.

26. **Obtaining Permits** – The successful CONTRACTOR SHALL obtain, and/or verify that they have been obtained, any and all permits (state, federal and local) required for the construction of this project. A copy of any permit obtained must be provided to the engineer. One such permit that may be required is a KPDES Storm Water General Permit, NOI. (see attachment 00800A) It is required when the project disturbs more than 1 acre. The contractor must complete and submit the NOI at least 48 hours prior to the start of construction.

27. **Trench Width** – The trench width shall be as shown in the Standard Details, except in rock. In rock the minimum distance from the pipe OD to the trench wall shall be a minimum of 12-inches.
28. **Occupational Tax/License** - The CONTRACTOR shall verify all requirements and make all necessary payments with the local county treasurer.
29. **Tree Removal** – Trees shall only be removed during October 15th through March 31st.
30. **Special attention should be made to section 1010 “summary of work”, special notes.**

END OF SECTION

SECTION 00815

KENTUCKY PREVAILING WAGE DETERMINATION



Matthew G. Bevin
Governor

Jenean M. Hampton
Lt. Governor

**Kentucky Labor Cabinet
Department of Workplace Standards
Division of Employment Standards, Apprenticeship
and Mediation**

1047 US Hwy 127 S STE 4
Frankfort, Kentucky 40601
Phone: (502) 564-3070
Fax: (502) 696-1897
www.labor.ky.gov

Derrick K. Ramsey
Secretary

October 31, 2016

Michael Steen
Nesbitt Engineering
227 N. Upper St.
Lexington KY 40507

Re: Breathitt County Water District, KY 315/28 Waterline Extension Phase 1

Advertising Date as Shown on Notification: November 3, 2016

Dear Micheal Steen:

This office is in receipt of your written notification on the above project as required by KRS 337.510 (1).

I am enclosing a copy of the current prevailing wage determination number CR 2-030, dated October 7, 2015 for BREATHITT County. This schedule of wages shall be attached to and made a part of the specifications for the work, printed on the bidding blanks, and made a part of the contract for the construction of the public works between the public authority and the successful bidder or bidders.

The determination number assigned to this project is based upon the advertising date contained in your notification. There may be modifications to this wage determination prior to the advertising date indicated. In addition, if the contract is not awarded within 90 days of this advertising date or if the advertising date is modified, a different set of prevailing rates of wages may be applicable. It will be the responsibility of the public authority to contact this office and verify the correct schedule of the prevailing rates of wages for use on the project. Your project number is as follows: 013-H-00198-15-2, Heavy/Highway

Sincerely,

Michael C. Donta
Deputy Commissioner



**KENTUCKY LABOR CABINET
PREVAILING WAGE DETERMINATION
CURRENT REVISION
LOCALITY NO. 030**

BELL, BREATHITT, JOHNSON, LESLIE, PERRY & MAGOFFIN COUNTIES

Determination No. CR 2-030

Project No. 013-H-00198-15-2

Date of Determination: October 7, 2015

_____ Bldg X HH

This schedule of the prevailing rate of wages for Locality No. 030, which includes Bell, Breathitt, Johnson, Leslie, Perry & Magoffin Counties, has been determined in accordance with the provisions of KRS 337.505 to 337.550. This determination shall be referred to as Prevailing Wage Determination No. CR 2-030.

Apprentices shall be permitted to work as such subject to Administrative Regulations. Copies of these regulations will be furnished upon request to any interested person.

Overtime is to be computed at not less than one and one-half (1 1/2) times the indicated BASE RATE for all hours worked in excess of eight (8) per day, or in excess of forty (40) per week. However, KRS 337.540 permits an employee and employer to agree, in writing, that the employee will be compensated at a straight time base rate for hours worked in excess of eight (8) hours in any one workday, but not more than ten (10) hours worked in any one workday, if such written agreement is prior to the over eight (8) hours in a workday actually being worked, or where provided for in a collective bargaining agreement. The fringe benefit rate is to be paid for each hour worked at a straight time rate for all hours worked. Fringe benefit amounts are applicable for all hours worked except when otherwise noted. Welders will receive rate for craft in which welding is incidental.

No laborer, workman or mechanic shall be paid at a rate less than that of the General Laborer except those classified as bona fide apprentices registered with the Kentucky State Apprenticeship Supervisor unless otherwise specified in this schedule of wage rates.

NOTE: The type of construction shall be determined by applying the following definitions.

BUILDING CONSTRUCTION

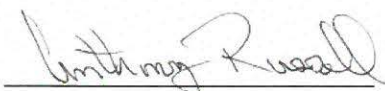
Building construction is the construction of sheltered enclosures with walk-in access for the purpose of housing persons, machinery, equipment, or supplies. It includes all construction of such structures, the installation of utilities and the installation of equipment, both above and below grade level, as well as incidental grading, utilities and paving.

HIGHWAY CONSTRUCTION

Highway construction includes the construction, alteration or repair of roads, streets, highways, runways, taxiways, alleys, trails, paths, parking areas, and other similar projects not incidental to building or heavy construction. It includes all incidental construction in conjunction with the highway construction project.

HEAVY CONSTRUCTION

Heavy projects are those projects that are not properly classified as either "building" or "highway". For example, dredging projects, water and sewer line projects, dams, flood control projects, sewage treatment plants and facilities, and water treatment plants and facilities are considered heavy.



ANTHONY RUSSELL, COMMISSIONER
DEPARTMENT OF WORKPLACE STANDARDS
KENTUCKY LABOR CABINET

ASBESTOS/INSULATION WORKERS: (Mechanical only)	BASE RATE	\$30.84
	FRINGE BENEFITS	20.84

BOILERMAKERS:	BASE RATE	\$23.95
	FRINGE BENEFITS	12.04

BRICKLAYERS:	BASE RATE	\$22.42
	FRINGE BENEFITS	4.78

CARPENTERS / BUILDING:

BELL & LESLIE COUNTIES:

Carpenters:	BUILDING	BASE RATE	\$22.72
		FRINGE BENEFITS	13.01

Piledrivermen:	BUILDING	BASE RATE	\$23.22
		FRINGE BENEFITS	13.01

BREATHITT, JOHNSON, MAGOFFIN & PERRY COUNTIES:

Carpenters:	BUILDING	BASE RATE	\$28.19
		FRINGE BENEFITS	15.90

Piledriver:	BUILDING	BASE RATE	\$28.59
		FRINGE BENEFITS	15.90

CARPENTERS / HEAVY HIGHWAY:

Carpenters:	HEAVY & HIGHWAY	BASE RATE	\$27.50
		FRINGE BENEFITS	15.00

Piledrivermen:	HEAVY & HIGHWAY	BASE RATE	\$27.75
		FRINGE BENEFITS	15.00

Divers:	HEAVY & HIGHWAY	BASE RATE	\$41.63
		FRINGE BENEFITS	15.00

CEMENT MASONS:	BASE RATE	\$8.75
	FRINGE BENEFITS	0.00

ELECTRICIANS:	BUILDING	BASE RATE	\$32.86
		FRINGE BENEFITS	22.67

ELECTRICIANS: (CONTINUED)

ELECTRICIANS:	HEAVY & HIGHWAY	*BASE RATE	\$23.50
		FRINGE BENEFITS	7.73

*When electricians are required to work from Bosum chairs, trusses, stacks, tanks, scaffolds, or catwalks, radio and TV towers, structural steel-open, unprotected, unfloored raw steel, bridges, or similar hazardous locations where workmen are subject to a direct fall (except for work performed using JLG's and bucket trucks up to 75 ft.): 50' to 75' - add 25% above workman's straight time rate; over 75' - add 50% above workman's straight time rate.

LINEMAN	HEAVY & HIGHWAY	BASE RATE	\$32.98
		FRINGE BENEFITS	11.60
EQUIPMENT OPERATOR	HEAVY & HIGHWAY	BASE RATE	\$29.48
		FRINGE BENEFITS	10.90
GROUND MEN	HEAVY & HIGHWAY	BASE RATE	\$19.53
		FRINGE BENEFITS	8.91

ELEVATOR CONSTRUCTORS:	BASE RATE	\$29.50
	FRINGE BENEFITS	6.56

GLAZIERS:	BASE RATE	\$9.05
	FRINGE BENEFITS	0.00

IRONWORKERS:	BUILDING	BASE RATE	\$8.65
		FRINGE BENEFITS	0.00

Structural:	HEAVY & HIGHWAY	BASE RATE	\$18.45
		FRINGE BENEFITS	5.80

Reinforcing:	HEAVY & HIGHWAY	BASE RATE	\$18.25
		FRINGE BENEFITS	5.80

LABORERS / BUILDING

GROUP 1:

Laborers, Carpenter Helpers, Cement Finisher Helpers, Concrete Men, Wreckers, Oxygen & Acetylene Handlers, Environmental Laborers, Hole Watch & Fire Watch:

BASE RATE	\$28.14
FRINGE BENEFITS	14.67

GROUP 2:

Hod Carriers & Mortar Men, Jackhammer, Electrical, Gas or Air Driven Tools, Burning Torch, Wagon Drill Operators, Tile Layers, Signal Men, Tool Room Men, Asphalt Worker, Creosote Material Handler:

BASE RATE	\$28.29
FRINGE BENEFITS	14.67

LABORERS / BUILDING CONTINUED:

GROUP 3:

Deck & Scow Men, Wrapping & Applying Hot & Cold Tar & Tape on all Pipes, Operation of Tester:

BASE RATE	\$28.31
FRINGE BENEFITS	14.67

Rock & Powder Men:

BASE RATE	\$29.37
FRINGE BENEFITS	14.67

Sand Hog & Mucker:

BASE RATE	\$28.77
FRINGE BENEFITS	14.67

Caisson Worker:

BASE RATE	\$29.34
FRINGE BENEFITS	14.67

LABORERS / HEAVY HIGHWAY:

HEAVY HIGHWAY GROUP 1: Aging and curing of concrete (any mode or method), asbestos abatement worker, asphalt plant laborers, asphalt laborers, batch truck dumpers, carpenter tenders, cement mason tenders, cleaning of machines, concrete laborers, demolition laborers, dredging laborers, drill helper, environmental laborer - nuclear, radiation, toxic and hazardous waste - Level D, flagmen, grade checkers, all hand digging and hand back filling, highway marker placers, landscaping laborers, mesh handlers and placers, puddler, railroad laborers, rip-rap and grouters, right of way laborers, sign, guard rail and fence installers (all types), signal men, sound barrier installer, storm and sanitary sewer laborers, swamper, truck spotters and dumpers, and wrecking of concrete forms, general cleanup:

HEAVY & HIGHWAY	BASE RATE	\$19.86
	FRINGE BENEFITS	9.55

HEAVY HIGHWAY GROUP 2: Batter board men (sanitary and storm sewer), brickmason tenders, mortar mixer operator, scaffold builders, burner and welder, bushhammers, chain saw operator, concrete saw operators, deckhand scow man, dry cement handlers, environmental laborers - nuclear, radiation, toxic and hazardous waste - Level C, forklift operators for masonry, form setters, green concrete cutting, hand operated grouter and grinder machine operator, jack hammers, lead paint abatement, pavement breakers, paving joint machine, pipe layers-laser operators (non-metallic), plastic pipe fusion, power driven Georgia buggy or wheelbarrow, power post hole diggers, precast manhole setters, walk-behind tampers, walk-behind trenchers, sand blasters, concrete chippers, surface grinders, vibrator operators, wagon drillers:

HEAVY & HIGHWAY	BASE RATE	\$20.11
	FRINGE BENEFITS	9.55

HEAVY HIGHWAY GROUP 3: Asphalt luteman and rakers, gunnite nozzleman, gunnite operators and mixers, grout pump operator, side rail setters, rail paved ditches, screw operators, tunnel laborers (free air), and water blasters:

HEAVY & HIGHWAY	BASE RATE	\$20.16
	FRINGE BENEFITS	9.55

LABORERS / HEAVY HIGHWAY: (CONTINUED)

HEAVY HIGHWAY GROUP 4: Caisson workers (free air), cement finishers, environmental laborer - nuclear, radiation, toxic and hazardous waste - Levels A and B, miners and drillers (free air), tunnel blasters, and tunnel muckers (free air), directional and horizontal boring, air track driller (all types), powder man and blaster, troxler and concrete tester if laborer is utilized:

HEAVY & HIGHWAY	BASE RATE	\$20.76
	FRINGE BENEFITS	9.55

MARBLE, TILE & TERRAZZO SETTERS:	BASE RATE	\$22.64
	FRINGE BENEFITS	6.10

MARBLE, TILE & TERRAZZO WORKERS:	BASE RATE	\$15.42
	FRINGE BENEFITS	5.42

MILLWRIGHTS:	BASE RATE	\$33.07
	FRINGE BENEFITS	17.26

OPERATING ENGINEERS / BUILDING:

CLASS A-1:

Operating Engineers possessing 3rd party certification NCCCO (National Commission for the Certification of Crane Operators) or OECF (Operating Engineers Certification Program) shall be paid the minimum wage rate per hour on the following equipment: Cherry picker, clamshell, crane, dragline, hoist (1 drum when used for stack or chimney construction or repair), orangepeel bucket, overhead crane, piledriver, rough terrain crane, truck crane, hoist, tower crane:

BUILDING	BASE RATE	\$31.97
	FRINGE BENEFITS	14.52

CLASS A:

Articulating Dump, auto patrol, batcher plant, bituminous paver, cableway, central compressor plant, clamshell, concrete mixer (21 cf or over), concrete pump, crane, crusher plant, derrick, derrick boat, directional boring machine, ditching and trenching machine, all types of loaders, forklift (regardless of lift height), GPS systems (on equipment within the classification), hoe-type machine, hoist (1-drum when used for stack or chimney construction or repair), hoisting engineer (2 or more drums), laser or remote controlled equipment (within the classification), locomotive, motor scrapper, carry-all scoop, bulldozer, heavy duty welder, mechanic, orangepeel bucket, piledriver, power blade, motor grader, roller (bituminous), scarifier, shovel, tractor shovel, truck crane, winch truck, push dozer, highlift, all types of boom cats, core drill, hoist, tow or push boat, a-frame winch truck, concrete paver, gradeall, hoist, hystar, pumpcrete, cross carrier, boom, tail boom, rotary drill, hydro hammer, muchking machine, rock spreader attached to equipment, scoopmobile, KeCal loader, tower cranes (French, German and other types, hydrocrane, backfiller, guries, subgrader, tunnel mining machines including moles, shields, or similar types of tunnel mining equipment.

BUILDING	*BASE RATE	\$31.10
	FRINGE BENEFITS	14.52

OPERATING ENGINEERS / BUILDING (CONTINUED):

CLASS B:

All air compressors over 900 cfm, bituminous mixer, joint sealing machine, concrete mixer under 21 cu ft, form grader, roller (rock), tractor (50 HP and over), bull float, finish machine, outboard motor boat, flexplane, firemen, boom type tamping machine, greaser on grease facilities servicing heavy equipment, switchman or brakeman, mechanic helper, whirley oiler, self-propelled compactor, tractair and road widening trencher and farm tractor with attachments (except backhoe, highlift and endloader), elevator (regardless of ownership when used for hoisting any building material), hoisting engineer (1-drum or buck hoist), Firebrick masonry excluded), well points, grout pump, throttle-valve man, tugger, electric vibrator compactor, and caisson drill helper.

BUILDING	BASE RATE	\$26.47
	FRINGE BENEFITS	14.52

CLASS C:

Bituminous distributor, cement gun, coveyor, mud jack, paving joint machine, roller (earth), tamping machine, tractors under 50 HP, vibrator oiler, concrete saw, burlap and curing machine, truck crane oiler, hydro-seeder, power form handling equipment, deckhand steersman, hydraulic post driver, and drill helper.

BUILDING	BASE RATE	\$25.13
	FRINGE BENEFITS	14.52

OPERATING ENGINEERS / HEAVY HIGHWAY:

CLASS A-1:

Operating Engineers possessing 3rd party certification NCCCO (National Commission for the Certification of Crane Operators) or OECP (Operating Engineers Certification Program) shall be paid the minimum wage rate per hour on the following equipment: Cherry picker, clamshell, crane, dragline, hoist (1 drum when used for stack or chimney construction or repair), orangepeel bucket, overhead crane, piledriver, rough terrain crane, truck crane, hoist, tower crane:

HEAVY & HIGHWAY	BASE RATE	\$31.08
	FRINGE BENEFITS	14.40

CLASS A:

Auto patrol, batcher plant, bituminous paver, cable way, clamshell, concrete mixer (21 cf or over), concrete pump, crane, crusher plant, derrick, derrick boat, ditching and trenching machine, dragline, dredge engineer, elevator (regardless of ownership when used for hosting any build material), elevating grader and all types of loaders, hoe-type machine, hoisting engine, locomotive, LeTourneau or carry all scoop, bulldozer, mechanic, orangepeel bucket, piledriver, power blade roller, (bituminous), roller (earth), roller (rock), scarifer, shovel, tractor shovel, truck crane, well points, winch truck, push dozer, grout pump, high lift, fork lift (regardless of lift height), all types of boom cats, multiple operator, core drill, tow or push boat, A-frame winch truck, concrete paver, gradeall, hoist, hyster, material pump, pumpcrete, ross carrier, sheep foot, sideboom, throttle valve man, rotary drill, power generator, mucking machine, rock spreader attached to equipment, scoopmobile, KeCal loader, tower cranes (French, German and other types), hydrocrane, tugger, backfiller gurries, self propelled compactor, self contained hydraulic percussion drill.

HEAVY & HIGHWAY	BASE RATE	\$29.95
	FRINGE BENEFITS	14.40

OPERATING ENGINEERS / HEAVY HIGHWAY (CONTINUED):

CLASS B: All air compressors 200 cfm or greater, bituminous mixer, concrete mixer under 21 cf, welding machine, form grader, tractor 50 HP & over, bull float, finish machine, outboard motor boat, brakeman, mechanic helper, whirly oiler, tractair and road widening wrencher, articulating trucks.

HEAVY & HIGHWAY	BASE RATE	\$27.26
	FRINGE BENEFITS	14.40

CLASS B2: Greaser on grease facilities service heavy equipment:

HEAVY & HIGHWAY	BASE RATE	\$27.68
	FRINGE BENEFITS	14.40

CLASS C: Bituminous distributor, cement gun, conveyor, mud jack, paving joint machine, pump, tamping machine, tractors (under 50 HP), vibrator, oiler, air compressors (under 200 cfm capacity), concrete saw, burlap and curing machine, hydro seeder, power form handling equipment, deckhand oiler, hydraulic post driver:

HEAVY & HIGHWAY	BASE RATE	\$26.96
	FRINGE BENEFITS	14.40

PAINTERS:	BUILDING	BASE RATE	\$11.00
	HEAVY & HIGHWAY	BASE RATE	\$17.30
		FRINGE BENEFITS	3.80

PLASTERERS:	BASE RATE	\$13.30
	FRINGE BENEFITS	0.00

PLUMBERS & STEAMFITTERS:	BASE RATE	\$29.00
	FRINGE BENEFITS	24.12

ROOFERS: (Excluding metal roofs)	BASE RATE	\$13.00
	FRINGE BENEFITS	0.00

SHEETMETAL WORKERS: (Including metal roofs)	BASE RATE	\$10.88
	FRINGE BENEFITS	.46

SPRINKLER FITTERS:	BASE RATE	\$27.05
	FRINGE BENEFITS	12.90

TRUCK DRIVERS / BUILDING:

Truck Drivers:	BUILDING	BASE RATE	\$7.33
		FRINGE BENEFITS	0.00

TRUCK DRIVERS / HEAVY/HIGHWAY:

Truck helper and warehouseman:			
	HEAVY & HIGHWAY	BASE RATE	\$18.90
		FRINGE BENEFITS	8.30
Driver, winch truck & A-frame truck when used in transporting material:			
	HEAVY & HIGHWAY	BASE RATE	\$19.00
		FRINGE BENEFITS	8.30
Driver, semi-trailer or pole trailer, dump truck, tandem axle, and driver of distributors:			
	HEAVY & HIGHWAY	BASE RATE	\$19.10
		FRINGE BENEFITS	8.30
Driver on mixer trucks - all types:			
	HEAVY & HIGHWAY	BASE RATE	\$19.15
		FRINGE BENEFITS	8.30
Truck mechanic:	HEAVY & HIGHWAY	BASE RATE	\$19.20
		FRINGE BENEFITS	8.30
Driver, 3 tons & under, tire changer & truck mechanic helper:			
	HEAVY & HIGHWAY	BASE RATE	\$19.23
		FRINGE BENEFITS	8.30
Driver of pavement breakers:	HEAVY & HIGHWAY	BASE RATE	\$19.25
		FRINGE BENEFITS	8.30
Driver, over 3 tons & truck mounted rotary drill:			
	HEAVY & HIGHWAY	BASE RATE	\$19.44
		FRINGE BENEFITS	8.30
Driver, Euclid & other heavy earth moving equipment & low boy:			
	HEAVY & HIGHWAY	BASE RATE	\$20.01
		FRINGE BENEFITS	8.30
Greaser on greasing facilities:	HEAVY & HIGHWAY	BASE RATE	\$20.10
		FRINGE BENEFITS	8.30

END OF DOCUMENT
CR 2-030
October 7, 2015

SECTION 00820

FEDERAL PREVAILING WAGE DETERMINATION

General Decision Number: KY160139 05/13/2016 KY139

Superseded General Decision Number: KY20150139

State: Kentucky

Construction Type: Heavy

Counties: Bell, Breathitt, Carter, Clay, Elliott, Floyd, Harlan, Jackson, Knott, Lawrence, Lee, Leslie, Letcher, Magoffin, Martin, Morgan, Owsley, Perry and Wolfe Counties in Kentucky.

HEAVY CONSTRUCTION PROJECTS (including sewer/water construction).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.15 for calendar year 2016 applies to all contracts subject to the Davis-Bacon Act for which the solicitation was issued on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.15 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2016. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/08/2016
1	03/25/2016
2	05/13/2016

CARP0064-007 05/01/2015

	Rates	Fringes
CARPENTER (Form Work Only).....	\$ 27.50	16.06

ELEC0369-004 09/01/2014

	Rates	Fringes
LINE CONSTRUCTION		
Equipment Operator.....	\$ 30.51	11.25
Groundman.....	\$ 20.21	9.19
Lineman.....	\$ 34.13	13.02

ENGI0181-011 07/01/2015

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1.....	\$ 29.95	14.40
GROUP 2.....	\$ 27.26	14.40
GROUP 4.....	\$ 26.96	14.40

OPERATING ENGINEER CLASSIFICATIONS

GROUP 1 - Bulldozer; Crane; Drill; Grader/Blade; Mechanic;
Scraper

GROUP 2 - Bobcat/Skid Steer/Skid Loader; Forklift

GROUP 4 - Oiler

Operators on cranes with booms 150 feet and over (including jib) shall receive \$1.00 above Group 1 rate; 250 feet and over including jib shall receive \$1.50 above Class 1 rate. Combination Rate: All crane operators operating cranes, where the length of the boom in combination with the length of the piling leads equal or exceeds 150 feet, shall receive \$1.00 above the Group 1 rate.

Employees assigned to work below ground level are to be paid 10% above basic wage rate. This does not apply to open cut work.

* IRON0782-010 05/01/2016

	Rates	Fringes
IRONWORKER (Reinforcing & Structural)		
Projects over		
\$20,000,000.00.....	\$ 27.09	20.66
Projects under		
\$20,000,000.00.....	\$ 26.00	21.52

LABO0189-014 07/01/2015

	Rates	Fringes
LABORER		
Concrete Saw (Hand		
Held/Walk Behind).....	\$ 22.55	12.46
Concrete Worker.....	\$ 22.30	12.46

LABO1445-001 07/01/2015

	Rates	Fringes
LABORER		
Airtrack Driller.....	\$ 23.20	12.46

SUKY2011-016 06/25/2014

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 21.60	10.35
ELECTRICIAN.....	\$ 32.35	2.18
LABORER: Common or General.....	\$ 21.36	9.39

LABORER: Flagger.....	\$ 18.31	8.89
LABORER: Pipelayer.....	\$ 20.15	8.92
OPERATOR:		
Backhoe/Excavator/Trackhoe.....	\$ 25.97	10.25
OPERATOR: Loader.....	\$ 30.35	0.00

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that

classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division

U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

=====
END OF GENERAL DECISION

SECTION 00830

Permits and Reports

Steen, Matt

From: Potts, Greg (KYTC-D10) <greg.potts@ky.gov>
Sent: Tuesday, January 26, 2016 8:19 AM
To: Steen, Matt
Subject: RE: Breathitt county water district, KY 315/28 Waterline

Yes , it has been approved upon pending receipt of bond in the amount of \$100,000. This email shall serve as notice .
Please contact Breathitt County Water District. Thank You.

From: Steen, Matt [mailto:msteen@nei-ky.com]
Sent: Monday, January 25, 2016 10:14 AM
To: Potts, Greg (KYTC-D10)
Subject: Breathitt county water district, KY 315/28 Waterline

Greg,
Has the encroachment permit for the above project been approved pending contractor's bond?
Thanks and let me know if you have any questions.

Matt Steen, Project Development Engineer
Nesbitt Engineering Inc.
Direct (859) 685-4523
Cell (859) 559-2399

STEVEN L. BESHEAR
GOVERNOR



LEONARD K. PETERS
SECRETARY

ENERGY AND ENVIRONMENT CABINET

DEPARTMENT FOR ENVIRONMENTAL PROTECTION

DIVISION OF WATER

200 FAIR OAKS LANE, 4TH FLOOR

FRANKFORT, KENTUCKY 40601

www.kentucky.gov

September 30, 2014

Mr. Bobby Thorpe, Jr.
Breathitt County Water District
1137 Main Street
Jackson, KY 41339

RE: Breathitt Co Water District
AI # 45303, APE20140002
PWSID # 0131012-14-002
KY 315/28 Waterline Extension Project
Breathitt County, KY

Dear Mr. Thorpe:

We have reviewed the plans and specifications for the above referenced project. The plans include the construction of approximately 8,310 feet of 8-inch PVC; 23,690 feet of 6-inch PVC; 32,680 feet of 4-inch PVC; 3,880 feet of 2-inch PVC; 10,380 feet of 8-inch DI; 6,000 feet of 6-inch DI and 250 feet of 4-inch DI water lines; a Booster Pump Station with 2 pumps at 320 gpm with 450 feet TDH and a second Variable speed Pump Station with 2 pumps at 14.6 gpm with 160 feet TDH and 2 Ground Water Storage Tanks of 109,000 gallons capacity. This is to advise that plans and specifications for the above referenced project are APPROVED with respect to sanitary features of design, as of this date with the requirements contained in the attached construction permit.

If you have any questions concerning this project, please contact Mr. Mohammed Mohiuddin at 502-564-3410 extension 4827.

Sincerely,

A handwritten signature in black ink that reads "Mark Rasche".

Mark Rasche, P.E.
Supervisor, Engineering Section
Water Infrastructure Branch
Division of Water

MR: MM
Enclosures

C: **Nesbitt Engineering Inc**
Breathitt County Health Department
Public Service Commission (by e-mail only)
Division of Plumbing (by e-mail only)

Distribution-Major Construction

Breathitt Co Water District
Facility Requirements

Activity ID No.: APE20140002

Page 1 of 15

PORT0000000041 (Waterline Extension) 8,310 feet of 8-inch PVC; 23,690 feet of 6-inch PVC; 32,680 feet of 4-inch PVC; 3,880 feet of 2-inch PVC; 10,380 feet of 8-inch DI; 6,000 feet of 6-inch DI and 250 feet of 4-inch DI Waterlines:

Narrative Requirements:

Condition No.	Condition
T-1	Construction of this project shall not result in the water system's inability to supply consistent water service in compliance with 401 KAR 8:010 through 8:600. [401 KAR 8:100 Section 5]
T-2	The public water system shall not implement a change to the approved plans without the prior written approval of the cabinet. [401 KAR 8:100 Section 4(3)]
T-3	A proposed change to the approved plans affecting sanitary features of design shall be submitted to the cabinet for approval in accordance with Section 2 of this administrative regulation. [401 KAR 8:100 Section 4(2)]
T-4	During construction, a set of approved plans and specifications shall be available at the job site. Construction shall be performed in accordance with the approved plans and specifications. [401 KAR 8:100 Section 3(1)]
T-5	Unless construction begins within two (2) years from the date of approval of the final plans and specifications, the approval shall expire. [401 KAR 8:100 Section 3(3)]
T-6	Upon completion of construction, a professional engineer shall certify in writing that the project has been completed in accordance with the approved plans and specifications. [401 KAR 8:100 Section 4(1)]
T-7	The system shall be designed to maintain a minimum pressure of 20 psi at ground level at all points in the distribution system under all conditions of flow. [Recommended Standards for Water Works 8.2.1, Drinking Water General Design Criteria IV.1.a]
T-8	Water lines should be hydraulically capable of a flow velocity of 2.5 ft/s while maintaining a pressure of at least 20 psi. [Drinking Water General Design Criteria IV.1.b]
T-9	The normal working pressure in the distribution system at the service connection shall not be less than 30 psi under peak demand flow conditions. Peak demand is defined as the maximum customer water usage rate, expressed in gallons per minute (gpm), in the pressure zone of interest during a 24 hour (diurnal) time period. [Drinking Water General Design Criteria IV.1.d]
T-10	When static pressure exceeds 150 psi, pressure reducing devices shall be provided on mains or as part of the meter setting on individual service lines in the distribution system. [Drinking Water General Design Criteria IV.1.c]

Distribution-Major Construction

Breathitt Co Water District
Facility Requirements

Activity ID No.: APE20140002

Page 2 of 15

PORT0000000041 (continued):

Narrative Requirements:

Condition No.	Condition
T-11	The minimum size of water main in the distribution system where fire protection is not to be provided should be a minimum of three (3) inch diameter. Any departure from minimum requirements shall be justified by hydraulic analysis and future water use, and can be considered only in special circumstances. [Recommended Standards for Water Works 8.2.2, Drinking Water General Design Criteria IV.2.b]
T-12	Water mains not designed to carry fire-flows shall not have fire hydrants connected to them. [Recommended Standards for Water Works 8.4.1.b]
T-13	Flushing devices should be sized to provide flows which will give a velocity of at least 2.5 feet per second in the water main being flushed. [Recommended Standards for Water Works 8.2.4.b, Recommended Standards for Water Works 8.4.1.b]
T-14	No flushing device shall be directly connected to any sewer. [Recommended Standards for Water Works 8.2.4.b, Recommended Standards for Water Works 8.4.1.b]
T-15	Pipe shall be constructed to a depth providing a minimum cover of 30 inches to top of pipe. [Drinking Water General Design Criteria IV.3.a]
T-16	Water mains shall be covered with sufficient earth or other insulation to prevent freezing. [Recommended Standards for Water Works 8.7]
T-17	A continuous and uniform bedding shall be provided in the trench for all buried pipe. Backfill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe. Stones found in the trench shall be removed for a depth of at least six inches below the bottom of the pipe. [Recommended Standards for Water Works 8.7]
T-18	Water line installation shall incorporate the provisions of the AWWA standards and/or manufacturer's recommended installation procedures. [Recommended Standards for Water Works 8.7]
T-19	All materials used for the rehabilitation of water mains shall meet ANSI/NSF standards. [Recommended Standards for Water Works 8.1]
T-20	Packing and jointing materials used in the joints of pipe shall meet the standards of AWWA and the reviewing authority. [Recommended Standards for Water Works 8.1]
T-21	All tees, bends, plugs and hydrants shall be provided with reaction blocking, tie rods or joints designed to prevent movement. [Recommended Standards for Water Works 8.7]

Distribution-Major Construction

Breathitt Co Water District

Facility Requirements

Activity ID No.: APE20140002

Page 3 of 15

PORT0000000041 (continued):

Narrative Requirements:

Condition No.	Condition
T-22	All materials including pipe, fittings, valves and fire hydrants shall conform to the latest standards issued by the ASTM, AWWA and ANSI/NSF, where such standards exist, and be acceptable to the Division of Water. [Recommended Standards for Water Works 8.1]
T-23	Water mains which have been used previously for conveying potable water may be reused provided they meet the above standards and have been restored practically to their original condition. [Recommended Standards for Water Works 8.1]
T-24	Manufacturer approved transition joints shall be used between dissimilar piping materials. [Recommended Standards for Water Works 8.1]
T-25	Pipes and pipe fittings containing more than 8% lead shall not be used. All products shall comply with ANSI/NSF standards. [Recommended Standards for Water Works 8.1]
T-26	The minimum size of water main which provides for fire protection and serving fire hydrants shall be six-inch diameter. [Recommended Standards for Water Works 8.2, Drinking Water General Design Criteria IV.2.a]
T-27	Gaskets containing lead shall not be used. Repairs to lead-joint pipe shall be made using alternative methods. [Recommended Standards for Water Works 8.1]
T-28	Pipe materials shall be selected to protect against both internal and external pipe corrosion. [Recommended Standards for Water Works 8.1]
T-29	Dead end mains shall be equipped with a means to provide adequate flushing. [Recommended Standards for Water Works 8.2]
T-30	The hydrant lead shall be a minimum of six inches in diameter. Auxiliary valves shall be installed on all hydrant leads. [Recommended Standards for Water Works 8.4.3]
T-31	A sufficient number of valves shall be provided on water mains to minimize inconvenience and sanitary hazards during repairs. [Recommended Standards for Water Works 8.3]
T-32	Wherever possible, chambers, pits or manholes containing valves, blow-offs, meters, or other such appurtenances to a distribution system, shall not be located in areas subject to flooding or in areas of high groundwater. Such chambers or pits should drain to the ground surface, or to absorption pits underground. The chambers, pits and manholes shall not connect directly to any storm drain or sanitary sewer. Blow-offs shall not connect directly to any storm drain or sanitary sewer. [Recommended Standards for Water Works 8.6]

Distribution-Major Construction

Breathitt Co Water District

Facility Requirements

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PORT0000000041 (continued):

Narrative Requirements:

Condition No.	Condition
T-33	At high points in water mains where air can accumulate provisions shall be made to remove the air by means of air relief valves. [Recommended Standards for Water Works 8.5.1]
T-34	Automatic air relief valves shall not be used in situations where flooding of the manhole or chamber may occur. [Recommended Standards for Water Works 8.5.1]
T-35	The open end of an air relief pipe from automatic valves shall be extended to at least one foot above grade and provided with a screened, downward-facing elbow. [Recommended Standards for Water Works 8.5.2.c]
T-36	Discharge piping from air relief valves shall not connect directly to any storm drain, storm sewer, or sanitary sewer. [Recommended Standards for Water Works 8.5.2.d]
T-37	Water pipe shall be constructed with a lateral separation of 10 feet or more from any gravity sanitary or combined sewer measured edge to edge where practical. If not practical a variance may be requested to allow the water pipe to be installed closer to the gravity sanitary or combined sewer provided the water pipe is laid in a separate trench or undisturbed shelf located on one side of the sewer with the bottom of the pipe at least 18 inches above the top of the gravity sanitary or combined sewer pipe. [Drinking Water General Design Criteria IV.3.b]
T-38	Water lines crossing sanitary, combined or storm sewers shall be laid to provide a minimum vertical distance of 18 inches between the outside of the water main and the outside of the sanitary, combined or storm sewer with preference to the water main located above the sanitary, combined or storm sewer. [Drinking Water General Design Criteria IV.3.c]
T-39	At crossings, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. [Recommended Standards for Water Works 8.8.3.b]
T-40	There shall be no connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contaminating materials may be discharged or drawn into the system. [Recommended Standards for Water Works 8.10.1]
T-41	Water utilities shall have a cross connection program conforming to 401 KAR 8. [Recommended Standards for Water Works 8.10.1]
T-42	Installed pipe shall be pressure tested and leakage tested in accordance with the appropriate AWWA Standards. [Recommended Standards for Water Works 8.7.6]

Distribution-Major Construction

Breathitt Co Water District
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PORT00000000041 (continued):

Narrative Requirements:

Condition No.	Condition
T-43	New, cleaned and repaired water mains shall be disinfected in accordance with AWWA Standard C651. The specifications shall include detailed procedures for the adequate flushing, disinfection, and microbiological testing of all water mains. In an emergency or unusual situation, the disinfection procedure shall be discussed with the Division of Water. [Recommended Standards for Water Works 8.7.7]
T-44	A minimum cover of five feet shall be provided over pipe crossing underwater. [Recommended Standards for Water Works 8.9.2]
T-45	Valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair; the valves shall be easily accessible, and not subject to flooding for pipes crossing underwater. [Recommended Standards for Water Works 8.9.2.b]
T-46	Permanent taps or other provisions to allow insertion of a small meter to determine leakage and obtain water samples on each side of the valve closest to the supply source for pipes crossing. [Recommended Standards for Water Works 8.9.2.c]

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PORT0000000042 (Booster Pump Station) a Booster Pump Station with 2 pumps at 320 gpm with 450 feet TDH and a second Variable Speed Pump Station with 2 pumps at 14.6 gpdm with 160 feet TDH:

Narrative Requirements:

Condition No.	Condition
T-1	Construction of this project shall not result in the water system's inability to supply consistent water service in compliance with 401 KAR 8:010 through 8:600. [401 KAR 8:100 Section 5]
T-2	The public water system shall not implement a change to the approved plans without the prior written approval of the cabinet. [401 KAR 8:100 Section 4(3)]
T-3	A proposed change to the approved plans affecting sanitary features of design shall be submitted to the cabinet for approval in accordance with Section 2 of this administrative regulation. [401 KAR 8:100 Section 4(2)]
T-4	During construction, a set of approved plans and specifications shall be available at the job site. Construction shall be performed in accordance with the approved plans and specifications. [401 KAR 8:100 Section 3(1)]
T-5	Unless construction begins within two (2) years from the date of approval of the final plans and specifications, the approval shall expire. [401 KAR 8:100 Section 3(3)]
T-6	Upon completion of construction, a professional engineer shall certify in writing that the project has been completed in accordance with the approved plans and specifications. [401 KAR 8:100 Section 4(1)]
T-7	The system shall be designed to maintain a minimum pressure of 20 psi at ground level at all points in the distribution system under all conditions of flow. [Recommended Standards for Water Works 8.2.1, Drinking Water General Design Criteria IV.1.a]
T-8	Pumping facilities shall be elevated to a minimum of three feet above the 100-year flood elevation, or three feet above the highest recorded flood elevation, whichever is higher, or protected to such elevations, [Recommended Standards for Water Works 6.1.1.a]
T-9	Pumping facilities shall be readily accessible at all times. [Recommended Standards for Water Works 6.1.1.b]
T-10	Pumping facilities shall be graded around the station so as to lead surface drainage away from the station. [Recommended Standards for Water Works 6.1.1.c]
T-11	Pumping facilities shall be protected to prevent vandalism and entrance by animals or unauthorized persons. [Recommended Standards for Water Works 6.1.1.d]

Distribution-Major Construction

Breathitt Co Water District
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PORT0000000042 (continued):

Narrative Requirements:

Condition No.	Condition
T-12	Raw and finished pump stations shall have adequate space for the installation of additional units if needed, and for the safe servicing of all equipment. [Recommended Standards for Water Works 6.2.a]
T-13	Raw and finished pump stations shall have floors that slope to a suitable drain. [Recommended Standards for Water Works 6.2.e]
T-14	Raw and finished pump stations shall provide a suitable outlet for drainage from pump glands without discharging onto the floor. [Recommended Standards for Water Works 6.2.f]
T-15	At least two pumping units shall be provided. With any pump out of service, the remaining pump or pumps shall be capable of providing the maximum pumping demand of the system. [Recommended Standards for Water Works 6.3]
T-16	Pumps shall have ample capacity to supply the peak demand against the required distribution system pressure without dangerous overloading, [Recommended Standards for Water Works 6.3.a]
T-17	Pumps shall be driven by prime movers able to meet the maximum horsepower condition of the pumps. [Recommended Standards for Water Works 6.3.b]
T-18	Pumps shall be provided with readily available spare parts and tools. [Recommended Standards for Water Works 6.3.c]
T-19	Pump stations shall have indicating, totalizing, and recording metering of the total water pumped. [Recommended Standards for Water Works 6.6.3]
T-20	Each pump shall have a standard pressure gauge on its discharge line. [Recommended Standards for Water Works 6.6.3.a]
T-21	Each pump shall have a compound gauge on its suction line. [Recommended Standards for Water Works 6.6.3.b]
T-22	Where two or more pumps are installed, provision shall be made for alternation. [Recommended Standards for Water Works 6.6.5]
T-23	Provisions shall be made to prevent energizing the pump motor in the event of a backspin cycle. [Recommended Standards for Water Works 6.6.5]
T-24	Electrical controls shall be located above grade. [Recommended Standards for Water Works 6.6.5]

Distribution-Major Construction

Breathitt Co Water District

Facility Requirements

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PORT0000000042 (continued):

Narrative Requirements:

Condition No.	Condition
T-25	Equipment shall be provided or other arrangements made to prevent surge pressures from activating controls which switch on pumps or activate other equipment outside the normal design cycle of operation. [Recommended Standards for Water Works 6.6.5]
T-26	Pump stations shall have a power supply provided from at least two independent sources or a standby or an auxiliary source. [Recommended Standards for Water Works 6.6.6]
T-27	If standby power is provided by onsite generators or engines, the fuel storage and fuel line must be designed to protect the water supply from contamination. [Recommended Standards for Water Works 6.6.6]
T-28	All lubricants which come into contact with the potable water shall be certified for conformance to ANSI/NSF Standard 60. [Recommended Standards for Water Works 6.6.8]
T-29	Booster pumps stations shall have a bypass available. [Recommended Standards for Water Works 6.4.e]
T-30	Each booster pumping station shall contain not less than two pumps with capacities such that peak demand can be satisfied with the largest pump out of service. [Recommended Standards for Water Works 6.4.1]
T-31	All booster pumping stations shall be fitted with a flow rate indicating and totalizer meter. [Recommended Standards for Water Works 6.4.2]
T-32	Inline booster pumps shall be accessible for servicing and repairs. [Recommended Standards for Water Works 6.4.3]
T-33	Each pump must have an isolation valve on the intake and discharge side of the pump to permit satisfactory operation, maintenance and repair of the equipment. [Recommended Standards for Water Works 6.6.1]
T-34	Each pump shall have a positive acting check valve on the discharge side between the pump and the shut off valve. [Recommended Standards for Water Works 6.6.1]
T-35	Pump station piping shall be designed so that the friction losses will be minimized, not be subject to contamination, have watertight joints, be protected against surge or water hammer with suitable restraints when necessary, and be such that each pump has an individual suction line or the lines shall be manifolded that they will insure similar hydraulic and operating conditions. [Recommended Standards for Water Works 6.6.2]

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PORT0000000042 (continued):

Narrative Requirements:

Condition No.	Condition
T-36	Booster pumps taking suction from storage tanks shall be provided adequate net positive suction head. [Recommended Standards for Water Works 6.4.b]
T-37	Booster pumps shall controlled so that automatic shutoff or low pressure controllers maintain at least 20 psi in the suction line under all operating conditions. [Recommended Standards for Water Works 6.4.c]
T-38	Booster pumps taking suction from ground storage tanks shall be equipped with automatic shutoffs or low pressure controllers. [Recommended Standards for Water Works 6.4.c]
T-39	All automatic pump stations should be provided with automatic signaling apparatus which will report when the station is out of service. [Recommended Standards for Water Works 6.5]
T-40	All remote controlled stations shall be electrically operated and controlled and shall have signaling apparatus of proven performance. [Recommended Standards for Water Works 6.5]
T-41	Raw and finished pump stations shall have a floor elevation of at least six inches above finished grade. [Recommended Standards for Water Works 6.2.c]

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STOR0000000025 (Ground Storage Tank) 2 Ground Water Storage Tanks of 109,000 gallons capacity:

Narrative Requirements:

Condition No.	Condition
T-1	Construction of this project shall not result in the water system's inability to supply consistent water service in compliance with 401 KAR 8:010 through 8:600. [401 KAR 8:100 Section 5]
T-2	The public water system shall not implement a change to the approved plans without the prior written approval of the cabinet. [401 KAR 8:100 Section 4(3)]
T-3	A proposed change to the approved plans affecting sanitary features of design shall be submitted to the cabinet for approval in accordance with Section 2 of this administrative regulation. [401 KAR 8:100 Section 4(2)]
T-4	During construction, a set of approved plans and specifications shall be available at the job site. Construction shall be performed in accordance with the approved plans and specifications. [401 KAR 8:100 Section 3(1)]
T-5	Unless construction begins within two (2) years from the date of approval of the final plans and specifications, the approval shall expire. [401 KAR 8:100 Section 3(3)]
T-6	Upon completion of construction, a professional engineer shall certify in writing that the project has been completed in accordance with the approved plans and specifications. [401 KAR 8:100 Section 4(1)]
T-7	The system shall be designed to maintain a minimum pressure of 20 psi at ground level at all points in the distribution system under all conditions of flow. [Recommended Standards for Water Works 8.2.1, Drinking Water General Design Criteria IV.1.a]
T-8	Water storage tanks shall have a minimum 100% turnover rate of once per 72 hours. [Drinking Water General Design Criteria IV.6.a]
T-9	Minimum water level for all gravity storage tanks shall maintain a minimum design pressure of 30 psi for all potential points of use supplied by the tank. [Drinking Water General Design Criteria IV.6.b]
T-10	Separate inlet and outlet is required on storage tanks; and the inlet has to be in the upper half of the tank (unless there is a separate mixing system). [Drinking Water General Design Criteria IV.6.c]
T-11	The maximum variation between high and low levels in storage structures providing pressure to a distribution system should not exceed 30 feet. [Recommended Standards for Water Works 7.3.1]

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STOR0000000025 (continued):

Narrative Requirements:

Condition No.	Condition
T-12	Finished water storage structures which provide pressure directly to the distribution system shall be designed so they can be isolated from the distribution system and drained for cleaning or maintenance without causing a loss of pressure in the distribution system. [Recommended Standards for Water Works 7.3.2]
T-13	The storage structure drain shall discharge to the ground surface with no direct connection to a sewer or storm drain. [Recommended Standards for Water Works 7.3.2]
T-14	Adequate controls shall be provided to maintain levels in distribution system storage structures. Level indicating devices should be provided at a central location. [Recommended Standards for Water Works 7.3.3]
T-15	The minimum storage capacity (or equivalent capacity) for systems not providing fire protection shall be equal to the average daily consumption. [Recommended Standards for Water Works 7.0.1.b]
T-16	The system should be designed to facilitate turnover of water in the reservoir. [Recommended Standards for Water Works 7.0.6]
T-17	Excessive storage capacity should be avoided to prevent potential water quality deterioration problems. [Recommended Standards for Water Works 7.0.1.c]
T-18	The overflow pipe shall be of sufficient diameter to permit waste of water in excess of the filling rate. [Recommended Standards for Water Works 7.0.7.d]
T-19	Finished water storage structures shall be designed with reasonably convenient access to the interior for cleaning and maintenance. [Recommended Standards for Water Works 7.0.8]
T-20	Finished water storage structures shall be vented. Vents shall prevent the entrance of surface water, rainwater, bird, and animals. The overflow pipe shall not be considered a vent. Open construction between the sidewall and roof is not permissible. [Recommended Standards for Water Works 7.0.9]
T-21	Finished water storage structures and their appurtenances, especially the riser pipes, overflows, and vents, shall be designed to prevent freezing. Equipment used for freeze protection that will come into contact with the potable water shall meet ANSI/NSF Standard 61. [Recommended Standards for Water Works 7.0.13]
T-22	If a flapper valve is utilized, a screen shall be provide inside the valve. Provisions must be included to prevent the flapper from freezing shut. [Recommended Standards for Water Works 7.0.7.e]

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STOR0000000025 (continued):

Narrative Requirements:

Condition No.	Condition
T-23	The roof and sidewalls of all water storage structures must be watertight with no openings except properly constructed vents, manholes, overflows, risers, drains, pump mountings, control ports, or piping for inflow and outflow. [Recommended Standards for Water Works 7.0.10]
T-24	Any pipes running through the roof or sidewall of a metal storage structure must be welded, or properly gasketed. In concrete tanks, these pipes shall be connected to standard wall castings which were poured in place during the forming of the concrete. [Recommended Standards for Water Works 7.0.10.a]
T-25	Openings in the roof of a storage structure designed to accommodate control apparatus or pump columns, shall be curbed and sleeved with proper additional shielding to prevent contamination from surface or floor drainage. [Recommended Standards for Water Works 7.0.10.b]
T-26	Valves and controls should be located outside the storage structure so that the valve stems and similar projections will not pass through the roof or top of the reservoir. [Recommended Standards for Water Works 7.0.10.c]
T-27	Every catwalk over finished water in a storage structure shall have a solid floor with sealed raised edges, designed to prevent contamination from shoe scrapings and dirt. [Recommended Standards for Water Works 7.0.14]
T-28	The discharge pipes from water storage structures shall be located in a manner that will prevent the flow of sediment into the distribution system. [Recommended Standards for Water Works 7.0.15]
T-29	Smooth-nosed sampling tap(s) shall be provided to facilitate collection of water samples for both bacteriological and chemical analyses. The sample tap(s) shall be easily accessible. [Recommended Standards for Water Works 7.0.19]
T-30	Sewers, drains, standing water, and similar sources of possible contamination must be kept at least 50 feet from water storage facilities. Gravity sewers constructed of water main quality pipe, pressure tested in place without leakage, may be used at distances greater than 20 feet but less than 50 feet. [Recommended Standards for Water Works 7.0.2.c]
T-31	The roof of the storage structure shall be well drained. Downspout pipes shall not enter or pass through the reservoir. [Recommended Standards for Water Works 7.0.10.d]
T-32	Porous material, including wood and concrete block shall not be used for potable water contact applications. [Recommended Standards for Water Works 7.0.11]
T-33	All finished water storage structures shall have suitable watertight roofs which exclude birds, animals, insects, and excessive dust. [Recommended Standards for Water Works 7.0.3]

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STOR0000000025 (continued):

Narrative Requirements:

Condition No.	Condition
T-34	Fencing, locks on access manholes, and other necessary precautions shall be provided to prevent trespassing, vandalism, and sabotage. [Recommended Standards for Water Works 7.0.4]
T-35	Ladders, ladder guards, balcony railings, and safely located entrance hatches shall be provided where applicable. [Recommended Standards for Water Works 7.0.12.a]
T-36	All water storage structures shall be provided with an overflow which is brought down to an elevation between 12 and 24 inches above the ground surface, and discharges over a drainage inlet structure or a splash plate. All overflow pipes shall be located so that any discharge is visible. [Recommended Standards for Water Works 7.0.7]
T-37	No drain on a water storage structure may have a direct connection to a sewer or storm drain. [Recommended Standards for Water Works 7.0.5]
T-38	The design shall allow draining the storage facility for cleaning or maintenance without causing loss of pressure in the distribution system. [Recommended Standards for Water Works 7.0.5]
T-39	No overflow may be connected directly to a sewer or a storm drain. [Recommended Standards for Water Works 7.0.7]
T-40	Proper protection shall be given to metal surfaces by paints or other protective coatings, by cathodic protective devices, or by both. [Recommended Standards for Water Works 7.0.17]
T-41	Paint systems shall meet ANSI/NSF standard 61. [Recommended Standards for Water Works 7.0.17.a]
T-42	Interior paint must be applied, cured, and used in a manner consistent with the ANSI/NSF approval. [Recommended Standards for Water Works 7.0.17.a]
T-43	After curing, the coating shall not transfer any substance to the water which will be toxic or cause taste or odor problems. [Recommended Standards for Water Works 7.0.17.a]
T-44	Wax coatings for the tank interior shall not be used on new tanks. [Recommended Standards for Water Works 7.0.17.b]
T-45	Old wax coating must be completely removed before using another tank coating. [Recommended Standards for Water Works 7.0.17.b]

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STOR0000000025 (continued):

Narrative Requirements:

Condition No.	Condition
T-46	Finished water storage structures shall be disinfected in accordance with AWWA Standard C652. Two or more successive sets of samples, taken at 24-hour intervals, shall indicate microbiologically satisfactory water before the facility is placed into operation. [Recommended Standards for Water Works 7.0.18.a]
T-47	The disinfection procedure specified in AWWA Standard C652 chlorination method 3, section 4.3 which allows use of the highly chlorinated water held in the storage tank for disinfection purposes, is prohibited unless the initial heavily chlorinated water is properly disposed. [Recommended Standards for Water Works 7.0.18.c]
T-48	The overflow for a ground-level storage reservoir shall open downward and be screened with twenty-four mesh non-corrodible screen. [Recommended Standards for Water Works 7.0.7.b]
T-49	Each ground level structure manhole shall be elevated at least 24 inches above the top of the tank or covering sod, whichever is higher. [Recommended Standards for Water Works 7.0.8.2]
T-50	Each ground level structure manhole shall be fitted with a solid water tight cover which overlaps a framed opening and extends down around the frame at least two inches. The frame shall be at least four inches high. Each cover shall be hinged on one side, and shall have a locking device. [Recommended Standards for Water Works 7.0.8.2]
T-51	Ground level structure vents shall open downward with the opening at least 24 inches above the roof or sod and covered with twenty-four mesh non-corrodible screen. [Recommended Standards for Water Works 7.0.9.d]
T-52	The area surrounding a ground-level structure shall be graded in a manner that will prevent surface water from standing within 50 feet of it. [Recommended Standards for Water Works 7.0.16]
T-53	The bottom of ground level reservoirs and standpipes should be placed at the normal ground surface and shall be above the 100 Year Flood or the highest flood of record. [Recommended Standards for Water Works 7.0.2.b]
T-54	The roof of concrete reservoirs with earthen cover shall be sloped to facilitate drainage. [Recommended Standards for Water Works 7.0.10.e]
T-55	If the bottom elevation of a storage reservoir must be below normal ground surface, it shall be placed above the groundwater table. At least 50 percent of the water stored should be above grade. [Recommended Standards for Water Works 7.0.2.c]

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STOR0000000025 (continued):

Narrative Requirements:

Condition No.	Condition
T-56	The top of a partially buried storage structure shall not be less than two feet above normal ground surface. [Recommended Standards for Water Works 7.0.2.d]
T-57	If a water circulation system is used, it is recommended that the circulation pipe be located separately from the riser pipe. [Recommended Standards for Water Works 7.0.13]
T-58	Reservoirs with pre-cast concrete roof structures must be made watertight with the use of a waterproof membrane or similar product. [Recommended Standards for Water Works 7.0.10.f]



Report of Geotechnical Exploration

for

Breathitt County Water Tanks

Breathitt and Perry Counties, Kentucky

April 29, 2016

Prepared for

Nesbitt Engineering

Lexington, Kentucky

CSI Project Number LX160076

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Geotechnical & Materials Engineering | IBC Special Inspection | Material Testing

April 29, 2016

Nesbitt Engineering
227 N. Upper Street
Lexington, KY 40507

ATTN: Mr. Matt Steen
E: msteen@nei-ky.com

Subject: **Report of Geotechnical Exploration**
Breathitt County Tank Sites
Breathitt and Perry Counties, Kentucky
CSI Project No. LX160076

Dear Mr. Steen:

Consulting Services Incorporated of Kentucky (CSI) is pleased to present our report for the geotechnical services completed for two proposed tank sites in Breathitt and Perry Counties, Kentucky. We provided our services in general accordance with CSI's proposal number 4251 dated March 4, 2016.

Our report represents information provided to us, readily available published data relevant to the site and site area, our observations and subsurface conditions encountered and our opinion of primary geotechnical conditions (discussion and recommendations) affecting design, construction and performance of the proposed earth and/or rock supported portions of the project.

We appreciate the opportunity to provide our geotechnical services to you and the design team. Please do not hesitate to contact us for questions or comments about the information contained herein.

Cordially,

Travis Greenwell, EIT, SI
Staff Engineer



Bruce L. Hatcher, PE, SI
Chief Engineer
Licensed KY 14,527

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INTRODUCTION

1 SCOPE OF THE GEOTECHNICAL EXPLORATION

As we proposed, we conducted geotechnical services which are summarized in the following report. Our services included a review of the project information provided, conducting a subsurface exploration that utilized soil borings and rock coring to obtain samples for modeling the soil/rock conditions at the subject sites, an analysis of the data and information obtained and providing recommendations for the earth and/or rock supported portions of the site as listed in our proposal.

2 PROVIDED INFORMATION

Project information for this project was provided to us via e-mail from you, dated March 2, 2016. We were provided with a latitude and longitude for each site in order to more readily locate them for two potential water storage tanks. Also, in the email was an attached aerial map with the two sites labeled.

We understand that two water storage tanks are being considered for development. The site for Tank #1 is located on KY 28 at the Breathitt/ Perry County line. The site for Tank #2 is located near the intersection of KY 315 and KY 28. Both of these sites are located between Chavies and Buckhorn, Kentucky.

We understand that the first site will consist of a 109,000 gallon water storage tank and will have dimensions of 28 feet by 24 feet. The second site will consist of a 33,000 gallon water storage tank with dimensions of 15 feet by 24 feet and an accompanying pump station. We expect that these tanks will be supported by the underlying bedrock through the use of a ring wall foundation system or a mat foundation.

Based on our site observations, the site for Tank #1 is offset and uphill from KY 28 along a gravel drive (possible strip mine bench or mine access road). The site is gently sloping up from the gravel drive towards an apparent highwall cut. Tank site #2 is directly adjacent on the north side of KY 28 and west of the intersection with KY 315. The site is moderately sloping from the roadway up the hillside. Thus, we expect minimal cuts/fills (less than 5 feet) will be required for these projects. We do not anticipate the need for steep cut/fill slopes or retaining walls for these projects.

No new pavement areas were discussed. Therefore, pavement recommendations have not been included in our scope of services.

If any of the aforementioned information is in error or if the information changes during the course of the project, please contact our office so that we can re-evaluate the new information with respect to our findings and recommendations.

3 AREA/SITE INFORMATION

3A AREA TOPOGRAPHY/PHYSIOGRAPHY

The sites are located in the Eastern Kentucky Coal Field Physiographic Region of Kentucky. This area consists of forested hills and V-shaped valleys. Published topographic mapping by the United States Geological Survey (USGS) indicates the elevations in either of the sites vicinities range from 750 feet to 1,350 feet. Below is a figure of the location of the sites with respect to the regional physiography.

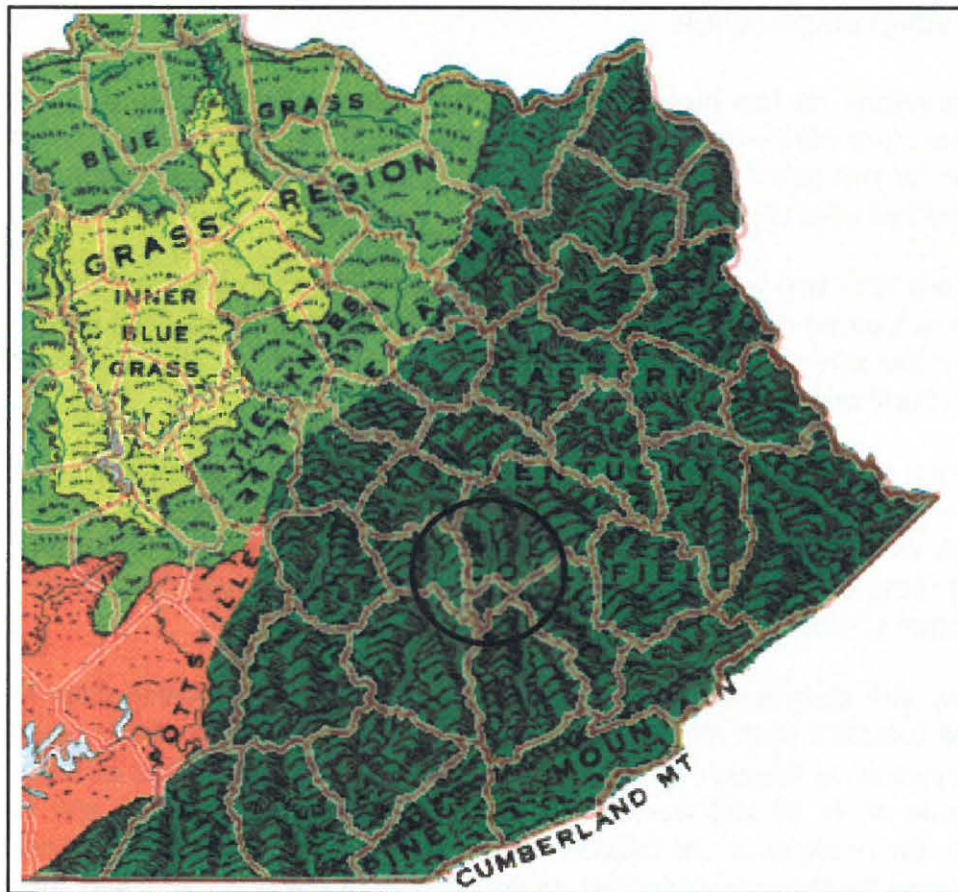


Figure 1. Kentucky Physiographic Map (site vicinity shown in the circle)

3B SITE GEOLOGY

A review of the *USGS Geologic Maps of the Buckhorn, Canoe, Cowcreek, and Mistletoe Quadrangles, Breathitt, Owsley, and Perry Counties, Kentucky* (all dated 1978), indicates that the project sites are located in an area underlain by Lower and Middle Pennsylvanian aged rock deposits. Specifically, both sites are underlain by the Breathitt Formation.



The Breathitt Formation consists primarily of shale along with siltstone, sandstone, clay, and coal seams. The shale and siltstone are described as gray to dark gray, weathering yellowish brown to buff. The sandstone is described as yellowish gray to buff, fine to medium grained, and is generally friable. The clay is described as gray, weathering to very light gray and white.

There are multiple coal seams and/or zones indicated on each of the geologic columns for the previously mentioned geologic quadrangles. Please note that tank site #1 is at the same approximate elevation as the Hazard Coal Zone.

Tank Site #1

Several coal seams are mapped near the site vicinity on the Buckhorn Quadrangle, but above the elevation of the tank site, including:

- Hindman (Hazard No. 9) coal bed - elevation 1,420 feet - 1,440 feet
- Francis (Hazard No. 8) coal zone - 1,340 - 1,360 feet
- Hazard No. 7 (Flag) coal bed - elevation 1,280 - 1,300 feet

Coal seams of potential concern for Tank Site #1 include:

- Hazard coal zone - elevation 1,200 - 1,240 feet (approximate elevation of site)
- Haddix coal zone - elevation 1,1150 - 1,170 feet
- Fire Clay coal bed - elevation 980 - 1,000 feet

Tank Site #2

Several coal seams are mapped near the site vicinity on the Canoe Quadrangle, but above the elevation of the tank site, including:

- Hazard #7 coal zone - elevation 1,250 - 1,270 feet
- Hazard coal zone - elevation 1,210 - 1,250 feet
- Haddix coal zone - elevation 1,180 - 1,200 feet
- Copland coal bed - elevation 1,080 - 1,100 feet
- Fire Clay coal bed - elevation 980 - 1,000 feet
- Whitesburg coal zone - elevation 930 - 950 feet

Coal seams of potential concern for Tank Site #1 include:

- unnamed coal seam - elevation 780 feet (approximate elevation of site)



- Upper Elkhorn #3 coal zone - elevation 600 - 650 feet (not mapped in the site vicinity)

Faults, Karst activity (i.e. - sinkholes, caves, underground streams, etc.), or other geologic hazards are not commonly associated with the Breathitt Formation. The geologic dip in this area is less than 1 percent to the east. No faults were mapped on the geologic quadrangles. Figure 2 below shows the site geology of the project area.

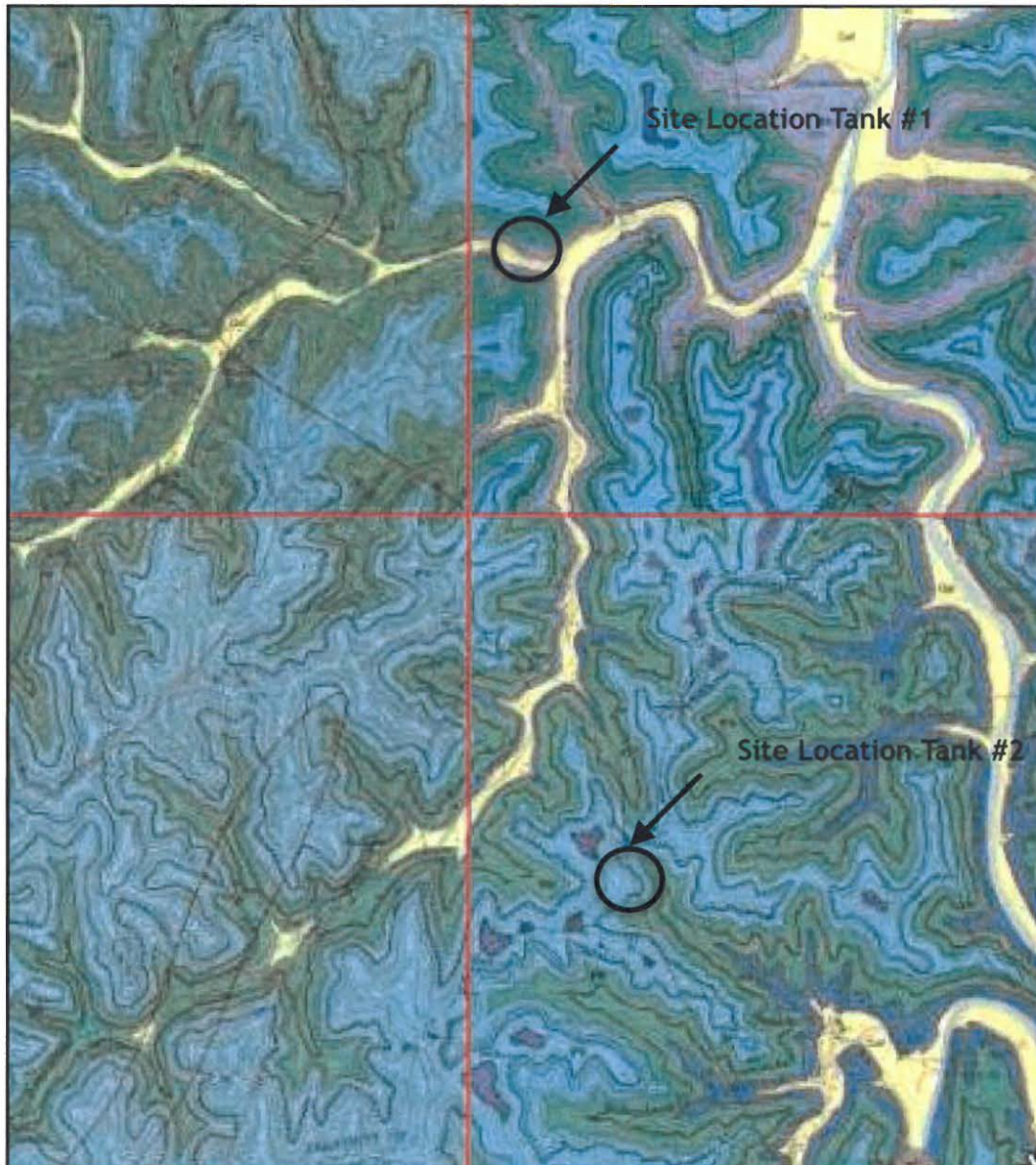


Figure 2. Site Geology USGS Buckhorn, Canoe, Cowcreek, and Mistletoe Geologic Quadrangle, dated 1979, 1976, 1976, and 1979. respectively (site vicinities shown by circles)



3C REVIEW OF MINING NOTED ON USGS MAPS

Our review of the USGS Buckhorn, Canoe, Cowcreek, and Mistletoe Quadrangle maps (topographic and geologic) revealed the following information:

Tank Site #1

- Strip mining and auger benches are indicated on the same seam (Hazard coal zone) as the project site, but not directly indicated on-site.
- Additional strip mining (and associated auger mining) has occurred to the north, south, east, and west of the project site.
- Mine adits (openings) are mapped to the north and east of the project site.

Tank Site #2

- Strip mining (and associated auger mining) has occurred to the south of the project site.
- Mine adits (openings) are mapped to the south of the project site.

3D REVIEW OF DEPARTMENT OF MINES AND MINERALS

We review publicly available underground mine maps from the Kentucky Mine Mapping Information System through their website www.minemaps.ky.gov. It should be noted that stored underground mining maps were destroyed in a fire at the Department of Mines and Minerals map room in 1948. Although most of the maps were able to be retrieved, not all maps were recovered.

Tank Site #1

Based on our review of the public records, these maps indicated that extensive mining occurred in proximity to Tank Site #1 within the Hazard coal zone, Hazard No. 7 seam, and the Hindman seam. Strip and auger mining operations were performed on all previously mentioned seams. However, the Hazard No. 5A seam within the Hazard coal zone was underground mined as well at approximately the same level as the site.

Tank Site #2

Based on our review of the public records, these maps indicated strip and deep mining on multiple seams to the south of the project site. There are multiple coal seams indicated on the geologic mapping near the project area. Our cursory mine map research did not indicate the presence of any deep mines directly below the project site for Tank Site #2. Normally mining activities are not common in Alluvial floodplains. Further details are provided by Figures 3 and 4 of the project location for tank site #2 on the following page.

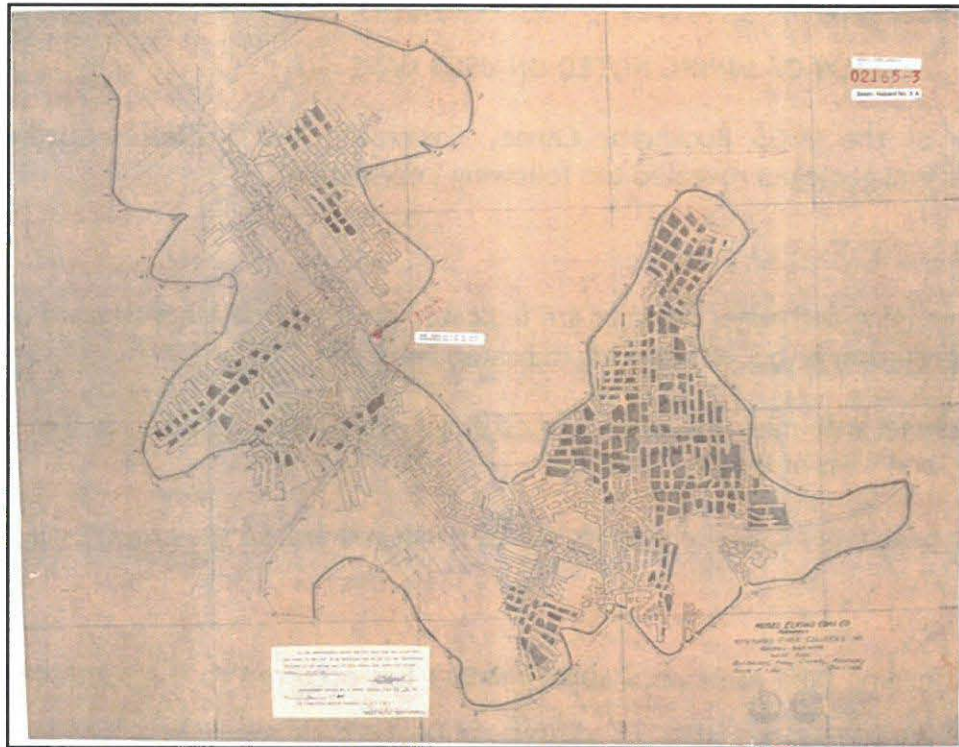


Figure 3. Mine Map 02165-3 detailing underground mining of Hazard No. 5A seam

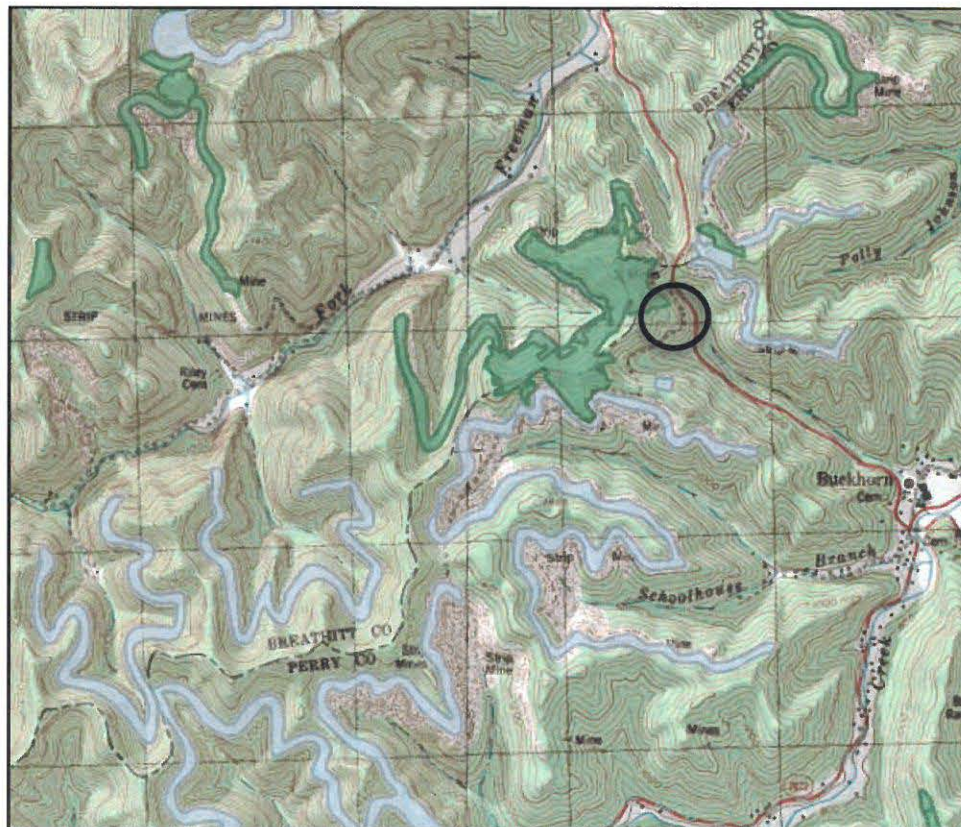


Figure 4. Mine Areas Map detailing underground and surface mined areas (site vicinity in circle)



3E PUBLISHED SITE SOIL CONDITIONS

According to the USDA Soil Survey of Perry County (NRCS website), the soils underlying the project site vicinity for Tank Site #1 consist of the following series (See Figure 5):

- Matewan-Marrowbone-Latham complex (DLF), 20 to 80 percent slopes, very rocky
- Shelocta-Cutshin-Gilpin complex (SCF), 20 to 75 percent slopes, very stony
- Shelocta-Highsplint-Gilpin complex (SGF), 20 to 75 percent slopes, very stony

The following are issues listed as characteristics of this series, which we believe could be of interest to the project:

- The soil series SCF and DLF are listed as having a high risk of corrosion to concrete. However, the soil series SGF is listed as having a moderate risk.
- All of the soil series are listed as having a moderate risk of corrosion to uncoated steel.
- All of the soil series are generally listed as being well drained.
- Depth to restrictive feature (i.e. - lithic bedrock) for the soil series DLF is generally listed as 28 inches. However, the soil series SCF and SGF are listed as 60 inches.
- Depth to water table for all of the soil series are generally listed as being greater than 80 inches.
- All of the soil series are generally listed as being very limited to the construction of shallow excavations. Particular issues affecting construction include being depth to hard bedrock, slope, and large stones.
- All of the soil series are generally listed as being very limited to the construction of local roads and streets. Particular issues affecting construction include slope, frost action, low strength, and depth to hard bedrock.

Due to the development of the site vicinity, the soil survey information listed above may no longer be useful since the site soils may have been altered. Thus, the soils described above may be on-site but not in their natural condition. Figure 5 on the following page is the soils map from the USDA website.



Figure 5: USDA Soil Survey Map of Project Site for Tank Site #1 (site vicinity in circle)

According to the USDA Soil Survey of Breathitt County (NRCS website), the soils underlying the project site vicinity for Tank Site #2 consist of the following series (See Figure 6):

- Matewan-Marrowbone-Latham complex (DLF), 20 to 80 percent slopes, very rocky
- Shelocta-Cutshin-Gilpin complex (SCF), 20 to 75 percent slopes, very stony
- Shelocta-Highsplint-Gilpin complex (SGF), 20 to 75 percent slopes, very stony

The following are issues listed as characteristics of this series, which we believe could be of interest to the project:

- The soil series SCF and DLF are listed as having a high risk of corrosion to concrete. However, the soil series SGF is listed as having a moderate risk.



- All of the soil series are listed as having a moderate risk of corrosion to uncoated steel.
- All of the soil series are generally listed as being well drained.
- Depth to restrictive feature (i.e. - lithic bedrock) for the soil series DLF is generally listed as 28 inches. However, the soil series SCF and SGF are listed as 60 inches.
- Depth to water table for all of the soil series are generally listed as being greater than 80 inches.
- All of the soil series are generally listed as being very limited to the construction of shallow excavations. Particular issues affecting construction include being depth to hard bedrock, slope, and large stones.
- All of the soil series are generally listed as being very limited to the construction of local roads and streets. Particular issues affecting construction include slope, frost action, low strength, and depth to hard bedrock.

Due to the development of the site vicinity, the soil survey information listed above may no longer be useful since the site soils may have been altered. Thus, the soils described above may be on-site but not in their natural condition. Figure 6 below is the soils map from the USDA website.

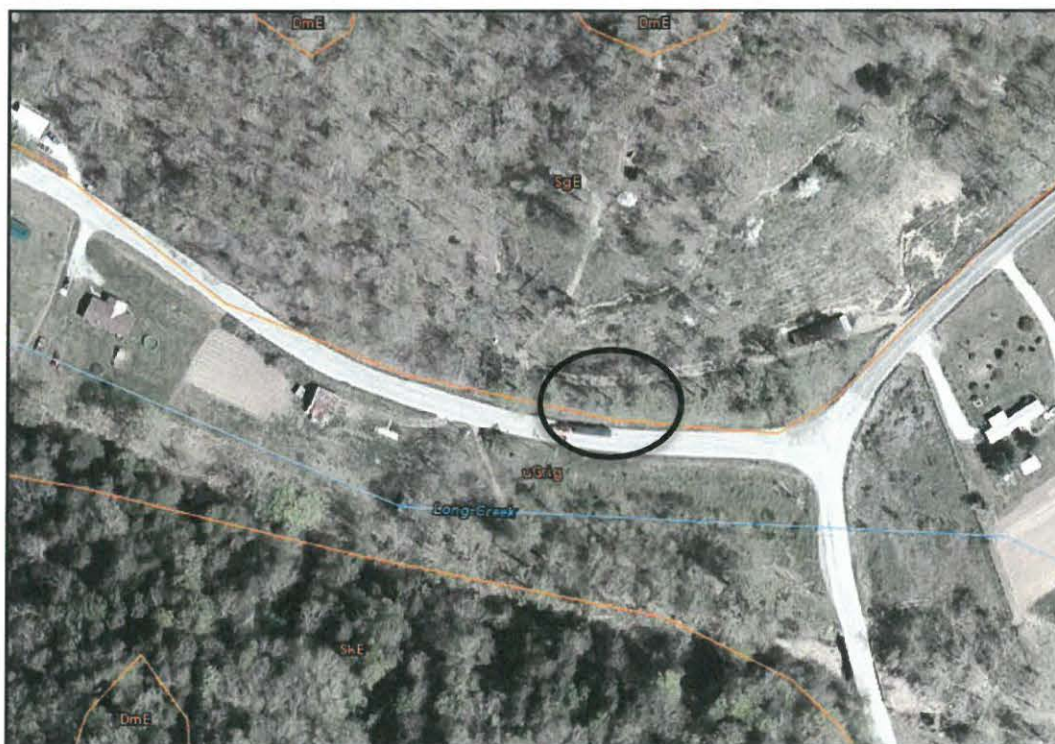


Figure 6: USDA Soil Survey Map of Project Site for Tank Site #2 (site vicinity in circle)



3F OTHER PUBLISHED SITE INFORMATION

We have reviewed several available aerial photographs, dated as far back as February 1995. The aerial photographs shows the proposed location for Tank Site #1 with minimal changes to the site vicinity. Some time between October 2008 and August 2010, a small gravel road was constructed to the west of the site above the proposed tank location. Since August 2010, no noticeable changes have occurred in the site vicinity. Please reference the aerial photographs on the following pages for further details.



Figure 7: Aerial photograph, dated October 2008 from Google Earth (marker denoting site location)

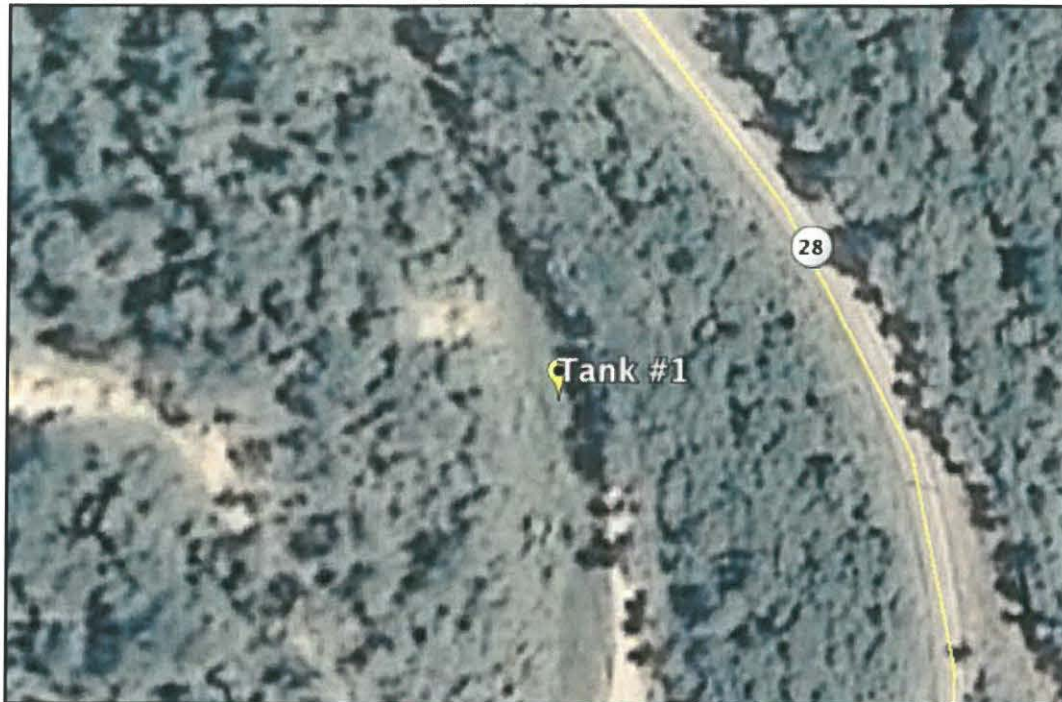


Figure 8: Aerial photograph, dated August 2010
from Google Earth (marker denoting site location)

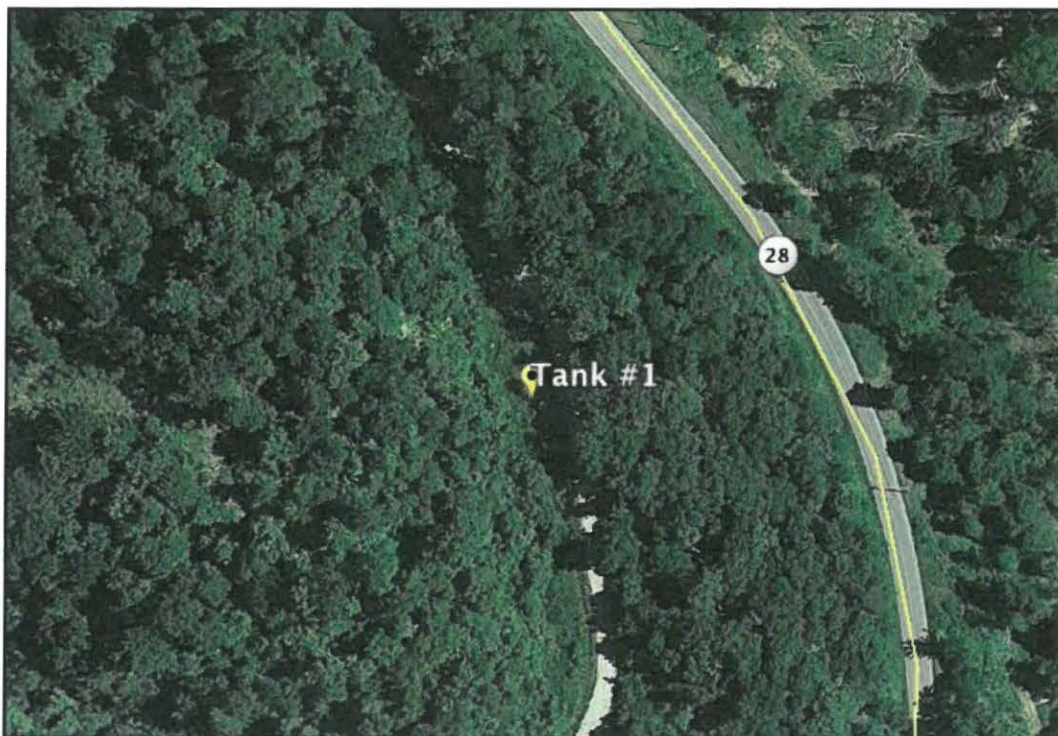


Figure 9: Aerial photograph, dated September 2014
from Google Earth (marker denoting site location)



Tank Site #2 has also experienced minimal changes since February 1995. Between November 2004 and July 2006, additional land was cleared to the northeast of the proposed tank location. Since July 2006, no noticeable changes have occurred in the site vicinity. Please reference the aerial photographs below for further details.

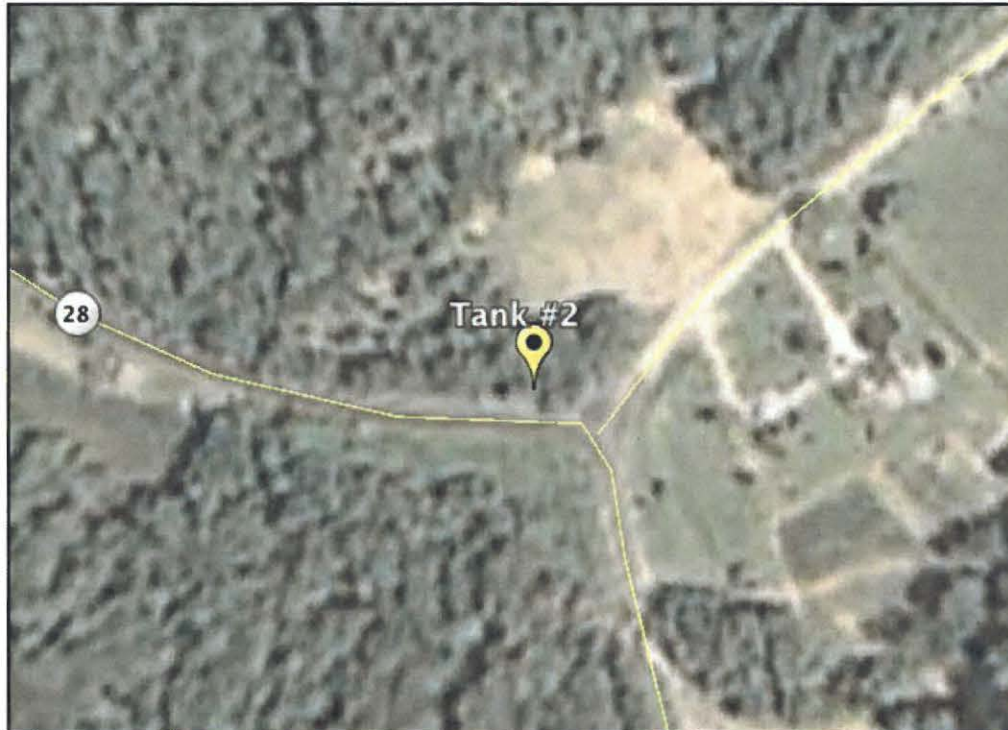


Figure 10: Aerial photograph, dated July 2006 from Google Earth (marker denoting site location)



Figure 11: Aerial photograph, dated June 2014 from Google Earth (marker denoting site location)



FINDINGS

4 SITE SURFACE OBSERVATIONS

Mr. Travis Greenwell, EIT of CSI conducted a site visit, performed a field reconnaissance, logged soil borings and rock coring, and directed drilling operations within the proposed project area on April 20, 2016.

Tank Site #1

The project site is located west of KY 28, north of the city of Buckhorn, and south of the Breathitt/Perry county line. The proposed tank site is located on a relatively flat bench bordered on the west by a weathered highwall. Large sandstone boulders were noted as having become loose and sliding down to the toe of the highwall. The surrounding area is sloping downward to the east and south. The ground cover in the proposed tank site consisted primarily of short grasses and thorny scrub with some small trees located on the perimeter of the property. No utilities were observed or marked at the site at the time of our field exploration including gas, electric, water, storm, or communications lines. The site photographs below depict the site conditions at the time of our field exploration.

Tank Site #2

The project site is located north of KY 28, adjacent to the edge of the roadway, and west of the intersection with KY 315. The proposed tank site is moderately sloping up from the roadway to the north. Previous site work had cleared the area of moderate size trees and some underbrush. No utilities were observed or marked at the site at the time of our field exploration. However, elevated American Electric Power lines were noted on the southern edge of KY 28.

5 SUBSURFACE CONDITIONS

The subsurface conditions encountered at each of our soil boring locations are shown on the Boring Logs in the Appendix. It should be noted that our soil borings were sampled according to the procedures presented in the Appendix. The Boring Logs represent our interpretations of the subsurface conditions based on field logs, visual examination of field samples by an engineer, and tests of the samples collected. The letters in parentheses following the soil descriptions are the soil classifications in accordance with the Unified Soil Classification System. It should be noted that the stratification lines shown on the soil boring logs represent approximate transitions between material types. In-situ stratum changes could occur gradually or at slightly different depths. Water levels shown on the Boring Logs represent the conditions only at the time of our exploration.



5A SOIL CONDITIONS

During our field exploration, we completed eight (8) soil borings - four soil borings at tank site #1 (labeled B-101 through B-104) and four (4) soil borings at tank site #2 (labeled B-201 through B-204). Please reference the Boring Location Plans in the Appendix for the approximate boring locations.

Tank Site #1

In general, we encountered the following in our borings: a thin layer of topsoil (where encountered), overlying previously placed fill, overlying weathered rock, overlying bedrock. Please reference the Summary of Soil Borings table on page 16 for further details.

We encountered a thin layer of topsoil in borings B-102 and B-103. The thickness of the topsoil was 1 inch and 2 inches, respectively.

In all four of our soil borings, we encountered a layer of previously placed fill. The previously placed fill consisted of gray to orangish-brown lean clay with varying amounts of coal fragments, shale fragments, sandstone fragments, and sand. The thickness of the previously placed fill ranged from 3.1 feet (boring B-102) to 6.3 feet (boring B-103). The previously placed fill was sampled as firm to hard. Additionally, note that the SPT blow counts may be inflated due to rock fragments within the previously placed fill.

Underlying the previously placed fill, weathered rock was encountered in all four of our borings. The weathered rock thicknesses varied from 1.9 feet (boring B-103) to 6.0 feet (boring B-104).

Tank Site #2

In general, we encountered the following in our borings: a thin layer of topsoil, overlying previously placed fill, overlying residual soil, overlying weathered rock, overlying bedrock. Please reference the Summary of Soil Borings table on page 16 for further details.

In all four of our soil borings, we encountered a thin layer of topsoil. The thickness of the topsoil ranged from 2 to 6 inches.

Underlying the topsoil, we encountered a layer of previously placed fill. The previously placed fill consisted of dark brown to brown lean clay with sand, trace sandstone fragments, root hairs, and red oxidation staining. The thickness of the previously placed fill ranged from 3.2 feet (boring B-204) to 5.7 feet (boring B-203). The previously placed fill was sampled as firm to stiff. Additionally, note that the SPT blow counts may be inflated due to rock fragments within the previously placed fill.

Underlying the previously placed fill, we encountered two horizons of residual soils. The first horizon of residual soil encountered was a light brown to orangish-brown lean clay with sand, trace rock fragments, and trace coal fragments. The second horizon of residual soil was a brown clayey sand with rock fragments. The residual soil thicknesses ranged from 1.7 feet (boring B-204) to 6.3 feet (borings B-201 and B-202). The residual soils encountered were sampled as



stiff to very stiff. However, the SPT blow counts may be inflated due to rock fragments within the residual soil horizon.

Underlying the residual soil, weathered rock was encountered in all four of our borings. The weathered rock thicknesses varied from 2.2 feet (borings B-201 and B-202) to 2.7 feet (boring B-204).

5B GROUND WATER CONDITIONS

Groundwater was not encountered in any of our eight borings upon completion of soil augering at either tank site #1 or tank site #2. Please note that groundwater readings could not be obtained at our rock core locations because water was used to cool the rock coring bit. Additionally, final 24-hour groundwater readings were not taken at any of our boring locations since we immediately backfilled our borings due to safety concerns for the general public.

Water conditions that usually affect construction and performance of projects consist of trapped/perched water zones which occur in variable areas in the soil mass (especially in old fill), at or near existing or former structures, at or near the bedrock bedding planes, or at or near the soil/rock interface. Perched water sources are often not linked to the more continuous relatively stable ground water table that typically occurs at greater depths. Site excavation activities or ground disturbance can expose these features and the resulting seepage can vary greatly. Finally, water issues are also dependent upon recent rainfall activity and surface and subsurface drainage patterns in the area.

5C BEDROCK INFORMATION

Tank Site #1

Auger refusal was encountered at all four of our soil borings. Auger refusal is typically interpreted as top of hard bedrock. Auger refusal depths varied from 5.7 feet (boring B-102) to 9.8 feet (boring B-104).

Refusal material was further explored by rock coring methods at boring location B-103. Two 5-foot runs of rock core were obtained. The recovered rock cores consisted of a layer of dark gray sandstone overlying a buff claystone overlying grayish-brown sandstone. Our rock cores had recoveries of 92 percent and 98 percent. The rock quality designations (RQDs) for our recovered rock cores were of poor to excellent engineering quality with RQD values of 36 percent and 92 percent. No voids were observed in our rock core. However, core water loss was observed during our rock coring operations at an approximate depth of 13.0 feet.

Tank Site #2

Auger refusal was encountered at all four of our soil borings. Auger refusal is typically interpreted as top of hard bedrock. Auger refusal depths varied from 7.8 feet (boring B-203) to 14.8 feet (boring B-202).



Refusal material was further explored by rock coring methods at boring location B-201. Two 5-foot runs of rock core were obtained. The recovered rock cores consisted of dull brown (due to water staining) to gray sandstone. Our rock cores had recoveries of 98 percent and 100 percent. The rock quality designations (RQDs) for our recovered rock cores were of poor to excellent engineering quality with RQD values of 43 percent and 90 percent. No voids or core water loss were observed during rock coring.

Table 1. Summary of Soil Borings

Boring No.	Elevation (ft)*	Topsoil Thickness (in)	Previously Placed Fill Thickness (ft)	Residual Soil Thickness (ft)	Weathered Bedrock Thickness (ft)	Auger Refusal (AR)	Auger Refusal Elevation (ft)
Tank Site #1							
B-101	102.4	-	4.5	-	2.2	6.7	95.7
B-102	100.2	1	3.1	-	2.5	5.7	94.5
B-103	104.1	2	6.3	-	1.9	8.4	95.7
B-104	100.7	-	3.8	-	6.0	9.8	90.9
Tank Site #2							
B-201	198.7	6	5.5	6.3	2.2	14.5	184.2
B-202	198.6	4	5.7	6.3	2.5	14.8	183.8
B-203	202.1	2	3.3	1.8	2.5	7.8	194.3
B-204	203.0	3	3.2	1.7	2.7	7.9	195.1

*Elevations for Tank Site #1 were estimated to the nearest 0.1 feet from the top of the existing steel pipe culvert, assumed as 100.0 feet.

**Elevations for Tank Site #2 were estimated to the nearest 0.1 feet from the north side of AEP's utility pole 121-143 80T, assumed as 200.0 feet.

6 LABORATORY TESTING

Laboratory tests were performed on selected recovered samples from our borings. Detailed descriptions of these tests and the results of our testing are included in the Appendix. Tests performed included:

- Natural moisture contents
- Atterberg limits
- Percent fines analyses
- Unconfined compressive strength test (on rock)



GEOTECHNICAL DISCUSSION AND RECOMMENDATIONS

7 DISCUSSION-GEOTECHNICAL ISSUES

Based on our experience with similar projects and the conditions observed during our subsurface exploration, we believe that both sites can be adapted for the proposed development. However, the development of Tank Site #2 may prove to be difficult (and therefore more expensive than Tank Site #1). The primary geotechnical concerns are:

- Previously Placed (Old) Fill
- Structure Location/Grade Selection
- Varying Depth to Bedrock

The following sections discuss each issue. However, recommendations to address the issues are contained in later sections of the report.

7A PREVIOUSLY PLACED (OLD) FILL

Previously placed fill material was encountered at both sites. Old fill materials are often improperly compacted, commonly contain organics and debris, and are poor bearing materials. Fills placed in an uncontrolled manner have proven to be problematic. The problems generally arise not from general settlement, but from erratic differential settling of the fill. The settlement of old fill masses is dependent upon several factors such as fill thickness, degree of compaction, fill contents, and age of the fill mass.

We recommend complete removal of any encountered old fill within proposed structure areas. If any old fill is left in-place beneath the proposed site improvements, you must assume the risk of construction over old fill material and hold CSI harmless for poor performance of the site improvements due to construction over the old fill.

7B STRUCTURE LOCATION/GRADE SELECTION

According to our boring elevations and visual observations, tank site #1 exists as a gently sloping area from the gravel roadway up to the highwall cut. We believe that the site could have been previously strip mined since the underlying bedrock is at approximately equivalent elevations. Alternatively, this bench could be an old mine access road

According to our boring elevations and visual observations, tank site #2 exists as a moderately sloping hillside adjacent to KY-28. No specific grading information for this project was supplied to us. However, we expect that the proposed structure will be founded on bedrock. As such, cut depths (which could be deep) will vary along with the selected design bottom of footing (BOF) for the structure.



Additional considerations should be taken during construction of tank #2 (which is located close to the KY-28 road shoulder) to not undermine the existing roadway. Depending upon the design bottom of foundation elevation for the proposed structure, the stability of the existing roadway can be compromised (causing a slope instability and potential failure of the existing roadway). Therefore to minimize undermining the existing roadway, your design should provide that the new tank foundation be excavated at a minimum of one horizontal foot away from the existing roadway edge for each vertical foot of embedment depth. Thus, the final embedment depth for the proposed structure will have a major impact on the location of the new structure.

7C VARYING DEPTH TO BEDROCK

The depth to bedrock was fairly consistent across the proposed location for Tank Site #1. However, the depth to bedrock at Tank Site #2 varied significantly between boring locations. Thus, the following discussion refers primarily to Tank Site #2.

Auger refusal depths at Tank Site #2 varied from 7.8 feet (boring B-203) to 14.8 feet (boring B-202) over an approximate horizontal difference of 20 feet. Depending upon the selected final grade and structure location, we expect that there will be the likelihood of some foundations bearing on soil while others may bear on bedrock. Bearing project foundations on any combination of both soil and rock will likely result in unwanted differential settlement. Therefore, the structure foundations should be bear entirely on rock (not soil bearing or a combination of both). Based on our understanding of the project, we recommend that all foundations be rock bearing.

8 EARTHWORK

Historically, more change orders (in total number and costs) occur during the earthwork portion of construction than in almost any other part of the project. Further, the site preparation phase of construction always affects the future performance of project structures and pavements. Add into this, the fact that earthwork is the portion of work most influenced by wet weather and unknown conditions and time-wise, this section of the report could be the most important to prevent and minimize delays and costs during construction and for the life of the project.

Please review the concerns listed in section 7 prior to reading the following recommendations. If problems occur that the recommendations do not address or do not adequately remedy, please contact CSI as soon as possible.

8A SITE PREPARATION (WORK PRIOR TO FILLING)

- All topsoil and organic materials should be removed (stripped) from the construction area. These materials should be wasted from the site or used as topsoil in landscape areas (if any).
- Remove all soils (fill or natural) to the underlying weathered bedrock surface.



- If possible, areas ready to receive new fill (if any) should be proofrolled with a fully-loaded dump truck (GVW of at least 80,000 pounds) or similar equipment judged acceptable by a CSI geotechnical engineer.
- The level of proofroll should be determined by a CSI geotechnical engineer on a case-by-case basis.
- Perform the proofrolling after a suitable period of dry weather to avoid degrading the subgrade.
- Areas which pump, rut, or wave during proofrolling may require undercutting or other forms of remediation (geogrid, surge stone, etc.). Thus, a CSI geotechnical engineer should be contacted for guidance.
- For areas that can not be proof rolled, visual approval by a CSI geotechnical engineer is required.
- Backfill of undercut areas should be performed in accordance with the following sections.
- Retain CSI to observe the proofrolling operations and as previously outlined, make recommendations for any unstable or unsuitable conditions encountered-this can save time on the construction schedule and save unnecessary undercutting.

We recommend that site grading should take place between about late April to early November. Earthwork taking place outside this time period will likely encounter wet conditions and weather conditions that will provide little to no assistance with drying the soils.

8B NEW FILL OPERATIONS - SOIL

We do not recommend the use of soil or soil fill beneath either of these two new tanks. However, soil fill can be used in areas outside of the tank footprints. Our laboratory tests indicate that the tested on-site soils are suitable for use as structural fill material provided the material is placed and compacted in accordance with the following guidelines and specifications. Off-site soils with a plasticity index (PI) greater than 30 percent should not be used for new fill.

For one of our following recommended scenarios for Tank Site #2, dense graded aggregate (DGA) be used as new structural fill. See the following section for details.

After the subgrade has been approved to receive new fill, the fill may commence with the following procedures and guidelines recommended:

- Silty soils exist at this project site (and in this general area), thus minimal vibration should be used in compaction equipment. Vibration may be used on off-site fill materials depending upon the type of soil that is imported. However, vibration may adversely affect the surrounding on-site soils.



- Place fill in maximum 8-inch thick loose lifts.
- Fill lifts should be compacted to at least 95 percent of the soil's maximum dry density (ASTM D 698).
- Maintain the moisture content of compacted fill within 3 percent of optimum moisture.
- Off-site soils with a plasticity index (PI) of greater than 30 percent should not be used as new fill.
- Fill compaction requirements should extend to at least 5 feet outside the proposed construction areas.
- Maximum particle size of the soil should be limited to 4 inches in any one dimension. Additionally, no concentration of large fragments should be permitted.
- Density testing should be performed as a means to verify percent compaction and moisture content of the material as it is being placed and compacted.
- Soils should not be "overcompacted" and construction traffic should be kept to minimum to assure compaction is achieved and that the soil is not allowed to "break down".
- Retain a representative of CSI to observe and document fill placement and compaction operations.

8C NEW FILL OPERATIONS - DENSE GRADED AGGREGATE (DGA)

After the subgrade has been approved to receive new fill, the fill may commence with the following procedures and guidelines recommended for DGA backfill:

- Place fill in maximum 8-inch thick loose lifts.
- Fill lifts should be compacted to at least 95 percent of the DGA's maximum dry density (ASTM D 698).
- Maintain the moisture content of the compacted DGA material within plus or minus 3 percent of optimum moisture content.
- Density testing should be performed as a means to verify percent compaction and moisture content of the material as it is being placed and compacted. When using dry granular material, the basis for approval should be determined by a CSI geotechnical engineer.
- Retain a representative of CSI to observe and document fill placement and compaction operations.



8D BACKFILL OPERATIONS (FOUNDATION WALLS, UTILITIES, ETC.)

These materials are placed in more confined areas than mass earthwork materials or pavement materials and therefore cannot be placed in full compliance with sections 8B or 8C. The following are general recommendations for backfill areas:

- Fill lift thicknesses will vary dependent on compaction equipment available and material types, but in no case should exceed 8 inches.
- For crushed stone/aggregate backfills in trenches or wall backfill and when using smaller compaction equipment (such as a plate compactor or trench compactor or similar) the lift thickness should not exceed 4 inches.
- Compaction/moisture percentages and density testing requirements should be the same as in section 8B and 8C.

8E GENERAL NOTES

- For all earthwork operations, positive surface drainage is prudent to keep water from ponding on the surface and to assist in maintaining surface stability.
- The surface should be sealed prior to expected wet weather. This can usually be accomplished with rubber-tired construction equipment or a steel-drum roller.
- If any soil placement problems occur, CSI should be retained to provide additional recommendations, as needed.

9 SITE DRAINAGE

During construction, water should not be allowed to pond in excavations or undercutting will likely be required. During the life of the project, slope the subgrade and other site features so that surface water flows away from the site structures. Structure roof drains (if any) should be piped away to proper storm drainage systems. Diversion ditches should be used to keep surface water from accumulating at or near site structures.

For excavations during construction, most free water (not observed in our soil borings) could likely be removed via sump pumps and open channel flow (ditches) at or near the source of seepage. However, if normal dewatering measures prove insufficient, CSI should be retained to provide recommendations on the issue.

Wet conditions are possible in excavations on-site during site construction. Daylighting wet zones for drainage or the use of french/rock drains may be prudent or cost effective methods of de-watering wet areas of the site. Pumping with long-flexible hoses day-lighted hundreds of feet away or other types of sumping could also be utilized if necessary. CSI should be retained to observe all excavations in locations of springs or other water-bearing features.



10 FOUNDATIONS

Based on the information provided and the conditions encountered, shallow foundations bearing on rock (either directly or indirectly) should be a suitable foundation system to support both of the proposed tanks. If there are any changes in the project criteria or tank locations, CSI should be allowed to review the recommendations to determine if any modifications are required.

10A SHALLOW FOUNDATIONS BEARING DIRECTLY ON ROCK

We believe that due to the conditions encountered for Tank Site #1 (relatively level bedrock surface), that shallow foundations bearing directly on rock is the likely foundation option. Although this option is applicable to Tank Site #2 as well, we believe that the varying depth to bedrock at that location makes this foundation alternative unlikely.

For shallow foundations bearing completely on bedrock, foundations may be sized using a maximum allowable bearing pressure of 10,000 pounds per square foot (10 ksf). Any existing soil or weathered rock should be excavated until competent rock is exposed in the bottom of the foundation excavation. We interpret competent rock by observing the teeth of the backhoe or trackhoe being dragged vertically across the top of exposed rock. Upon approval by a CSI geotechnical engineer, the excavation can be backfilled to the design bottom of footing elevation with lean concrete (2,000 psi minimum) or flowable fill (300 psi minimum).

A detailed settlement analysis was beyond the scope of this exploration. However, based on the expected structural loads and foundations bearing on competent bedrock, we expect both total settlements and differential settlements will not exceed ¼ inch.

Additional design considerations for spread foundations bearing on bedrock are outlined as follows:

- Foundations bearing directly on bedrock are not subject to a minimum frost embedment depth.

10B SHALLOW FOUNDATIONS ON ROCK - CONSTRUCTION NOTES

For foundations constructed on top of competent bedrock (either directly or indirectly), we also recommend the following procedures.

- Loose soil, mud, debris, and excess water should be removed from the bearing surface immediately prior to concrete placement.
- Foundation bearing surfaces should be benched (as much as practical) to provide nearly-level bearing surfaces.



- A CSI geotechnical engineer should observe all foundation excavations and provide recommendations for treatment of any unsuitable conditions encountered.

10C SHALLOW FOUNDATIONS BEARING INDIRECTLY ON ROCK

We believe that due to the varying depth to rock encountered at Tank Site #2, foundations bearing indirectly on rock (through compacted DGA fill over bedrock) will be the likely option chosen for this location.

For shallow foundations bearing indirectly on rock, (i.e. - if they bear on DGA backfill overlying bedrock), foundations may be sized using a maximum allowable bearing pressure of 5,000 pounds per square foot (5 ksf). Any existing soil or weathered rock should be excavated until competent rock is exposed in the bottom of the foundation excavation. We interpret competent rock by observing the teeth of the backhoe or trackhoe being dragged vertically across the top of exposed rock. Upon approval by a CSI geotechnical engineer, the excavation can be backfilled to the design bottom of footing elevation with properly placed and compacted DGA fill.

A detailed settlement analysis was beyond the scope of this exploration. However, based on the expected structural loads and foundations bearing on competent bedrock, we expect both total settlements and differential settlements will not exceed 1/2 inch.

Additional design considerations for spread foundations bearing indirectly on bedrock are outlined as follows:

- Design all footings with a minimum 18 inches width.
- All exterior footing bottoms should bear at least 30 inches below finished exterior grading (Kentucky Building Code, Table 1805.2.1 for Breathitt County).

10D SHALLOW FOUNDATIONS INDIRECTLY ON ROCK - CONSTRUCTION NOTES

For foundations constructed on top of compacted DGA over competent bedrock, we also recommend the following procedures.

- Loose soil, mud, debris, and excess water should be removed from the bearing surface immediately prior to concrete placement.
- Foundation bearing surfaces should be benched (as much as practical) to provide nearly-level bearing surfaces.
- A CSI geotechnical engineer should observe all foundation excavations and provide recommendations for treatment of any unsuitable conditions (unlikely) encountered.

10E SHALLOW SPREAD FOUNDATIONS ON SOIL

Shallow spread footings for ancillary structures (if any) bearing on soil may be sized using a maximum allowable bearing pressure of 2,000 pounds per square foot (psf). If rock is encountered within 2 feet of the bottom of the foundation (BOF) elevation, we recommend



that the rock be undercut at least 2 feet below bottom of footing and the excavation backfilled with compacted soil fill up to the design BOF elevation to provide a "cushion".

A detailed settlement analysis was beyond the scope of this exploration. However, if project foundations are constructed on stiff or better residual soils or new structural soil fill, we expect that total settlements will not exceed 1 inch, and that differential settlements will not exceed 1/2 inch over 30 feet. Settlement estimates are based, in part, upon the assumption that site preparation is performed in accordance with our recommendations and with good quality control of the earthwork. Removal of old fill and proper placement and compaction of new fill is particularly important in keeping settlements within tolerable limits.

Additional design considerations for project foundations are outlined as follows:

- Design all footings with a minimum 24 inches width.
- All exterior footing bottoms should bear at least 30 inches below finished exterior grading (Kentucky Building Code, Table 1805.2.1 for both Breathitt and Perry Counties).

10F SHALLOW FOUNDATIONS ON SOIL - CONSTRUCTION NOTES

Any soils can lose strength if they become wet, so we recommend the foundation subgrades be protected from exposure to water. For foundations construction, we also recommend the following procedures.

- For soils that will remain exposed overnight or for an extended period of time, place a "lean" concrete mudmat over the bearing areas. The concrete should be at least 4 inches thick. Flowable fill concrete or low-strength concrete is suitable for this cover, as conditions allow;
- Disturbed soil should be removed prior to foundation concrete placement.
- Foundation bearing conditions should be benched level.
- Areas loosened by excavation operations should be recompact prior to reinforcing steel placement.
- Loose soil, debris, and excess surface water should be removed from the bearing surface prior to concrete placement.
- Retain a CSI geotechnical engineer to observe all foundation excavations and provide recommendations for treatment of any unsuitable conditions encountered.
- The foundation bearing conditions should be checked by means of portable dynamic cone penetration (DCP) testing at the direction of a CSI geotechnical engineer.



11 SEISMIC SITE CLASSIFICATION

The latest edition of the Kentucky Building Code (KBC) was reviewed to determine the Site Seismic Classification. Based on our review of geologic data, our experience, and subsurface conditions encountered, we recommend a Seismic SITE CLASS "B" for both of the sites. Our site classification is based on the assumption that the foundations for both of the tank sites will be shallow spread footings bearing on rock (either directly or indirectly).

If foundations are to be soil bearing (possible ancillary structures), we recommend a Seismic SITE CLASS "B" for both of the sites.

A detailed geotechnical earthquake engineering analysis was not performed since it was beyond the scope of our authorized work. However, based on a review of published literature and our experience with similar subsurface conditions, we believe the potential for slope instability, liquefaction, and surface rupture due to faulting or lateral spreading resulting from earthquake motions is low. However, this potential could be elevated during wet periods of the year unless adequate drainage is provided.

12 NOTES ON THE REPORT AND RECOMMENDATIONS

We recommend that this complete report be provided to the various design team members, the contractors and the project Owner. Potential contractors should be informed of this report in the "Instructions to Bidders" section of the bid documents. A geotechnical exploration, such as the one we performed, uses widely spaced borings to attempt to model the subsurface conditions at the site. Because no exploration contains complete data or a complete model, there is always a possibility that conditions between borings will be different from those at specific boring locations. Thus, it is possible that some subsurface conditions will not be as anticipated by the project team or contractor. If this report is included or referenced in the actual contract documents, it shall be explicitly understood that this report is for informational purposes only. CSI shall not be responsible for the opinions of, or conclusions drawn by, others.

It has been our experience that the construction process often disturbs soil conditions and this process, no matter how much experience we use to anticipate construction methodology, is not completely predictable. Therefore, changes or modifications to our recommendations are likely needed due to these possible variances. Experienced CSI geotechnical personnel should be used to observe and document the construction procedures and the conditions encountered. Unanticipated conditions and inadequate procedures should be reported to the design team along with timely recommendations to solve the problems created. We recommend that the Owner retain CSI to provide this service based upon our familiarity with the project, the subsurface conditions and the intent of our recommendations.

This report is based on the supplied project information, the subsurface conditions observed at the time of the report, and our experience with similar conditions. As such, it cannot be applied to other project sites, types, or combinations thereof. If the Project Information section in this report contains incorrect information or if additional information is available,



you should convey the correct or additional information to us and retain us to review our recommendations. Our recommendations may then require modification.

No section or portion of this report (including Appendix information) can be used as a stand alone article to make distinct changes or assumptions. The entire report and Appendix should be used together as one resource.

While this report deals with samples of subsurface materials and some comments on water conditions at the site, no assessment of site environmental conditions or the presence of contaminants were performed.

We wish to remind you that our exploration services include storing the soil and rock core samples collected and making them available for inspection for 30 days. The soil and rock core samples are then discarded unless you request otherwise. Please inform us if you wish to keep any of the obtained samples.



APPENDIX

Site Location Plan

Boring Location Plans

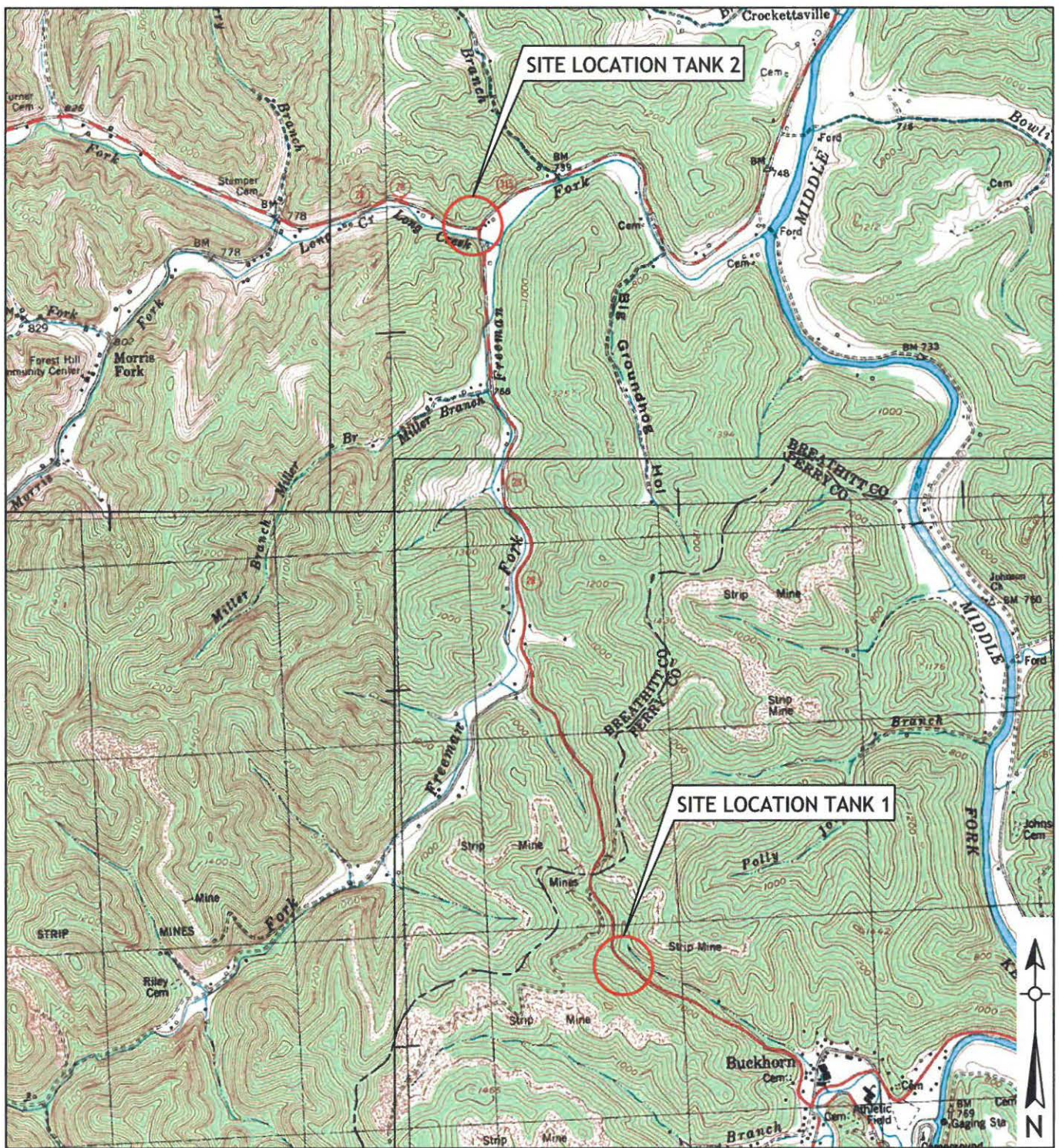
Key to Symbols and Descriptions

Boring Logs

Field Testing Procedures

Summary of Lab Testing Table(s) and Lab Testing Sheets

Laboratory Testing Procedures



Site Location Plan adapted from USGS Canoe Topographic Quadrangle map dated 1976 and USGS Buckhorn Topographic Quadrangle map dated 1979, with further adaptation by CSI personnel.

FOR ILLUSTRATION PURPOSES ONLY



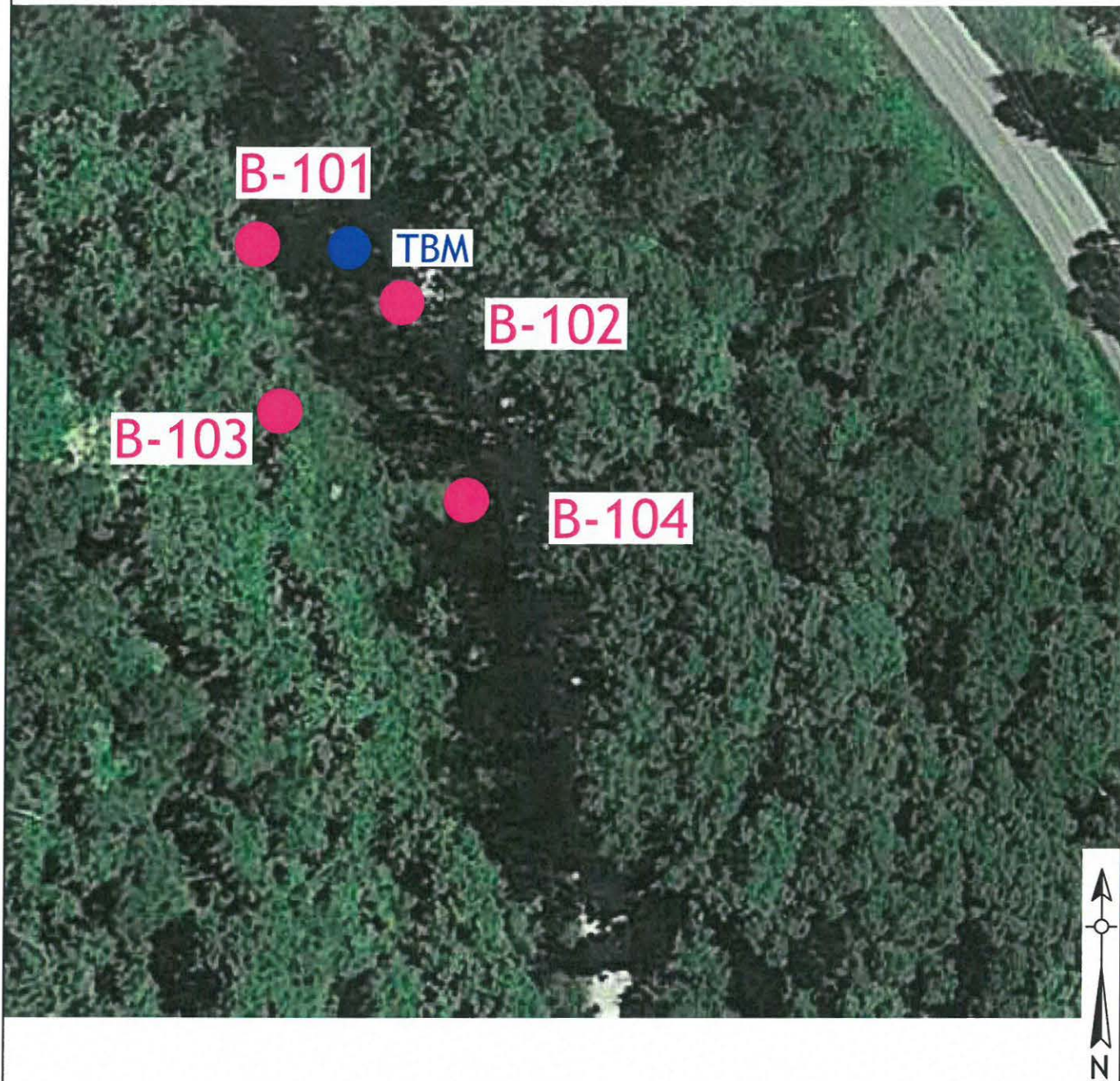
Consulting Services Incorporated of Kentucky
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Lexington, Kentucky 40505
859.309.6021 Office | 888.792.3121 Fax
www.csikentucky.com

TITLE: SITE LOCATION PLAN
PROJECT: BREATHITT COUNTY WATER TANKS
BREATHITT & PERRY COUNTIES,
KENTUCKY

Project No:
LX160076
Date:
April 29, 2016
Scale: Not To Scale

Drawn By:
JB
Checked By:
TG
Drawing No:
1 of 1

This drawing is being furnished for this specific project only. Any party accepting this document does so in confidence and agrees that it shall not be duplicated in whole or in part, nor disclosed to others without the consent of Consulting Services Incorporated of Kentucky.



Boring Location Plan adapted from aerial images, with further adaptation by CSI personnel.
Elevations estimated to the nearest 0.1 feet from the existing steel pipe culvert, assumed as 100.0 feet.

FOR ILLUSTRATION PURPOSES ONLY

LEGEND

- B-XXX BORING LOCATIONS
- TBM TEMPORARY BENCHMARK



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Lexington, Kentucky 40505
859.309.6021 Office | 888.792.3121 Fax
www.csikentucky.com

TITLE: BORING LOCATION PLAN

Project No:
LX160076

Drawn By:
CC

PROJECT: BREATHITT COUNTY WATER
TANK, TANK #1
BREATHITT & PERRY COUNTIES,
KENTUCKY

Date:
April 29, 2016

Checked By:
TG

Scale: Not To Scale

Drawing No:
1 of 2

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Boring Location Plan adapted from provided aerial imaging with further adaptation by CSI personnel.
Elevations estimated to the nearest 0.1 feet from the north side of AEP's utility pole 121-143 80T, assumed as 200.0 feet.

LEGEND

- B-XXX BORING LOCATIONS
- TBM TEMPORARY BENCHMARK

FOR ILLUSTRATION PURPOSES ONLY



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www.csikentucky.com

TITLE: BORING LOCATION PLAN

PROJECT: BREATHITT COUNTY
WATER TANKS - TANK #2
BREATHITT & PERRY COUNTIES,
KENTUCKY

Project No:
LX160076

Date:
April 29, 2016

Scale: Not To Scale

Drawn By:
CC

Checked By:
TG

Drawing No:
2 of 2

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Geotechnical Boring Information Sheet

Sample Type Symbols		Definitions
Splitspoon (SPT)		SPT-"Splitspoon" or standard penetration test. Blow counts are number of drops required for a 140 lb hammer dropping 30 inches to drive the sampler 6 inches.
Shelby Tube		N-value is the addition of the last two intervals of the 18-inch sample.
Grab		Shelby tubes are often called "undisturbed samples". They are directly pushed into the ground, twisted, allowed to rest for a small period of time and then pulled out of the ground. Tops and bottoms are cleaned and then sealed.
Rock Core		
Auger Cuttings		
Surface Symbols		Sample classification is done in general accordance with ASTM D2487 and 2488 using the Unified Soil Classification System (USCS) as a general guide.
Topsoil		Soil moisture descriptions are based on the recovered sample observations. The descriptors are dry, slightly moist, moist, very moist and wet. These are typically based on relative estimates of the moisture condition of a visual estimation of the soils optimum moisture content (EOMC). Dry is almost in a "dusty" condition usually 6 or more percent below EOMC. Slightly moist is from about 6 to 2 percent below EOMC at a point at which the soil color does not readily change with the addition of water. Moist is usually 2 percent below to 2 percent above EOMC and the point at which the soil will tend to begin forming "balls" under some pressure in the hand. Very moist is usually from about 2 percent to 6 percent above EOMC and also the point at which it's often considered "muddy". Wet soil is usually 6 or more percent above EOMC and often contains free water or the soil is in a saturated state.
Asphalt		
Concrete		
Lean Clay		
Fat Clay		
Glacial Till		
Sandy Clay		
Silt		
Elastic Silt		
Lean Clay to Fat Clay		
Gravelly Clay		
Sandy Silt		
Gravelly Silt		
Sand		
Gravel		
Fill		
Limestone		
Sandstone		
Shale/Siltstone		
Weathered Rock		
Samples Strength Descriptors		Silt or Clay is defined as material finer than a standard #200 US sieve (<0.075mm) Sand is defined as material between the size of #200 sieve up to #4 sieve. Gravel is from #4 size sieve material to 3". Cobbles are from 3" to 12". Boulders are over 12".
Cohesive Soils:	N	Rock hardness is classified as follows: Very Soft: Easily broken by hand pressure Soft: Ends can be broken by hand pressure; easily broken with hammer Medium: Ends easily broken with hammer; middle requires moderate blow Hard: Ends require moderate hammer blow; middle requires several blows Very Hard: Many blows with a hammer required to break core
Very Soft	0-1	
Soft	2-4	
Firm	5-8	
Stiff	9-15	
Very Stiff	16-30	
Hard	31+	
Non-cohesive Soils:		
Very Loose	0-4	
Loose	5-10	
Firm	11-20	Rock Quality Designation (RQD) is defined as total combined length of 4" or longer pieces of core divided by the total core run length; defined in percentage.
Very Firm	21-30	
Dense	30-50	
Very Dense	51+	
		Water or cave-in observed in borings is at completion of drilling each boring unless otherwise noted.
		Strata lengths shown on borings represents a rough estimate. Transition may be more abrupt or gradual. Soil borings are representative of that estimated location at that time and are based on recovered samples. Conditions may be different between borings and between sample intervals. Boring information is not to be considered stand alone but should be taken in context with comments and information in the geotechnical report and the means by which the borings are logged, sampled and drilled.



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Phone: 859.309.6021
Fax: 888.792.3121

TEST BORING LOG

CLIENT Nesbitt Engineering
PROJECT NAME Breathitt County Tank Sites
PROJECT LOCATION Breathitt & Perry Counties, Kentucky

BORING # B-101
JOB # LX160076
LOGGED BY TMG
APPROVED BY BLH

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 4/20/2016 Contractor Geo-Drill
Date Completed 4/20/2016 Boring Size 3.25 in.
Drill Rig CME 550 Sampling Method SFA
Weather Sunny, 70's Hammer Type Automatic

SOIL CLASSIFICATION				Sample No.	Sample Type	Sample Graphics	Recovery (in)	Standard Penet. Blows per 6" [N-Value] blow	Qu-ksf Unconfined Compressive Str	Moisture Content	Liquid Limit (LL)	Plasticity Index	Percent Passing	
Elev. (ft)	Depth Scale	Water Level	SURFACE ELEVATION: 102.4											
102			FILL - sampled as STIFF to HARD, gray to brown lean clay (CL), with rock and coal fragments	1	SS		15	5-5-5 [10]		9.8				Dry upon completion of soil augering
100	2			2	SS		17	9-9-11 [20]		11.3				
98	4			3	SS		12	13-40-50/0.1 [50/0.1]						
96	6		Weathered Rock											
94	8		Auger Refusal at 6.7 feet											
92	10													
90	12													
88	14													
86	16													
84	18													
82	20													
80	22													
78	24													

Depth to Groundwater

● Noted on Drilling Tools _____ ft.
▽ At Completion _____ ft.
▼ After _____ hours _____ ft.
⊠ Cave Depth _____ ft.

Sample Type

SPT- Standard Penetration Test
SS- Split Spoon
ST- Shelby Tube
RC- Rock Core
CU- Auger Cuttings

Boring Method

HSA- Hollow Stem Augers
CFA- Continuous Flight Augers
MD- Mud Drilling



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TEST BORING LOG

CLIENT Nesbitt Engineering
PROJECT NAME Breathitt County Tank Sites
PROJECT LOCATION Breathitt & Perry Counties, Kentucky

BORING # B-102
JOB # LX160076
LOGGED BY TMG
APPROVED BY BLH

DRILLING and SAMPLING INFORMATION

Date Started 4/20/2016 Contractor Geo-Drill
Date Completed 4/20/2016 Boring Size 3.25 in.
Drill Rig CME 550 Sampling Method SFA
Weather Sunny, 70's Hammer Type Automatic

TEST DATA

DRILLING and SAMPLING INFORMATION				TEST DATA											Remarks
Date Started	4/20/2016	Contractor	Geo-Drill	Sample No.	Sample Type	Sample Graphics	Recovery (in)	Standard Penetration Test Blows per 6" [N-Value] blows/foot	Qu-ksf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plasticity Index (PI)	Percent Passing #200 Sieve		
Date Completed	4/20/2016	Boring Size	3.25 in.												
Drill Rig	CME 550	Sampling Method	SFA												
Weather	Sunny, 70's	Hammer Type	Automatic												
SOIL CLASSIFICATION															
Elev. (ft)	Depth Scale	Water Level	SURFACE ELEVATION: 100.2												
100			TOPSOIL (1 inch)	1	SS		18	3-3-6 [9]		16.0				Dry upon completion of soil augering	
98	2		FILL - sampled as STIFF to HARD, gray to orangish-brown lean clay (CL), with sand and rock fragments, trace root hairs	2	SS		8	7-50/0.3- [50/0.3]							
96	4		Weathered Shale - gray	3	SS		0	50/0.1-- [50/0.1]							
94	6		Weathered Rock												
92	8		Auger Refusal at 5.7 feet												
90	10														
88	12														
86	14														
84	16														
82	18														
80	20														
78	22														
76	24														

Depth to Groundwater

- Noted on Drilling Tools _____ ft.
- ▽ At Completion _____ ft.
- ▼ After _____ hours _____ ft.
- ⊠ Cave Depth _____ ft.

Sample Type

- SPT- Standard Penetration Test
- SS- Split Spoon
- ST- Shelby Tube
- RC- Rock Core
- CU- Auger Cuttings

Boring Method

- HSA- Hollow Stem Augers
- CFA- Continuous Flight Augers
- MD- Mud Drilling



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TEST BORING LOG

CLIENT **Nesbitt Engineering**
PROJECT NAME **Breathitt County Tank Sites**
PROJECT LOCATION **Breathitt & Perry Counties, Kentucky**

BORING # **B-103**
JOB # **LX160076**
LOGGED BY **TMG**
APPROVED BY **BLH**

DRILLING and SAMPLING INFORMATION

Date Started **4/20/2016** Contractor **Geo-Drill**
Date Completed **4/20/2016** Boring Size **3.25 in.**
Drill Rig **CME 550** Sampling Method **SFA**
Weather **Sunny, 70's** Hammer Type **Automatic**

TEST DATA

SOIL CLASSIFICATION				TEST DATA										Remarks
Elev. (ft)	Depth Scale	Water Level		Sample No.	Sample Type	Sample Graphics	Recovery (in)	Standard Penetration Test Blows per 6" [N-Value] blows/foot	Qu-ksf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plasticity Index (PI)	Percent Passing #200 Sieve	
			SURFACE ELEVATION: 104.1											
			TOPSOIL (2 inches)	1	SS		18	4-8-8 [16]		15.4				Dry upon completion of soil augering
102	2		FILL - sampled as VERY STIFF, orangish-tan clayey sand (SC)	2	SS		16	12-14-7 [21]		11.7				
100	4		FILL - sampled as FIRM to VERY STIFF, gray to orangish-brown lean clay (CL)	3	SS		16	3-4-3 [7]		20.1				
98	6		Weathered Rock	4	SS		1	50/0.1-- [50/0.1]						
96	8		Auger Refusal at 8.4 feet Begin Coring at 8.4 feet											REC (%) - 92 RQD (%) - 36
94	10		Sandstone - dark gray, fine-grained, moderately to severely weathered, Medium Hard	5	CORE		55							Core water loss observed at 13.0 feet REC (%) - 98 RQD (%) - 92
92	12		SHALE (CLAYSTONE) - buff, VERY SOFT											
90	14		SANDSTONE - grayish-brown, medium grained, moderately weathered, moderately friable, MEDIUM HARD	6	CORE		59							
88	16													
86	18		Coring Terminated at 18.4 feet											
84	20													
82	22													
80	24													

Depth to Groundwater

● Noted on Drilling Tools _____ ft.
▽ At Completion _____ ft.
▼ After _____ hours _____ ft.
⊠ Cave Depth _____ ft.

Sample Type

SPT- Standard Penetration Test
SS- Split Spoon
ST- Shelby Tube
RC- Rock Core
CU- Auger Cuttings

Boring Method

HSA- Hollow Stem Augers
CFA- Continuous Flight Augers
MD- Mud Drilling



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TEST BORING LOG





CLIENT **Nesbitt Engineering**
PROJECT NAME **Breathitt County Tank Sites**
PROJECT LOCATION **Breathitt & Perry Counties, Kentucky**

BORING # **B-104**
JOB # **LX160076**
LOGGED BY **TMG**
APPROVED BY **BLH**

DRILLING and SAMPLING INFORMATION

Date Started **4/20/2016** Contractor **Geo-Drill**
Date Completed **4/20/2016** Boring Size **3.25 in.**
Drill Rig **CME 550** Sampling Method **SFA**
Weather **Sunny, 70's** Hammer Type **Automatic**

TEST DATA

DRILLING and SAMPLING INFORMATION				TEST DATA											Remarks
Date Started	4/20/2016	Contractor	Geo-Drill	Sample No.	Sample Type	Sample Graphics	Recovery (in)	Standard Penetration Test Blows per 6" [N-Value] blows/foot	Qu-ksf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plasticity Index (PI)	Percent Passing #200 Sieve		
Date Completed	4/20/2016	Boring Size	3.25 in.												
Drill Rig	CME 550	Sampling Method	SFA												
Weather	Sunny, 70's	Hammer Type	Automatic												
SOIL CLASSIFICATION															
Elev. (ft)	Depth Scale	Water Level	SURFACE ELEVATION: 100.7												
100			FILL - sampled as FIRM to HARD, orangish-brown sandy clay (CL), with sandstone and gray shale fragments	1	SS		14	2-3-3 [6]		20.2					
98	2			2	SS		13	11-9- 50/0.3 [50/0.3]							
96	4		Weathered Shale - light gray to buff	3	SS		3	50/0.3-- [50/0.3]							
94	6			4	SS		7	45- 50/0.3- [50/0.3]							
92	8		Weathered Rock												
90	10		Auger Refusal at 9.8 feet												
88	12														
86	14														
84	16														
82	18														
80	20														
78	22														
76	24														

Depth to Groundwater

- Noted on Drilling Tools _____ ft.
- ▽ At Completion _____ ft.
- ▼ After _____ hours _____ ft.
- ⊠ Cave Depth _____ ft.

Sample Type

- SPT- Standard Penetration Test
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Boring Method

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- MD- Mud Drilling



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TEST BORING LOG

CLIENT **Nesbitt Engineering**
PROJECT NAME **Breathitt County Tank Sites**
PROJECT LOCATION **Breathitt & Perry Counties, Kentucky**

BORING # **B-201**
JOB # **LX160076**
LOGGED BY **TMG**
APPROVED BY **BLH**

DRILLING and SAMPLING INFORMATION

Date Started **4/20/2016** Contractor **Geo-Drill**
Date Completed **4/20/2016** Boring Size **3.25 in.**
Drill Rig **CME 550** Sampling Method **SFA**
Weather **Sunny, 70's** Hammer Type **Automatic**

TEST DATA

SOIL CLASSIFICATION				TEST DATA										Remarks
Elev. (ft)	Depth Scale	Water Level		Sample No.	Sample Type	Sample Graphics	Recovery (in)	Standard Penetration Test Blows per 6" [N-Value]	Qu-ksf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plasticity Index (PI)	Percent Passing #200 Sieve	
SURFACE ELEVATION: 198.7														
198			TOPSOIL (6 inches)	1	SS		16	2-4-4 [8]		20.9				Dry upon completion of soil augering
196	2		FILL - sampled as FIRM to STIFF, dark brown to brown lean clay (CL), with sand, trace sandstone fragments, root hairs, and red oxidation staining	2	SS		12	3-3-5 [8]		20.3				
194	4			3	SS		11	3-4-5 [9]		19.5				
192	6		SILT (ML) - VERY STIFF, light brown to orangish-brown, with sand and rock fragments, trace coal fragments	4	SS		18	7-9-11 [20]		19.4	33.9	0.52	36.71	
190	8		CLAYEY SAND (SC) - FIRM, brown, with rock fragments	5	SS		18	6-14-14 [28]		23.3				
188	10													
186	12		Weathered Sandstone - buff											
184	14		Auger Refusal at 14.5 feet Begin Coring at 14.5 feet	6	SS		3	50/0.3-- [50/0.3]						No core water loss observed REC (%) - 98 RQD (%) - 43
182	16		SANDSTONE - dull brown (water stained) to gray, massive bedded, medium grained, moderately to slightly weathered, HARD	7	CORE		59							
180	18													
178	20													REC (%) - 100
176	22			8	CORE		60							RQD (%) - 90
174	24		Coring Terminated at 24.5 feet											

Depth to Groundwater

- Noted on Drilling Tools _____ ft.
- ▽ At Completion _____ ft.
- ▼ After _____ hours _____ ft.
- ⊗ Cave Depth _____ ft.

Sample Type

- SPT- Standard Penetration Test
- SS- Split Spoon
- ST- Shelby Tube
- RC- Rock Core
- CU- Auger Cuttings

Boring Method

- HSA- Hollow Stem Augers
- CFA- Continuous Flight Augers
- MD- Mud Drilling



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Fax: 888.792.3121

TEST BORING LOG

CLIENT Nesbitt Engineering
PROJECT NAME Breathitt County Tank Sites
PROJECT LOCATION Breathitt & Perry Counties, Kentucky

BORING # B-202
JOB # LX160076
LOGGED BY TMG
APPROVED BY BLH

DRILLING and SAMPLING INFORMATION

Date Started 4/20/2016 Contractor Geo-Drill
Date Completed 4/20/2016 Boring Size 3.25 in.
Drill Rig CME 550 Sampling Method SFA
Weather Sunny, 70's Hammer Type Automatic

TEST DATA

SOIL CLASSIFICATION				TEST DATA										Remarks
Elev. (ft)	Depth Scale	Water Level	SURFACE ELEVATION: 198.6	Sample No.	Sample Type	Sample Graphics	Recovery (in)	Standard Penetration Test Blows per 6" [N-Value] blows/foot	Qu-ksf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plasticity Index (PI)	Percent Passing #200 Sieve	
198			TOPSOIL (4")	1	SS		16	2-2-3 [5]		21.8				Dry upon completion of soil augering
196	2		FILL - sampled as FIRM, dark brown lean clay (CL), with sand, rock fragments, and roots (up to 1" diameter)	2	SS		16	3-3-4 [7]		18.6				
194	4			3	SS		4	5-5-3 [8]						
192	6		SILT (ML) - VERY STIFF to STIFF, orangish-brown, with sandstone fragments	4	SS		15	6-7-10 [17]		15.0				
190	8			5	SS		18	8-6-7 [13]		18.3				
188	10		CLAYEY SAND (SC) - FIRM, with sandstone fragments and trace coal fragments											
186	12		Weathered Sandstone - buff											
184	14		Auger Refusal at 14.8 feet	6	SS		8	18-50/0.3-50/0.3 [50/0.3]						
182	16													
180	18													
178	20													
176	22													
174	24													

Depth to Groundwater

● Noted on Drilling Tools _____ ft.
▽ At Completion _____ ft.
▼ After _____ hours _____ ft.
⊠ Cave Depth _____ ft.

Sample Type

SPT- Standard Penetration Test
SS- Split Spoon
ST- Shelby Tube
RC- Rock Core
CU- Auger Cuttings

Boring Method

HSA- Hollow Stem Augers
CFA- Continuous Flight Augers
MD- Mud Drilling



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TEST BORING LOG

CLIENT Nesbitt Engineering
PROJECT NAME Breathitt County Tank Sites
PROJECT LOCATION Breathitt & Perry Counties, Kentucky

BORING # B-203
JOB # LX160076
LOGGED BY TMG
APPROVED BY BLH

DRILLING and SAMPLING INFORMATION

TEST DATA

Date Started 4/20/2016 Contractor Geo-Drill
Date Completed 4/20/2016 Boring Size 3.25 in.
Drill Rig CME 550 Sampling Method SFA
Weather Sunny, 70's Hammer Type Automatic

SOIL CLASSIFICATION				TEST DATA										Remarks
Elev. (ft)	Depth Scale	Water Level		Sample No.	Sample Type	Sample Graphics	Recovery (in)	Standard Penetration Test Blows per 6" [N-Value]	Qu-ksf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plasticity Index (PI)	Percent Passing #200 Sieve	
SURFACE ELEVATION: 202.1														
			TOPSOIL (2")	1	SS		18	2-3-3 [6]		22.5				Dry upon completion of soil augering
200	2		FILL - sampled as FIRM to STIFF, dark brown lean clay (CL), with roots, rock fragments, and sand	2	SS		14	3-6-6 [12]		19.2	341	.806	9172	
198	4		SILT (ML) - VERY STIFF, brown, with sand and sandstone fragments	3	SS		14	6-12-50/0.3 [50/0.3]		19.2				
196	6		Weathered Sandstone, buff											
194	8		Auger Refusal at 7.8 feet											
192	10													
190	12													
188	14													
186	16													
184	18													
182	20													
180	22													
178	24													

Depth to Groundwater

- Noted on Drilling Tools _____ ft.
- ▽ At Completion _____ ft.
- ▼ After _____ hours _____ ft.
- ⊠ Cave Depth _____ ft.

Sample Type

- SPT- Standard Penetration Test
- SS- Split Spoon
- ST- Shelby Tube
- RC- Rock Core
- CU- Auger Cuttings

Boring Method

- HSA- Hollow Stem Augers
- CFA- Continuous Flight Augers
- MD- Mud Drilling



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TEST BORING LOG

CLIENT Nesbitt Engineering
PROJECT NAME Breathitt County Tank Sites
PROJECT LOCATION Breathitt & Perry Counties, Kentucky

BORING # B-204
JOB # LX160076
LOGGED BY TMG
APPROVED BY BLH

DRILLING and SAMPLING INFORMATION

Date Started 4/20/2016 Contractor Geo-Drill
Date Completed 4/20/2016 Boring Size 3.25 in.
Drill Rig CME 550 Sampling Method SFA
Weather Sunny, 70's Hammer Type Automatic

TEST DATA

SOIL CLASSIFICATION				TEST DATA										Remarks
Elev. (ft)	Depth Scale	Water Level	SURFACE ELEVATION: 203.0	Sample No.	Sample Type	Sample Graphics	Recovery (in)	Standard Penetration Test Blows per 6" [N-Value] blows/foot	Qu-ksf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plasticity Index (PI)	Percent Passing #200 Sieve	
202			TOPSOIL (3")	1	SS		14	2-1-3 [4]		22.6				Dry upon completion of soil augering
200	2		FILL - sampled as SOFT to FIRM, dark brown lean clay (CL), with sand and rock fragments	2	SS		15	4-4-4 [8]						
198	4		SILT (ML) - FIRM, brown, with sandstone fragments and sand	3	SS		12	3-5- 50/0.2 [50/0.2]						
196	6		Weathered Sandstone - buff to gray											
194	8		Auger Refusal at 7.9 feet											
192	10													
190	12													
188	14													
186	16													
184	18													
182	20													
180	22													
178	24													

Depth to Groundwater

- Noted on Drilling Tools _____ ft.
- ▽ At Completion _____ ft.
- ▼ After _____ hours _____ ft.
- ⊠ Cave Depth _____ ft.

Sample Type

- SPT- Standard Penetration Test
- SS- Split Spoon
- ST- Shelby Tube
- RC- Rock Core
- CU- Auger Cuttings

Boring Method

- HSA- Hollow Stem Augers
- CFA- Continuous Flight Augers
- MD- Mud Drilling



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FIELD TESTING PROCEDURES

Field Operations: The general field procedures employed by CSI are summarized in ASTM D 420 which is entitled "Investigating and Sampling Soils and Rocks for Engineering Purposes." This recommended practice lists recognized methods for determining soil and rock distribution and ground water conditions. These methods include geophysical and in situ methods as well as borings.

Borings are drilled to obtain subsurface samples using one of several alternate techniques depending upon the subsurface conditions. These techniques are:

- a. Continuous 2-1/2 or 3-1/4 inch I.D. hollow stem augers;
- b. Wash borings using roller cone or drag bits (mud or water);
- c. Continuous flight augers (ASTM D 1425).

These drilling methods are not capable of penetrating through material designated as "refusal materials." Refusal, thus indicated, may result from hard cemented soil, soft weathered rock, coarse gravel or boulders, thin rock seams, or the upper surface of sound continuous rock. Core drilling procedures are required to determine the character and continuity of refusal materials.

The subsurface conditions encountered during drilling are reported on a field test boring record by the chief driller. The record contains information concerning the boring method, samples attempted and recovered, indications of the presence of various materials such as coarse gravel, cobbles, etc., and observations between samples. Therefore, these boring records contain both factual and interpretive information. The field boring records are on file in our office.

The soil and rock samples plus the field boring records are reviewed by a geotechnical engineer. The engineer classifies the soils in general accordance with the procedures outlined in ASTM D 2488 and prepares the final boring records, which are the basis for all evaluations and recommendations.

The final boring records represent our interpretation of the contents of the field records based on the results of the engineering examinations and tests of the field samples. These records depict subsurface conditions at the specific locations and at the particular time when drilled. Soil conditions at other locations may differ from conditions occurring at these boring locations. Also, the passage of time may result in a change in the subsurface soil and ground water conditions at these boring locations. The lines designating the interface between soil or refusal materials on the records and on profiles represent approximate boundaries. The transition between materials may be gradual. The final boring records are included with this report.

The detailed data collection methods used during this study are discussed on the following pages.

Soil Test Borings: Soil test borings were made at the site at locations shown on the attached Boring Plan. Soil sampling and penetration testing were performed in accordance with ASTM D 1586.

The borings were made by mechanically twisting a hollow stem steel auger into the soil. At regular intervals, the drilling tools were removed and soil samples obtained with a standard 1.4 inch I.D., 2 inch O.D., split tube sampler. The sampler was first seated 6 inches to penetrate any loose cuttings, then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot was recorded and is designated the "penetration resistance". The penetration resistance, when properly evaluated, is an index to the soil strength and foundation supporting capability.

Representative portions of the soil samples, thus obtained, were placed in glass jars and transported to the laboratory. In the laboratory, the samples were examined to verify the driller's field classifications. Test Boring Records are attached which graphically show the soil descriptions and penetration resistances.



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Core Drilling: Refusal materials are materials that cannot be penetrated with the soil drilling methods employed. Refusal, thus indicated, may result from hard cemented soil, soft weathered rock, coarse gravel or boulders, thin rock seams or the upper surface of sound continuous rock. Core drilling procedures are required to determine the character and continuity of refusal materials.

Prior to coring, casing is set in the drilled hole through the overburden soils, if necessary, to keep the hole from caving. Refusal materials are then cored according to ASTM D 2113 using a diamond-studded bit fastened to the end of a hollow double tube core barrel. This device is rotated at high speeds, and the cuttings are brought to the surface by circulating water. Core samples of the material penetrated are protected and retained in the swivel-mounted inner tube. Upon completion of each drill run, the core barrel is brought to the surface, the core recovered is measured, the samples are removed and the core is placed in boxes for storage.

The core samples are returned to our laboratory where the refusal material is identified and the percent core recovery and rock quality designation is determined by a soils engineer or geologist. The percent core recovery is the ratio of the sample length obtained to the depth drilled, expressed as a percent. The rock quality designation (RQD) is obtained by summing up the length of core recovered, including only the pieces of core which are four inches or longer, and dividing by the total length drilled. The percent core recovery and RQD are related to soundness and continuity of the refusal material. Refusal material descriptions, recoveries, and RQDs are shown on the "Test Boring Records".

Hand Auger Borings and Dynamic Cone Penetration Testing: Hand auger borings are performed manually by CSI field personnel. This consists of manually twisting hand auger tools into the subsurface and extracting "grab" or baggie samples at intervals determined by the project engineer. At the sample intervals, dynamic cone penetration (DCP) testing is performed. This testing involves the manual raising and dropping of a 20-pound hammer, 18 inches. This "driver" head drives a solid-13/4 inch diameter cone into the ground. DCP "counts" are the number of drops it takes for the hammer to drive three 13/4 inch increments, recorded as X-Y-Z values.

Test Pits: Test pits are excavated by the equipment available, often a backhoe or trackhoe. The dimensions of the test pits are based on the equipment used and the power capacity of the equipment. Samples are taken from the spoils of typical buckets of the excavator and sealed in jars or "Ziploc" baggies. Dynamic Cone Penetration or hand probe testing is often performed in the upper few feet as OSHA standards allow. Refusal is deemed as the lack of advancement of the equipment with reasonable to full machine effort.

Water Level Readings: Water table readings are normally taken in conjunction with borings and are recorded on the "Test Boring Records". These readings indicate the approximate location of the hydrostatic water table at the time of our field investigation. Where impervious soils are encountered (clayey soils) the amount of water seepage into the boring is small, and it is generally not possible to establish the location of the hydrostatic water table through water level readings. The ground water table may also be dependent upon the amount of precipitation at the site during a particular period of time. Fluctuations in the water table should be expected with variations in precipitation, surface run-off, evaporation and other factors.

The time of boring water level reported on the boring records is determined by field crews as the drilling tools are advanced. The time of boring water level is detected by changes in the drilling rate, soil samples obtained, etc. Additional water table readings are generally obtained at least 24 hours after the borings are completed. The time lag of at least 24 hours is used to permit stabilization of the ground water table, which has been disrupted by the drilling operations. The readings are taken by dropping a weighted line down the boring or using an electrical probe to detect the water level surface.

Occasionally the borings will cave-in, preventing water level readings from being obtained or trapping drilling water above the caved-in zone. The cave-in depth is also measured and recorded on the boring records.

Summary of Laboratory Results

Sheet 1 of 1

Borehole	Depth	Sample Type	Liquid Limit	Plastic Limit	Plasticity Index	Classification	Water Content (%)	Unconfined Compressive Strength (ksf)	Dry Density (pcf)	Wet Density (pcf)	Max. Dry Density (pcf)	Opt. Water Content (%)	CBR	Swell (%)	RQD	Percent Recovery	k (cm/sec)	% Finer #200
B-101	0.0	SS					9.8											
B-101	1.5	SS					11.3											
B-102	0.0	SS					16.0											
B-103	0.0	SS					15.4											
B-103	1.5	SS					11.7											
B-103	4.0	SS					20.1											
B-103	12.4	CORE						420										
B-104	0.0	SS					20.2											
B-201	0.0	SS					20.9											
B-201	1.5	SS					20.3											
B-201	4.0	SS					19.5											
B-201	6.5	SS	33	24	9	ML	19.4											71.1
B-201	9.0	SS					23.3											
B-201	18.8	CORE						513										
B-202	0.0	SS					21.8											
B-202	1.5	SS					18.6											
B-202	6.5	SS					15.0											
B-202	9.0	SS					18.3											
B-203	0.0	SS					22.5											
B-203	1.5	SS	34	22	12	CL	19.2											72.3
B-203	4.0	SS					19.2											
B-204	0.0	SS					22.6											



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SS - Split Spoon Sample
GRAB - Bulk Grab Sample
k - Coefficient of Permeability
- See Attached test Results

PROJECT INFORMATION

Client: Nesbitt Engineering
Project Name: Breathitt County Tank Sites Project
Number: LX160076
Project Location: Breathitt & Perry Counties, Kentucky

The figure is a semi-logarithmic plot showing the relationship between Plasticity Index (Y-axis) and Liquid Limit (X-axis). The Y-axis is labeled 'PLASTICITY INDEX' and ranges from 0 to 60. The X-axis is labeled 'LIQUID LIMIT' and ranges from 0 to 100. The plot is divided into several regions by a solid line and a dashed line. The regions are labeled: CL (Clay of Low Plasticity), CH (Clay of High Plasticity), ML (Silt of Low Plasticity), MH (Silt of High Plasticity), and CL-ML (Clay of Low to Medium Plasticity). A data point is plotted at Liquid Limit = 35 and Plasticity Index = 10, which is marked with a cross and a dot.

 <p>Consulting Services Incorporated 858 Contract Street Lexington, Kentucky 40505 Phone: 859.309.6021 Fax: 888.792.3121</p>	<p align="center">PROJECT INFORMATION</p> <p>Client: Nesbitt Engineering Project Name: Breathitt County Tank Sites Project Number: LX160076 Project Location: Breathitt & Perry Counties, Kentucky</p>
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LABORATORY TESTING PROCEDURES

Soil Classification: Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply past experience to current problems. In our investigations, samples obtained during drilling operations are examined in our laboratory and visually classified by an engineer. The soils are classified according to consistency (based on number of blows from standard penetration tests), color and texture. These classification descriptions are included on our "Test Boring Records."

The classification system discussed above is primarily qualitative and for detailed soil classification two laboratory tests are necessary: grain size tests and plasticity tests. Using these test results the soil can be classified according to the AASHTO or Unified Classification Systems (ASTM D 2487). Each of these classification systems and the in-place physical soil properties provides an index for estimating the soil's behavior. The soil classification and physical properties obtained are presented in this report.

Rock Classification: Rock classifications provide a general guide to the engineering properties of various rock types and enable the engineer to apply past experience to current situations. In our explorations, rock core samples obtained during drilling operations are examined in our laboratory and visually classified by an engineer. The rock cores are classified according to relative hardness and RQD (see Guide to Rock Classification Terminology), color, and texture. These classification descriptions are included on our Test Boring Records.

Atterberg Limits: Portions of the samples are taken for Atterberg Limits testing to determine the plasticity characteristics of the soil. The plasticity index (PI) is the range of moisture content over which the soil deforms as a plastic material. It is bracketed by the liquid limit (LL) and the plastic limit (PL). The liquid limit is the moisture content at which the soil becomes sufficiently "wet" to flow as a heavy viscous fluid. The plastic limit is the lowest moisture content at which the soil is sufficiently plastic to be manually rolled into tiny threads. The liquid limit and plastic limit are determined in accordance with ASTM D 4318.

Moisture Content: The Moisture Content is determined according to ASTM D 2216.

Percent Finer Than 200 Sieve: Selected samples of soils are washed through a number 200 sieve to determine the percentage of material less than 0.074 mm in diameter.

Rock Strength Tests: To obtain strength data for rock materials encountered, unconfined compression tests are performed on selected samples. In the unconfined compression test, a cylindrical portion of the rock core is subjected to increasing axial load until it fails. The pressure required to produce failure is recorded, corrected for the length to diameter ratio of the core and reported.

Compaction Tests: Compaction tests are run on representative soil samples to determine the dry density obtained by a uniform compactive effort at varying moisture contents. The results of the test are used to determine the moisture content and unit weight desired in the field for similar soils. Proper field compaction is necessary to decrease future settlements, increase the shear strength of the soil and decrease the permeability of the soil.

The two most commonly used compaction tests are the Standard Proctor test and the Modified Proctor test. They are performed in accordance with ASTM D 698 and D 1557, respectively. Generally, the Standard Proctor compaction test is run on samples from building or parking areas where small compaction equipment is anticipated. The Modified compaction test is generally performed for heavy structures, highways, and other areas where large compaction equipment is expected. In both tests a representative soil sample is placed in a mold and compacted with a compaction hammer. Both tests have three alternate methods.



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Test	Method	Hammer Wt./Fall	Mold Diam.	Run on Material Finer Than	No. of Layers	No. of Blows/ Layer
Standard D 698	A	5.5 lb./12"	4"	No. 4 sieve	3	25
	B	5.5 lb./12"	4"	3/8" sieve	3	25
	C	5.5 lb./12"	6"	3/4" sieve	3	56

Test	Method	Hammer Wt./Fall	Mold Diam.	Run on Material Finer Than	No. of Layers	No. of Blows/ Layer
Modified D 1557	A	10 lb./18"	4"	No. 4 sieve	5	25
	B	10 lb./18"	4"	3/8" sieve	5	25
	C	10 lb./18"	6"	3/4" sieve	5	56

The moisture content and unit weight of each compacted sample is determined. Usually 4 to 5 such tests are run at different moisture contents. Test results are presented in the form of a dry unit weight versus moisture content curve. The compaction method used and any deviations from the recommended procedures are noted in this report.

Laboratory California Bearing Ratio Tests: The California Bearing Ratio, generally abbreviated to CBR, is a punching shear test and is a comparative measure of the shearing resistance of a soil. It provides data that is a semi-empirical index of the strength and deflection characteristics of a soil. The CBR is used with empirical curves to design pavement structures.

A laboratory CBR test is performed according to ASTM D 1883. The results of the compaction tests are utilized in compacting the test sample to the desired density and moisture content for the laboratory California Bearing Ratio test. A representative sample is compacted to a specified density at a specified moisture content. The test is performed on a 6-inch diameter, 4.58-inch-thick disc of compacted soil that is confined in a cylindrical steel mold. The sample is compacted in accordance with Method C of ASTM D 698 or D 1557.

CBR tests may be run on the compacted samples in either soaked or unsoaked conditions. During testing, a piston approximately 2 inches in diameter is forced into the soil sample at the rate of 0.05 inch per minute to a depth of 0.5 inch to determine the resistance to penetration. The CBR is the percentage of the load it takes to penetrate the soil to a 0.1 inch depth compared to the load it takes to penetrate a standard crushed stone to the same depth. Test results are typically shown graphically.

Consolidation Tests: Consolidation tests are conducted on representative soil samples to determine the change in height of the sample with increasing load. The results of these tests are used to estimate the settlement and time rate of settlement of structures constructed on similar soils. A consolidation test is performed according to ASTM D2435 on a single section of an undisturbed sample extruded from a sample tube. The sample is trimmed into a disc 2.5 inches in diameter and 0.75 inch thick. The disc is confined in a stainless steel ring and sandwiched between porous plates. It is then subjected to incrementally increasing vertical loads, and the resulting deformations are measured with a micrometer dial gauge. Void ratio are then calculated from these deformation readings. The test results are typically provided in tabular form or in the form of plots of void ratio versus applied stress (e-log p curves).



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Organic Content: The Organic Content is determined according to ASTM D2974. The moisture content is first determined by drying portions of the sample at 105 degrees Celsius. The ash content is then determined by igniting the oven-dried sample from the moisture content determination in a muffle furnace at 440 degrees Celsius. The substance remaining after ignition is the ash. The organic content is expressed as a percentage by subtracting the percent ash from one hundred.

Direct Shear Tests: Direct shear tests are performed according to ASTM D3080 to determine the shear strength parameters of the soil. The specimen of soil is placed in a rigid box that is divided horizontally into two frames. The specimen is then confined under a vertical or normal stress and horizontal force is applied to fail the specimen along a horizontal plane at its mid-height.

Because drainage of the soil specimen cannot be easily controlled, undrained tests (i.e., UU and CU tests) are possible only on impervious soils and pore pressure measurements cannot be made. Drained tests (i.e., CD tests), however, are possible on all soil types. Since the drainage paths through the specimen are short and pore water pressures are dissipated fairly rapidly, the direct shear test is well suited to the CD test.

A minimum of three test specimens are required to establish the strength envelope of a soil. The soil parameters obtained are the cohesion and angle of internal friction.

Unconfined Compression Tests: The unconfined compression test is an unconsolidated-undrained triaxial shear test with no lateral confining pressure. This test is used to determine the shear strength of clayey soils. An unconfined compression test is performed according to ASTM D2166 on a single section of an undisturbed sample extruded from a sampling tube. The sample is trimmed to a length-to-diameter ratio of about 2 and placed in the testing device. Incrementally increasing vertical loads are applied until the sample fails. Test results are provided in the form of a stress-strain curve or a value representing the unconfined compressive strength of the sample.

Grain Size Tests: Grain Size Tests are performed to determine the soil classification and the grain size distribution. The soil samples are prepared for testing according to ASTM D421 (dry preparation) or ASTM D2217 (wet preparation). The grain size distribution of soils coarser than a number 200 sieve (0.074 mm opening) is determined by passing the samples through a standard set of nested sieves. Materials passing the number 200 sieve are suspended in water and the grain size distribution calculated from the measured settlement rate. These tests are conducted in accordance with ASTM D422.

Triaxial Shear Tests: Triaxial shear tests are used to determine the strength characteristics and friction angle of a given soil sample. Triaxial tests are also used to determine the elastic properties of the soil specimen. Triaxial shear tests are performed on several sections of a relatively undisturbed sample extruded from the sampling tube. The samples are trimmed into cylinders 1.4 to 2.8 inches in diameter and encased in rubber membranes. Each is then placed in a compression chamber and confined by all around water pressure. Samples are then subjected to additional axial and/or lateral loads, depending on the soil and the field conditions to be simulated. The test results are typically presented in tabular form or in the form of stress-strain curves and Mohr envelopes or p-q plots.

Three types of triaxial tests are normally performed. The most suitable type of triaxial test is determined by the loading conditions imposed on the soil in the field and the soil characteristics.

1. Consolidated-Undrained (designated as a CU or R Test).
2. Consolidated-Drained (designated as a CD or S Test).
3. Unconsolidated-Undrained (designated as a UU or Q Test).



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Technical Specifications

**Contract 1 Distribution System
KY 315/28 Waterline Project
Breathitt County Water District
Jackson, Kentucky**

November, 2016

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.01 SCOPE OF WORK COVERED BY THE CONTRACT

A. These SPECIFICATIONS and the accompanying DRAWINGS describe the WORK to be done and the materials to be furnished for construction of the **KY 315/28 Waterline Extension, Contract 1 Distribution System.**

B. The proposed WORK is located along **KY315, KY28 and related side roads southwest of the City of Jackson, KY,** at the location shown on the drawings.

C. Contract WORK includes:

Including:

Work is to include installation of approximately 17,680 LF of 8-inch, 22,320 LF of 6-inch, 20,640 LF of 4-inch, 6,800 LF of 3-inch and 3,630 LF of 2-inch waterline with 3,100 LF of various sized directionally drilled creek/river crossings and other appurtenances, Installation of two (2) duplex pump stations, a pressure reducing vault, a hydro pneumatic pump station, telemetry and electrical service and 117 service connections.

D. Special Notes:

- Electrical service and telemetry to the tank sites are included in Contract 1. The contractor shall obtain the 911 address and load sheets, request the service and pay any deposits as part of their bid. The water district is not obligated to provide any of this information.
- Included in the pump station is transfer switch connections for a generator.
- Meter and valve lids shall be HDPE.
- Valves shall have all control line fittings and rigid tubing made of stainless steel.
- The contractor will be billed for water usage at a rate equivalent to the BCWD leak adjustment rate of \$6.96/1000 gallons. The volume of usage shall be determined by the water district.
- The contractor shall be responsible for notifying the owner to perform water sampling during the project. The contractor shall be responsible for a \$500.00 fee per sampling event,

payable to the owner. A sampling event shall be defined as a three (3) bottle sample technique typically used when a line or line segment is tested for Chlorine and Coliforms and E Coli. Resampling of a line shall result in an additional \$500.00 fee. All lines shall be tested and sampled prior to being placed into service.

- There is no telemetry required at the Hydro pneumatic pump station. Pump control shall be regulated with a discharge pressure transducer.
- A geotech inspection report is provided as part of these bid documents.
- No blasting shall occur during construction of this project.
- Flushing hydrants located in KTC ROW shall have barrel extensions as needed for appropriate installation.
- Mechanical trenchers shall not be used during construction, all trenching in rock shall be done in a manner allowing access to the pipe for repairs or service connections.
- Electrical service for the Town Hill pump station shall be true 3 phase and not a transient supply.

1.02 RELATED REQUIREMENTS

- A. Refer to the CONTRACT AGREEMENT for a listing of the CONTRACT DOCUMENTS.
- B. Refer to Section 00700, paragraph 25 for coordination with other contractors.

1.03 WORK SEQUENCE

- A. This project includes WORK that must be properly sequenced and collection system and all other utilities. Sequencing information in this Section is intended to identify constraints with respect to maintenance of existing service, and to assist the CONTRACTOR in planning the WORK. This information does not relieve the CONTRACTOR from his responsibility to complete the WORK on time.
- B. All existing water services must remain active during construction and residential and commercial traffic flow shall be maintained during construction.

Temporary pumping and piping facilities for rerouting the flows shall be provided by the CONTRACTOR as required to maintain service.

- C. The CONTRACTOR shall plan, schedule and accomplish the WORK of this Contract to avoid interruption of system service. Should any such

interruptions become necessary, the CONTRACTOR shall notify the OWNER and ENGINEER in writing of such need as far ahead of the interruption as possible, but in no case less than one (1) week. The CONTRACTOR must state in his notification of need to interrupt the existing system at least the following:

1. Construction sequence to minimize the interruption time, and propose time-of-day that WORK would be accomplished.
 2. Expected length of time of the interruption.
 3. Alternate procedures in the event the expected time is exceeded.
 4. List of all equipment and material that must be on hand to complete the WORK.
- D. The ENGINEER shall review the CONTRACTOR'S written notification, and the ENGINEER and OWNER must concur that the proposed interruption is acceptable prior to commencement of the interruption

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

The Contractor shall furnish all necessary labor, machinery, tools, apparatus, equipment, materials, service, other necessary supplies and perform all work including all excavation and backfilling (without additional compensation, except where specifically set out in these specifications) at the unit or lump sum bid price for the items or work described under PART 2 of this section.

1.02 PROGRESS AND PAYMENTS SCHEDULES

- A. Within fifteen (15) days after the date of formal execution of the AGREEMENT, the Contractor shall prepare and submit to the Engineer, for approval, a construction schedule which depicts the Contractor's plan for completing the contract requirements and show work placement in dollars versus contract time. The Contractor's construction schedule must be approved by the Engineer before any payments will be made on this contract.
- B. Within fifteen (15) days after the date of formal execution of the CONTRACT AGREEMENT, the Contractor shall prepare and submit to the Engineer, for approval, a periodic estimate which depicts the Contractor's cost for completing the contract requirements and show by major unit of the project work, the Contractor's dollar value for the material and the labor (two separate amounts) to be used as a basis for the periodic payments. The Contractor's periodic estimate must be approved by the Engineer before any payments will be made on this contract.
- C. The Engineer's decision as to sufficiency and completeness of the Contractor's construction schedule and periodic estimate will be final.
- D. The Contractor must make current, to the satisfaction of the Engineer, the construction schedule and periodic estimate each time he requests a payment on this contract.
- E. The Contractor's construction schedule and periodic estimate must be maintained at the construction site available for inspection and shall be revised to incorporate approved change orders as they occur.
- F. When the Contractor requests a payment on this contract, it must be on the approved periodic estimate and be current. Further, the current periodic estimate and construction schedule (both updated and revised) shall be submitted for review and approval by the Engineer before monthly payments will be made by the Owner. The Contractor shall

submit six (6) current copies of each (periodic estimate and construction schedule) when requesting payment.

1.03 CONDITIONS FOR PAYMENT

- A. The Owner will make payments for acceptable work in place and materials properly stored on-site. The value of payment shall be as established on the approved construction schedule and periodic estimate, EXCEPT the Owner will retain ten percent (10%) of the work in place and a percentage as hereinafter listed for items properly stored or untested.
- B. No payment will be made for stored materials unless a proper invoice from the supplier is attached to the pay request. Further, no item whose value is less than \$1,000.00 will be considered as stored materials for pay purposes.
- C. Payment for pipeline items shall be limited to eighty percent (80%) of the bid price until the pipeline items have been tested and accepted by the Engineer.
- D. Payment for equipment items shall be limited to eighty-five percent (85%) of their scheduled value (materials portion only) until they are set in place. Eighty-five percent (85%) payment for stored materials and equipment shall be contingent on proper on-site storage as recommended by the manufacturer or required by the Engineer.
- E. Payment for equipment items set in-place shall be limited to ninety percent (90%) of their scheduled value until they are ready for operation and have been certified by the manufacturer. Ninety percent (90%) payment for installed equipment shall be contingent on proper routine maintenance of the equipment in accordance with the manufacturer's recommendations.
- F. Payment for equipment items set in place and ready for operation shall be limited to ninety-five percent (95%) of their scheduled value until all acceptance tests have been completed and the required manufacturer's pre-startup operator's training has been completed.
- G. Payment for the labor portion of equipment items will be subject only to the degree of completeness and the appropriate retainage.
- H. The Owner may reduce the percent of retainage once the project has achieved satisfactory progress and is at the fifty percent (50%) mark. If the percent of retainage is reduced, the dollar amount of retainage for work-in-place will not be reduced but will remain constant following the fifty percent (50%) constructed status. The retainage on the equipment items shall be determined as defined hereinbefore.
- I. Additionally, the Owner may reinstate the retainage to a full ten percent (10%) of the scheduled value of work-in-place and material items should

the Owner, at its discretion, determine that the Contractor is not making satisfactory progress or there is other specific cause for such withholding.

1.04 CLAIMS FOR EXTRA WORK

- A. If the Contractor claims that any instructions by Drawings or otherwise involve extra cost, he shall give the Engineer written notice of said claim within ten (10) days after the receipt of such instructions, and in any event before proceeding to execute the work, stating clearly and in detail the basis of his claim or claims. No such claim shall be valid unless so made.
- B. Claims for additional compensation for extra work, due to alleged errors in spot elevations, contour lines, or bench marks, will not be recognized unless accompanied by certified survey data, made prior to the time the original ground was disturbed, clearly showing that errors exist which resulted, or would result, in handling more material, or performing more work than would reasonably be estimated from the Drawings and/or topographical maps issued.
- C. Any discrepancies which may be discovered between actual conditions and those represented by the topographical maps and/or Drawings shall at once be reported to the Engineer, and work shall not proceed, except at the Contractor's risk, until written instructions have been received by him from the Engineer.
- D. If, on the basis of the available evidence, the Engineer determines that an adjustment of the Contract Price or time is justifiable, the procedure shall then be as provided herein for "Changes in the Work".
- E. By execution of this Contract, the Contractor warrants that he has visited the site of the proposed work and fully acquainted himself with the existing site conditions relating to construction and labor, and that he fully understands the facilities, difficulties, and restrictions attending the execution of the work under this Contract. The Contractor further warrants that he has thoroughly examined and is familiar with the Drawings, Specifications and all other documents comprising the Contract. The Contractor further warrants that by execution of this Contract his failure when he was bidding on this Contract to receive or examine any form, instrument or document, or to visit the site and acquaint himself with conditions there existing, in no way relieves him from any obligation under the Contract, and the Contractor agrees that the Owner shall be justified in rejecting any claim based on facts regarding which he should have been on notice as a result thereof.

1.05 DETERMINATION OF THE VALUE OF EXTRA (ADDITIONAL) OR OMITTED WORK

- A. The value of extra (additional) or omitted work shall be determined in one or more of the following ways:

1. On the basis of the actual cost of all the items of labor (including on-the-job supervision), materials, and use of equipment, plus a maximum 15 percent for added work or a minimum 15 percent for deleted work which shall cover the Contractor's general supervision, overhead and profit. In case of subcontracts, the 15 percent (maximum for added work and minimum for deleted work) is interpreted to mean the subcontractor's supervision, overhead and profit, and an additional 5 percent (maximum for added work and minimum for deleted work) may then be added to such costs to cover the General Contractor's supervision, overhead and profit. The cost of labor shall include required insurance, taxes and fringe benefits. Equipment costs shall be based on current rental rates in the areas where the work is being performed but, in no case shall such costs be greater than the current rates published by the Associated Equipment Distributors, Chicago, Illinois.
 2. By estimate and acceptance in a lump sum.
 3. By unit prices named in the Contract or subsequently agreed upon.
- B. Provided, however, that the cost or estimated cost of all extra (additional) work shall be determined in advance of authorization by the Engineer and approved by the Owner.
- C. All extra (additional) work shall be executed under the conditions of the original Contract. Any claim for extension of time shall be adjusted according to the proportionate increase or decrease in the final total cost of the work unless negotiated on another basis.
- D. Except for over-runs in contract unit price items, no extra (additional) work shall be done except upon a written Field Order Directive, or Change Order from the Engineer, and no claim on the part of the Contractor for pay for extra (additional) work shall be recognized unless so ordered in writing by the Engineer.

PART 2 – PRODUCTS

2.01 WATERLINES

Payment for **Waterlines** will be made at the contract unit price per linear foot in place, which shall include compensation for all labor, material and equipment required for furnishing and installing pipe; excavation (including rock excavation); dewatering; bedding material; laying; jointing; pipe anchoring; erosion control measures; temporary trench shoring; sheeting and bracing; initial and final backfill, seed and straw of all areas disturbed during construction activities; tracer wire; waterline markers; testing of the completed lines; and any utility relocation if necessary. Incidental to the construction of the waterline shall be crushed stone, asphalt, or concrete surface replacement (in kind), replacement or repair to

drainage ditches, rip rap ditches, curb and gutter, and sidewalks.

Miscellaneous fittings required to complete the installation as shown on the drawings shall be incorporated into the unit price per linear foot of pipe. Such fittings include but are not limited to as elbows, tees, wyes and mechanical restraint.

2.02 GATE VALVE & BOXES

Payment for the **Gate Valves & Boxes** will be made at the contract unit price per assembly, which shall include compensation for all labor, material and equipment required for furnishing and installing Gate Valve & Box; excavation (including rock excavation); dewatering; bedding material; laying; jointing; pipe anchoring; erosion control measures; temporary trench shoring; sheeting and bracing; initial and final backfill, seed and straw of all areas disturbed during construction activities; tracer wire; terminal for tracer wire; testing of the completed valves; and fittings. Incidental to the installation of the Gate Valve & Box shall be valve box, crushed stone, asphalt, or concrete surface replacement (in kind), replacement or repair to drainage ditches, rip rap ditches, curb and gutter, gate valve concrete collar and sidewalks.

Miscellaneous fittings required to complete the installation as shown on the drawings shall be incorporated into the unit price. Such fittings include but are not limited to as adapters, elbows, tees, wyes and mechanical restraint.

2.03 FLUSHING HYDRANT ASSEMBLY

Payment for the **Flushing Hydrant Assembly** will be made at the contract unit price per assembly, which shall include compensation for all labor, material and equipment required for furnishing and installing hydrant, valve & box; excavation (including rock excavation); dewatering; bedding material; laying; jointing; pipe anchoring; erosion control measures; temporary trench shoring; sheeting and bracing; initial and final backfill, seed and straw of all areas disturbed during construction activities; tracer wire; marker posts; terminal for tracer wire; testing of the completed lines; and any utility relocation if necessary. Incidental to the installation of the hydrant assembly shall be valve box, crushed stone, asphalt, or concrete surface replacement (in kind), replacement or repair to drainage ditches, rip rap ditches, curb and gutter, gate valve concrete collar and sidewalks.

2.04 5/8" x 3/4" METERS ONLY (Orion Radio Read Profiler)

Payment for the **Meters Only** will be made at the contract unit price per assembly, which shall include compensation for delivery of the new meters to the Owners warehouse in Jackson, KY.

2.05 5/8" x 3/4" Tandem Setter Meter Tub with IPRV (installed)

Payment for the **Tandem Setter Meter Tub with IPRV** will be made at the

contract unit price per assembly, which shall include compensation for all labor, material and equipment required for furnishing and installing, new meter box, new box lid, new copper setter, individual pressure reducing valve, etc; excavation (including rock excavation); dewatering; bedding material; laying; jointing; pipe anchoring; erosion control measures; temporary trench shoring; sheeting and bracing; initial and final backfill, seed and straw of all areas disturbed during construction activities; and any utility relocation if necessary. Incidental to the installation shall be necessary fittings, any work required to make installation complete, crushed stone, asphalt, or concrete surface replacement (in kind), replacement or repair to drainage ditches, rip rap ditches, curb and gutter and sidewalks.

New water meter tubs shall be installed per District's ordinances.

2.06 SERVICE TUBING

Payment for **Service Tubing** will be made at the contract unit price per linear foot in place, which shall include compensation for all labor, material and equipment required for furnishing and installing pipe; excavation (including rock excavation); dewatering; bedding material; laying; jointing; pipe anchoring; erosion control measures; temporary trench shoring; sheeting and bracing; initial and final backfill, seed and straw of all areas disturbed during construction activities; reconnection to existing yoke; testing of the completed lines; and any utility relocation if necessary. Incidental to the installation of the service tubing shall be crushed stone, asphalt, or concrete surface replacement (in kind), replacement or repair to drainage ditches, rip rap ditches, curb and gutter, and sidewalks.

Miscellaneous fittings required to complete the installation as shown on the drawings shall be incorporated into the unit price per linear foot of pipe. Such fittings include but are not limited to as service saddle, elbows, tees, wyes and mechanical restraint.

2.07 PRESSURE REDUCING VALVE & VAULT

Payment for the **Pressure Reducing Valve & Vault (PRV)** assembly will be made at the contract unit price per assembly, which shall include compensation for all labor, material and equipment required for furnishing and installing PRV & vault as shown on detail sheets included in plan set; excavation (including rock excavation); dewatering; bedding material; laying; jointing; pipe anchoring; erosion control measures; temporary trench shoring; sheeting and bracing; initial and final backfill, seed and straw of all areas disturbed during construction activities; tracer wire; marker posts; terminal for tracer wire; testing of the completed lines; and any utility relocation if necessary. Incidental to the installation of the PRV vault shall be valve boxes, crushed stone, asphalt, or concrete surface replacement (in kind), replacement or repair to drainage ditches, rip rap ditches, curb and gutter, gate valve concrete collar and sidewalks.

Miscellaneous fittings required to complete the installation as shown on the

drawings shall be incorporated into the unit price. Such fittings include but are not limited to as adapters, elbows, tees, wyes and mechanical restraint.

2.08 COMBINATION AIR RELEASE VALVE & BOX ASSEMBLY

Payment for the **Combination Air Relief Valve (CARV)** assembly will be made at the contract unit price per assembly, which shall include compensation for all labor, material and equipment required for furnishing and installing CARV & box; excavation (including rock excavation); dewatering; bedding material; laying; jointing; pipe anchoring; erosion control measures; temporary trench shoring; sheeting and bracing; initial and final backfill, seed and straw of all areas disturbed during construction activities; tracer wire; terminal for tracer wire; and any utility relocation if necessary. Incidental to the installation of the air release valve shall be valve box, crushed stone, asphalt, or concrete surface replacement (in kind), replacement or repair to drainage ditches, rip rap ditches, curb and gutter, gate valve concrete collar and sidewalks.

Miscellaneous fittings required to complete the installation as shown on the drawings shall be incorporated into the unit price. Such fittings include but are not limited to as adapters, elbows, tees, wyes and mechanical restraint.

2.09 FLOW MONITORING PIT ASSEMBLY

Payment for the **Flow Monitoring Pit Assembly** will be made at the contract unit price per each installation, which shall include compensation for all labor, material and equipment required for furnishing and installing Monitoring Pit; excavation (including rock excavation); dewatering; bedding material; meter setter; meter box; box lid; initial and final backfill, seed and straw of all areas disturbed during construction activities; tracer wire; marker posts; terminal for tracer wire; and any utility relocation if necessary. Incidental to the installation of the flow monitoring pit shall be valve box, crushed stone, asphalt, or concrete surface replacement (in kind), replacement or repair to drainage ditches, rip rap ditches, curb and gutter, gate valve concrete collar and sidewalks.

2.10 DIRECTIONAL DRILL

Payment for **Directional Drill** will be made at the contract unit price per linear foot or lump sum, which shall include compensation for all labor, material and equipment required for furnishing and installing pipe, excavation (including rock excavation), dewatering, bedding material, laying, jointing, pipe anchoring, erosion control measures, temporary trench shoring, sheeting and bracing, and initial and final backfill, seed and straw of all areas disturbed during construction activities, tracer wire; waterline markers; testing of the completed lines, and any utility relocation if necessary. Leak detection shall be included in the unit price if indicated on the plans. Sheet C-44 is all inclusive as a lump sum unit price.

Miscellaneous fittings required to complete the installation as shown on the drawings shall be incorporated into the unit price. Such fittings include but are not limited to as adapters, elbows, tees, wyes and mechanical restraint.

2.11 HIGHWAY CROSSING, BORE & JACK

Payment for the **Highway Crossing, Bore & Jack** will be made at the contract unit price per linear foot, which shall include compensation for all labor, material and equipment required for furnishing and installing highway bore; excavation (including rock excavation); dewatering; crushed stone bedding material; laying; jointing; pipe anchoring; **carrier pipe**; casing spacers; end seals; erosion control measures; temporary trench shoring; sheeting and bracing; initial and final backfill, seed and straw of all areas disturbed during construction activities; tracer wire; marker posts; terminal for tracer wire; testing of the completed lines; and any utility relocation if necessary. Incidental to the bore and jack shall be crushed stone, asphalt or concrete surface replacement (in kind), replacement or repair to drainage ditches, rip rap ditches, curb and gutter, gate valve concrete collar and sidewalks.

2.12 WATERLINE MARKER

Payment for the **Waterline Marker** will be made at the contract unit price per assembly, which shall include compensation for all labor, material and equipment required for furnishing and installing Waterline Marker; excavation (including rock excavation); initial and final backfill, seed and straw of all areas disturbed during construction activities; tracer wire; terminal for tracer wire; and identification sticker. Incidental to the installation of the Waterline Marker shall be marker post, identification sticker, replacement or repair to drainage ditches, rip rap ditches, curb and gutter.

2.13 DUPLEX PUMP STATION

Payment for the **Duplex Pump Station** will be made at the contract unit price, which shall include compensation for all labor, material and equipment required for furnishing, installing and start-up of the station as shown on plan set; excavation (including rock excavation); dewatering; bedding material; laying; jointing; pipe anchoring; erosion control measures; temporary trench shoring; sheeting and bracing; initial and final backfill, seed and straw of all areas disturbed during construction activities; electrical wiring installation; electrical service (including pole, meter base, etc.); electrical connection; tracer wire; marker posts; terminal for tracer wire; testing of the completed lines; and any utility relocation if necessary.

Miscellaneous fittings required to complete the installation as shown on the drawings shall be incorporated into the unit price. Such fittings include but are not limited to as adapters, elbows, tees, wyes and mechanical restraint.

2.14 SCADA TELEMETRY PACKAGE & ELECTRICAL SERVICE

Payment for the **Scada Telemetry Package & Electrical Service** will be made at the contract unit price, which shall include compensation for all labor, material and equipment required for furnishing, installing and upgrades to the existing telemetry system and the Electrical services to the 2 water storage tanks and 3 pump stations; and startup procedures. Incidental to the improvement of the Telemetry shall be all electrical conduit, necessary hardware to secure new towers, installation of electrical wiring, miscellaneous hardware, upgrades to existing telemetry software at the OWNER's office and any modifications required to make new equipment operational. **Electrical service shall be single phase to the tank site and hydro pneumatic pump station and true three phase to the 2 duplex pump stations. Contractor shall be responsible for obtaining all information required by the electrical utility company and any deposits required.**

2.15 HYDRO-PNEUMATIC PUMP STATION

Payment for the **Hydropneumatic Pump Station** will be made at the contract unit price, which shall include compensation for all labor, material and equipment required for furnishing & installing the Booster Station; and startup procedures. Incidental to the Booster Station shall be electrical conduit, necessary hardware to hang/secure control panels, installation of electrical wiring, pulling of existing electrical wiring, miscellaneous hardware, and any modifications required to

PART 3 QUANTITIES OF ESTIMATE

- A. Wherever the estimated quantities of work to be done and materials to be furnished under this contract are shown in any of the documents, including the Bid Proposal, they are given for use in comparing bids and the right is especially reserved except as herein otherwise specifically limited, to increase or diminish them as may be deemed reasonably necessary or desirable by the Owner to complete the work contemplated by this contract, and such increase or diminution shall not give cause for claims or liability for damages. The Engineer will not be financially responsible for any omissions from the Contract Documents and therefore not included by the Contractor in his proposal.

- B. Aerial photographs utilized for plan sheets in the Contract Documents are indicated at an approximate scale and shall not be scaled for quantity take-offs. The quantities listed in the bid schedule are given for use in comparing bids and may not be the actual quantities to be installed. It is the Contractor's responsibility to field verify the bid item quantities to be installed prior to the ordering of materials. Payment on unit price contracts are based on actual quantities installed. The Owner or Engineer will not be financially responsible for any shortage of the bid items or overrun of bid items ordered for the quantities.

- C. The actual quantities of all materials to be used for this project shall be field verified prior to the Contractor ordering the necessary materials. The quantity listed in the bid schedule is given for use in comparing bids and may increase or diminish as may be deemed necessary or as directed by the Owner. Any such increase or diminution shall not give cause for claims or liability for damages. The Engineer or Owner will not be financially responsible for any charges incurred for restocking of materials ordered.

- END OF SECTION -

SECTION 01060

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 LABOR REGULATIONS ON KENTUCKY PUBLIC WORKS PROJECTS

- A. All Public Works Project submitted for BIDS and constructed by a Public Authority in the State of Kentucky are subject to the provisions of the Kentucky Revised Statutes, Chapter 337, entitled Wages and Hours as may be amended from time to time.

CONTRACTORS are hereby advised that both State and Federal labor wage decisions are applicable to this contract. This does not guarantee nor infer that employees may be obtained for these rates. Should the CONTRACTOR choose or find it necessary to pay higher wage rates, the OWNER will not be liable for such higher rates.

1.02 ACCESS TO WORK

- A. The representative of the OWNER, the ENGINEER, the U.S. Environmental Protection Agency, the Kentucky Division of Water, OSHA and related agencies shall have access to the WORK wherever it is in preparation or progress, and the CONTRACTOR shall provide proper facilities for such access and inspection.

1.03 LOCAL GOVERNMENT REQUIREMENTS

- A. The CONTRACTOR and all SUBCONTRACTORS and SUPPLIERS shall fully comply with all local government requirements.
- B. Construction debris must be disposed in accordance with the local Solid Waste Management Plan, and with DWM regulatory requirement.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used

END OF SECTION

01060-1

SECTION 01200

PROJECT MEETINGS

PART 1 GENERAL

1.01 PRE-CONSTRUCTION CONFERENCES

- A. Prior to commencing the work, a pre-construction conference will be held and representatives of the following organizations shall have at least one (1) representative in attendance:

OWNER, ENGINEER, CONTRACTOR, major
Subcontractors, and representatives of the appropriate
State and Federal agencies as they choose.

- B. The pre-construction conference will be for the purpose of reviewing procedures to be followed concerning the orderly flow of required paperwork; coordination of the various parties involved with the project, review of shop drawing submittals, contract time, liquidated damages, payment estimates, change orders, and other items to the parties involved.

1.02 PROGRESS MEETINGS

- A. A progress meeting will be held once each month to review progress of the work, discuss problems encountered or foreseen, coordinate for the following month with the OWNER, and answer any questions as they arise.
- B. The organizations listed under 1.01 above shall have at least one representative in attendance at each meeting.

1.03 SCHEDULE UPDATE MEETINGS

- A. Schedule update meetings shall be in accordance with schedule requirements in Division 1, Section 01310.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

- A. This section specifies the general methods and requirements of submissions applicable to the following WORK-related submittals:
1. General Procedures for Submittals
 2. Construction Schedule
 3. Schedule of Values and Payments
 4. Schedule of SHOP DRAWING Submittals
 5. SHOP DRAWINGS, Product Data, Samples and O&M Instructions
 6. Construction Photographs
 7. Test Reports
 8. Manufacturer's Certificates
 9. Manufacturer's Instructions
 10. Contractor's Responsibility
 11. Submission Requirements
 12. Resubmission Requirements

Additional general submissions requirements are contained in paragraphs 5.1 through 5.7 of the General Conditions. The CONTRACTOR is responsible for the submittal of all weekly payrolls, monthly utilization and other required forms and reports, including reports and forms from his SUBCONTRACTORS. The prompt submittal of all required reports and forms will help to insure the timely processing of pay request. Detailed submittal requirements will be specified in the technical SPECIFICATIONS sections.

1.02 GENERAL PROCEDURES FOR SUBMITTALS

- A. Coordination of Submittal Times:

The CONTRACTOR shall prepare and transmit each submittal sufficiently in advance of performing the related WORK or other

applicable activities, or within the time specified in the individual WORK section of the SPECIFICATIONS, so that the installation will not be delayed by processing times including disapproval and re-submittal (if required), coordination with other submittals, testing, purchasing, fabrication, delivery and similar sequenced activities. No extension of time will be authorized because of the WORK.

1.03 CONSTRUCTION SCHEDULE

- A. In addition to the progress schedule requirements specified in Article 3 of the General Conditions, the CONTRACTOR shall, within ten (10) days after the NOTICE TO PROCEED provide and submit to the ENGINEER for review the schedule he plans to maintain in order to successfully construct the WORK within the time allotted. The schedule shall account for all WORK of the CONTRACTOR and his SUBCONTRACTORS.
- B. The CONTRACTOR shall update the schedule information monthly and submit the update information to the ENGINEER at the same time the pay estimate is prepared. The schedule shall contain all of the items of the periodic estimate and pay schedule.
- C. The CONTRACTOR bears full responsibility for scheduling all phases and stages of the WORK including his SUBCONTRACTOR WORK to insure its successful prosecution and completion within the time specified in accordance with all provisions of these SPECIFICATIONS.
- D. Refer to Section 01310 for additional requirements.

1.04 SCHEDULE OF VALUES AND PAYMENTS

- A. Within the (10) days after award of the Contract the CONTRACTOR shall submit to the OWNER in triplicate, a breakdown of the pay items, including a schedule of values and a schedule of payments. This breakdown shall be subject to approval by the OWNER, and when so approved shall become the basis for determining progress payments and for negotiation of CHANGE ORDERS, if required.

1.05 SCHEDULE OF SHOP DRAWING SUBMITTALS

- A. The CONTRACTOR shall, within ten (10) days after the NOTICE TO PROCEED provide and submit to the ENGINEER for review a SCHEDULE OF SHOP DRAWING SUBMITTALS. The schedule shall account for all materials used by the CONTRACTOR and his SUBCONTRACTORS.
- B. The schedule shall be organized to reflect the respective specification division under which it applies.

1.06 SHOP DRAWINGS, PRODUCT DATA, SAMPLES AND O & M INSTRUCTIONS

A. Shop Drawings

1. SHOP DRAWINGS, as defined in the General Conditions, and as specified in the technical SPECIFICATIONS include, but are not necessarily limited to custom-prepared data such as fabrication and erection/installation DRAWINGS, scheduled information, setting diagrams, actual shop WORK manufacturing instructions, custom templates, special wiring diagrams, coordination DRAWINGS, individual system of equipment inspection and test reports including performance curves and certifications, as applicable to the WORK.
2. All details on SHOP DRAWINGS submitted for review shall show clearly the relation of the various parts to the main member and lines of the structure, and where correct fabrication of the WORK depends upon field measurements, such measurements shall be made and noted on the SHOP DRAWINGS before being submitted for review by the ENGINEER.
3. Unless otherwise specified, the CONTRACTOR is not required to resubmit SHOP DRAWINGS on existing equipment. The CONTRACTOR shall, however, be responsible for obtaining all SHOP DRAWINGS and/or other information from the manufacturer necessary to complete the installation and startup of existing equipment.

B. Product Data

1. Product data as specified in individual sections, include, but are not necessarily limited to, standard prepared data for manufactured products (sometimes referred to as catalog data), such as the manufacturer's product specification and installation instructions, availability of colors and patterns, manufacturer's printed statements of compliances and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications, mill reports, product operating and maintenance instructions and recommended spare parts listing, and printed product warranties, as applicable to the WORK.

C. Samples

1. Samples specified in individual sections, included, but are not necessarily limited to, physical examples of the WORK such as sections of manufactured or fabricated WORK, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets,

specimens for coordination of visual effects, graphic symbols, and units of WORK to be used by the ENGINEER or OWNER for independent inspection and testing, as applicable to the WORK.

D. Operation and Maintenance Instructions

1. O&M instructions shall conform to Article 5 of the General Conditions (Section 00710) and the particular requirements of the individual sections.
2. Refer to Section 01785 for additional requirements.

1.07 CONSTRUCTION PHOTOGRAPHS

A. Miscellaneous photographs as directed by the ENGINEER or OWNER.

1. Photographs are required on this PROJECT and are the responsibility of the CONTRACTOR. Photographs shall be 3" x 5" color snapshots taken with a standard 35mm camera, or a digital camera with 8 MP minimum. CONTRACTOR shall be responsible for the taking, development, labeling and organizing of the photographs. All photographs shall be identified as to location, date and subject matter. Photographs shall be arranged in a photo album(s) by location, subject matter and date taken. Upon completion of the project, the CONTRACTOR shall supply the OWNER with the negatives or digital photo files. The later, if provided, shall be supplied on CD media in .jpg format.
2. Upon completion of the project, the CONTRACTOR shall provide three (3) professional-quality 8 x 10 color aerial photographs. Prior to photographing, the CONTRACTOR shall confirm with the ENGINEER that the site is ready. The photo shall also be provided in digital format (.jpg) on CD media.
3. The CONTRACTOR, before final payment is made, shall deliver one (1) set of photographic prints and negatives/.jpg's to the OWNER, one (1) set of prints to the ENGINEER, and one aerial photograph to each. Both sets of prints shall be arranged in a photo album(s) and labeled as outlined above.
4. No pay item has been set up for the photographs. The CONTRACTOR shall allow for a minimum of 200 - 3" x 5" color photographs (taken and arranged as outlined above) in his BID.

1.08 TEST REPORTS

- A. Submit for the Architect/Engineer's knowledge as contract administrator or for the Owner.

- B. Submit test reports for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.09 MANUFACTURER'S CERTIFICATES

- A. When specified in individual specification sections, submit certification by the manufacturer, installation/application subcontractor, or the Contractor to Architect/Engineer, in quantities specified for Product Data.
- B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect/Engineer.

1.10 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Architect/Engineer for delivery to owner in quantities specified for Product Data.

1.11 CONTRACTOR'S RESPONSIBILITY

- A. The CONTRACTOR shall review SHOP DRAWINGS, product data and samples prior to submission to determine and verify the following:
 - 1. Field measurements
 - 2. Field construction criteria
 - 3. Catalog numbers and similar data
 - 4. Conformance with the SPECIFICATIONS
- B. All SHOP DRAWINGS submitted by SUBCONTRACTORS for review shall be sent directly to the CONTRACTOR for preliminary checking. The CONTRACTOR shall be responsible for their submission at the proper time so as to prevent delays in delivery of materials.
- C. The CONTRACTOR shall check all SUBCONTRACTOR'S SHOP DRAWINGS regarding measurements, size of members, materials, and details to satisfy himself that they conform to the intent of the DRAWINGS and SPECIFICATIONS. DRAWINGS found to be inaccurate or otherwise in error shall be returned to the SUBCONTRACTORS for correction before submission thereof.
- D. Each shop drawing, WORKING drawing, sample and catalog data submitted by the CONTRACTOR shall have affixed to it a certification

statement, signed by the CONTRACTOR. The certification shall state that the CONTRACTOR represents that he has determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and has checked and coordinated each item with other applicable review SHOP DRAWINGS and all Contract requirements.

- E. The CONTRACTOR shall notify the OWNER in writing, at the time of submittal, of any deviations in the submittals from the requirements of the CONTRACT DOCUMENTS.
- F. The CONTRACTOR should include the notation "Critical Path" on critical path submittals.
- G. The review of SHOP DRAWINGS, samples or catalog data by the ENGINEER shall not relieve the CONTRACTOR from his responsibility with regard to the fulfillment of the terms of the Contract.
- H. No portion of the WORK requiring a shop drawing, WORKING drawing, sample or catalog data shall be started nor shall any materials be fabricated or installed prior to the review or qualified review SHOP DRAWINGS and data shall be at the CONTRACTOR'S risk. The OWNER will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.
- I. PROJECT WORK, materials, fabrication, and installation shall conform with reviewed SHOP DRAWINGS, WORKING DRAWINGS, applicable samples, and catalog data.

1.12 SUBMISSION REQUIREMENTS

- A. The CONTRACTOR shall make submittals promptly in accordance with the accepted schedule, and in such sequence as to cause no delay in the WORK or in the WORK of any other CONTRACTOR.
- B. Number of submittals required:
 - 1. SHOP DRAWINGS: Submit six (6) copies.
 - 2. Operation and Maintenance Instructions: Submit six (6) copies.
- C. Submittals shall contain:
 - 1. The date of submission and the dates of any previous submissions.
 - 2. The PROJECT title, contract number, and submittal number.
 - 3. CONTRACTOR identification.
 - 4. The names of:

- a. CONTRACTOR
 - b. SUPPLIER
 - c. Manufacturer
- 5. Identification of the product, with the specification section number.
 - 6. Field dimensions, clearly identified as such.
 - 7. Relation to adjacent or critical features of the WORK or materials.
 - 8. Applicable standards, such as ASTM or Federal Specification numbers.
 - 9. Identification of revisions on re-submittals.
 - 10. An 8-inch x 3-inch blank space for CONTRACTOR'S and ENGINEER'S stamps.
- D. Submittals shall be clear and legible. Submittals with facsimile copies will be automatically rejected.

1.13 RESUBMISSION REQUIREMENTS

- A. The CONTRACTOR shall make any corrections or changes in the submittals required by the ENGINEER and resubmit until accepted, in accordance with the following:
- 1. SHOP DRAWINGS and Product Data:
 - a. Revise initial DRAWINGS or data, and resubmit as specified for the initial submittal.
 - b. Indicate any changes which have been made other than those requested by the ENGINEER.
 - 2. Samples:
 - a. Submit new samples as required for initial submittal.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

01300-7

SECTION 01310

PROGRESS SCHEDULES

PART 1 GENERAL

1.01 GENERAL

A. Scheduling Responsibilities

1. In order to provide a definitive basis for determining job progress, a construction schedule of a type approved by the OWNER will be used to monitor the PROJECT.
2. The CONTRACTOR shall be responsible for preparing the schedule and updating on a monthly basis. It shall at all times remain the CONTRACTOR'S responsibility to schedule and direct his forces in a manner that will allow for the completion of the WORK within the contractual period.

B. Construction Hours

1. No WORK shall be done between 8:00 p.m. and 7:00 a.m. nor on Sundays or legal holiday without the written permission of the OWNER. However, emergency work may be done without prior written permission.
2. If the CONTRACTOR, for his convenience and at no additional cost to the OWNER, should desire to carry on his WORK at night or outside the regular hours, he shall submit a written request to the ENGINEER and shall allow nine (9) days for satisfactory arrangements to be made for inspecting the WORK in progress. If permission is granted, the CONTRACTOR shall light the different parts of the PROJECT as required to comply with all applicable Federal, State and local regulations. The CONTRACTOR shall also revise his schedule as appropriate at the next monthly schedule update meeting to reflect the changes in working hours.

C. Progress of the WORK

1. The WORK shall be started within ten (10) days following the NOTICE TO PROCEED and shall be executed with such progress as may be required to prevent delay to other CONTRACTORS or to the general completion of the PROJECT. The WORK shall be executed at such times and in or on such parts of the PROJECT, and with such forces, material and equipment, to assure completion of the WORK in the time established by the Contract.
2. The CONTRACTOR agrees that whenever it becomes apparent from the current monthly Schedule update that delays have resulted and, hence, that the Contract completion date will not be met or when so directed by the OWNER, he will take some or all of the following actions at no additional cost to the OWNER.

- (a) Increase construction manpower in such quantities and crafts as will substantially eliminate the backlog of WORK.
- (b) Increase the number of working hours per shift, shifts per working day or days per week, the amount of construction equipment, or any combination of the foregoing to substantially eliminate the backlog of WORK.
- (c) Reschedule activities to achieve maximum practical concurrence of accomplishment of activities, and comply with the revised schedule.
- (d) The CONTRACTOR shall submit to the OWNER or the OWNER'S representative for review a written statement of the steps he intends to take to remove or arrest the delay to the critical path in the accepted schedule. If the CONTRACTOR should fail to submit a written statement of the steps he intends to take or should fail to take such steps as required by the Contract, the OWNER may direct the level of effort in manpower (trades), equipment, and work schedule (overtime, weekend and holiday work, etc.), to be employed by the CONTRACTOR in order to remove or arrest the delay to the critical path in the accepted schedule, and the CONTRACTOR shall promptly provide such level of effort at no additional cost to the OWNER.

1.02 CONSTRUCTION SCHEDULE

A. Schedule Submissions

- 1. With ten (10) calendar days of the NOTICE TO PROCEED, the CONTRACTOR shall submit to the ENGINEER five (5) copies of his proposed schedule. The schedule will be the subject of a schedule review meeting with the CONTRACTOR, the ENGINEER and the OWNER or the OWNER'S representative within one (1) week of its submission. The CONTRACTOR will revise and resubmit schedule until it is acceptable and accepted by the OWNER or the OWNER'S representative.

1.03 SCHEDULE UPDATES

A. Monthly Meetings

- 1. A monthly Schedule Update Meeting will be held in conjunction with the applicable progress meeting at the construction site to review and update the Schedule. The Schedule Update Meetings will be chaired by the OWNER or the OWNER'S representative and attended by the CONTRACTOR and the ENGINEER. Actual progress of the previous month will be recorded and future activities will be reviewed. The duration of activities and their logical connections may be revised as needed. Decisions made at

these meetings and agreed to by all parties are binding with the exception that no contractual completion dates will be modified without formal written requests and acceptance as specified herein.

B. Conditions Requiring Revisions are as follows:

1. When a delay in completion of any WORK item or sequence of WORK items results in an extension of the PROJECT completion.
2. When delays in submittals or deliveries or work stoppages are encountered which make re-planning or rescheduling of the WORK necessary.
3. When the schedule does not represent the actual prosecution and progress of the PROJECT.

1.04 CONTRACT COMPLETION TIME

A. Causes for Extensions

1. The Contract completion time will be adjusted only for cause specified in this Contract. In the event the CONTRACTOR requests an extension of any Contract completion date, he shall furnish such justification and supporting evidence as the OWNER or the OWNER'S representative may deem necessary for a determination as to whether the CONTRACTOR is entitled to an extension of time under the provision of this Contract. The OWNER, with the assistance of ENGINEER and OWNER'S representative, will, after receipt of such justification and supporting evidence, make findings of fact and will advise the CONTRACTOR in writing thereof.

B. Request for Time Extension

1. Each request for change in any Contract completion date shall be initially submitted to the OWNER within the time frame stated in the General Conditions. All information known to the CONTRACTOR at that time concerning the nature and extent of the delay shall be transmitted to the OWNER at that time. Within the time frame stated in the General Conditions but before the date of final payment under this Contract, all information as required above concerning the delay must be submitted to the OWNER. No time extension will be granted for requests which are not submitted within the foregoing time limits.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

01310-3

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.01 SANITARY FACILITIES

- A. The CONTRACTOR shall construct and maintain sanitary facilities for his employees and employees of the subcontractors. The CONTRACTOR shall, at completion of the Contract Work, properly dispose of these sanitary facilities.

1.02 UTILITIES

- A. The CONTRACTOR shall be totally responsible for installation, maintenance and cost of his and his sub-contractor's telephone service.
- B. The CONTRACTOR shall install meters at all his points of use of electric, water, and natural gas utilities. The CONTRACTOR shall pay the monthly billed cost from the servicing utility for the CONTRACTOR'S use of these utilities. The CONTRACTOR shall pay any initial installation costs.
- C. If CONTRACTOR requires other utilities, he shall obtain and pay for them.

1.03 MAINTENANCE OF SERVICE IN EXISTING UTILITIES

- A. Where the existing utilities must be disturbed during construction under this Contract, their operation and function shall be maintained by the CONTRACTOR to such a degree that service to customers will be interrupted for minimum time periods only. Such disturbances and any maintenance use of these lines shall constitute no cost to the OWNER. The OWNER shall be notified of interruptions in sufficient time to prepare for them and shall agree to the hour, date, and duration of them before they are undertaken.
- B. Should shutdowns in service be in excess of the time of duration agreed upon, and such excessive shutdown time be due to the CONTRACTOR'S negligence, faulty Work and/or inability to perform, then and in that event, the CONTRACTOR shall be held liable to the OWNER for any and all damages that may accrue to the OWNER, by reason of such excessive shutdown periods.
- C. Digging through services with trenching machines will not be permitted. Upon damage to utility services, such services shall be repaired immediately and tested to the satisfaction of the ENGINEER. The CONTRACTOR shall notify all utility users of impending interruption of service and shall notify all utility users of impending interruption of service and shall be responsible for all damage resulting from same. Payment for necessary disconnection and reconnection of utility services shall be

included as a part of the CONTRACTOR'S bid and no extra compensation will be made for same.

- D. The CONTRACTOR shall at all times maintain on hand an adequate supply of repair materials and tools with which to make repair to damaged water, gas and sewer lines. Should the CONTRACTOR inadvertently damage existing utilities, he shall make immediate repair thereto and in no event shall he leave the site before such repair has been made and proven to be successful.
- E. As far as possible, the locations and sizes of existing mains are indicated on the drawings; however, exact locations, pipe materials and sizes cannot be guaranteed. It shall be the responsibility of the CONTRACTOR to locate and uncover existing lines. The CONTRACTOR shall provide all connecting fittings of the correct size and type for each connection to existing lines.

1.04 PROPERTY PROTECTION

- A. Care is to be exercised by the CONTRACTOR in all phases of construction, to prevent damage and/or injury to the OWNER'S and/or other property.
- B. The CONTRACTOR shall avoid unnecessary injury to trees and shall remove only those authorized to be removed by written consent of the OWNER. Fences, gates, and terrain damaged or disarranged by the CONTRACTOR'S forces shall be immediately restored in their original condition or better.

1.05 CONSTRUCTION WARNING SIGNS

- A. The CONTRACTOR shall provide construction warning signs for each location where he is working in the state highway right-of-way or in City or County streets. He will further provide flag men as required and shall abide by all Kentucky Transportation Cabinet, Department of Highways safety rules, including size, type and placement of construction signs.

1.06 RESIDENT OBSERVER OFFICE

- A. No office is required.

1.07 EXCAVATION

- A. No separate payment for solid rock excavation will be made under this Contract, unless specifically noted on the Bid Form. All excavation shall be considered unclassified, except in locations where solid rock excavation is paid for on a unit price basis.

1.08 ACCESS ROADWAYS

- A. The CONTRACTOR shall construct all access roadways needed during construction, and the planned access roadways for the completed project.

The CONTRACTOR shall maintain access roadways continuously during the construction period.

- B. The CONTRACTOR shall maintain all existing roadways within the project site which are used for any purpose by construction operations. The degree and frequency of maintenance shall be adequate to keep existing roadways in a condition at least equal to their condition prior to construction. Road maintenance shall include dust control and sweeping.

1.09 RESPONSIBILITY FOR TRENCH SETTLEMENT

- A. The CONTRACTOR shall be responsible for any settlement caused by the construction, that occurs within one (1) year after the final acceptance of this Contract by the OWNER. Temporary fences shall be provided at no extra cost to the OWNER wherever necessary to keep livestock away from the construction area. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Damaged limbs shall be trimmed and damaged tree trunks shall be treated with wound dressing.

1.10 DAMAGE TO CROPS, LIVESTOCK AND VEGETATION

- A. The CONTRACTOR shall protect crops, livestock and vegetation against damage or injury from construction operations at all times. Crops damaged or equipment access obtained outside of the easements provided shall be the responsibility of the CONTRACTOR. Temporary fences shall be provided at no extra cost to the OWNER wherever necessary to keep livestock away from the construction area.
- B. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Damaged limbs shall be trimmed and damaged tree trunks shall be treated with wound dressing.

1.11 WASTE DISPOSAL

- A. The CONTRACTOR shall dispose of waste, including hazardous waste, off-site in accordance with all applicable laws and regulations.

1.12 CONTRACTOR'S TRAILERS AND MATERIAL STORAGE

- A. The location of the CONTRACTOR'S and Subcontractor's office, work trailers and parking areas for the project shall be subject to the OWNER'S approval.
- B. The CONTRACTOR'S and Subcontractor's material storage yards for the project shall be subject to the OWNERS approval.

1.13 JURISDICTIONAL DISPUTES

- A. It shall be the responsibility of the CONTRACTOR to pay all costs that may be required to perform any of the work shown on the Drawings or

specified herein in order to avoid any work stoppages due to jurisdictional disputes. The basis for subletting work in question, if any, shall conform with precedent agreements and decisions on record with the Building and Construction Trades Department, AFL-CIO, dated June, 1973, including any amendments thereto.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01510

SURFACE WATER POLLUTION PREVENTION PLAN

PART 1 GENERAL

1.01 EROSION CONTROL MEASURES

Reference Section 2270.

All disturbed areas require erosion control. Erosion control shall consist of both natural and manmade barriers to the transport of sediment from the project area to surrounding areas not disturbed under this project.

This specification focuses on the requirement to avoid introduction of sediment into streams and other natural and manmade waterways and conveyances. A second focus is to prevent the deposition of sediment onto traffic surfaces.

A sediment pond is required to be constructed and completed prior to disturbance of the project area. All storm water run-offs from the project area will be routed to the sediment pond, where practical. Any areas not practical to route to the sediment pond shall be protected by the construction of silt fences between the disturbed area and the receiving stream. Silt fence placement shall be approved by the OWNER or his representative. Prior to beginning construction of the sediment pond, a silt fence will be constructed downstream from the downstream toe of the sediment pond to prevent silt from the construction of the embankment entering the stream.

Surface water from adjacent areas shall not be routed to the sediment pond, but rather routed around the sediment pond area.

PART 2 BEST MANAGEMENT PRACTICES

1.01 TEMPORARY BMP'S FOR

On-site storage tanks – On site storage tanks shall have a containment structure constructed around the tank. The containment structure shall be impervious to the substance stored in the tank and shall have a volume equal to 1.5 times the volume of the storage tank. Provisions shall be made to evacuate any water accumulation inside the containment structure to prevent loss of containment volume.

Stockpile areas – Stockpile areas shall have a silt fence constructed at the lower portion of the stockpile area to trap any sediment generated from the stockpile area.

Parking areas – Parking areas shall have a silt fence constructed at the lower perimeter of the parking area to trap any sediment generated from the parking area. Additionally, should the parking area be adjacent to a

paved public road, a gravel pad shall be constructed at the entrance from the public road to the parking area to prevent tracking of sediment onto the paved public road.

Equipment maintenance areas – Equipment maintenance areas shall have a silt fence constructed along the lower perimeter of the maintenance area to trap any sediment generated from the maintenance area.

Excavation areas – Excavation areas shall have a silt fence constructed at the lower perimeter of the excavation area to trap any sediment generated from the excavation area.

All temporary BMP's shall be maintained in accordance with the operations and maintenance plan until such time as permanent BMP's are constructed and completed, or until such time as the controlled area has been regraded, mulched, seeded and vegetation has been restored to the area.

1.02 PERMANENT BMP'S

Permanent BMP's shall consist of diversion ditches, sediment outfall structures, vegetation restoration and leachate containment lagoon as applicable.

1.03 OPERATIONS AND MAINTENANCE PLAN

The CONTRACTOR shall implement the following Best Management Practices (**BMP**) and shall maintain these BMP's until no longer needed or the completion of the project. The CONTRACTOR shall not remove any BMP without the agreement of the OWNER or his representative.

The CONTRACTOR shall have the sole responsibility for compliance with the requirements of the Storm Water Pollution Prevention Plan (**SWPPP**) as described in these BID DOCUMENTS, and shall be required to have a full and complete understanding of the SWPPP and the required BMP's contained in the SWPPP. It shall also be the responsibility of the CONTRACTOR to submit to the Kentucky Division of Water a completed Notice of Intent (**NOI**) prior to beginning work on this project and to submit a completed Notice of Termination (**NOT**) to the Kentucky Division of Water at the completion of this project.

Copies of the above forms are contained in this SECTION.

The required BMP's, the locations to be used, inspection frequency, and approved maintenance actions are shown in the following table.

Location	BMP	Inspection Frequency	Maintenance Action
On-site Storage Tanks	Containment Structure	1. Daily 2. After rain event	Remove captured water, check for leakage
Stockpile Areas	Silt Fence	1. Weekly 2. After rain event 3. Prior to forecast storm	Clean out surplus silt, repair fence as needed
Parking Areas	Silt Fence Gravel Entrance Pad	1. Weekly 2. After rain event	Clean out surplus silt, repair fence as needed. Add gravel to pad as needed
Equipment maintenance areas	Silt Fence	1. Weekly 2. After rain event	Remove surplus silt, repair fence as needed.
Excavation Areas	Silt Fence	1. Weekly 2. After rain event 3. Prior to forecast storm	Remove surplus silt, repair fence as needed
Project Perimeter	Diversion Ditch	1. Weekly 2. After rain event	Remove accumulated sediment, install erosion protection after completion
Perimeter, along stream buffer	Silt Fence	1. Daily 2. After rain event 3. Prior to forecast storm	Remove accumulated silt when half of depth of fence is covered, straighten posts, replace destroyed sections and spray paint date on repaired sections.
Sediment Pond	Sediment Pond	1. Weekly 2. After rain event 3. Prior to forecast storm	Remove any observed obstructions in spillway systems, remove any surplus sediment accumulation
Inlets	Inlet Protection (aka "Pigs in a Blanket")	1. Weekly 2. After rain event	Remove accumulated silt when half of depth of fence is covered, straighten and replace destroyed sections

1.04 CONTINUING EDUCATION

All personnel actively involved in this project, whether associated with the Design A/E or the General Contractor, shall be notified of this SWPPP and shall be given the opportunity to review the S.O.P. prepared by the DOE for SWPPP's.

The General Contractor (CONTRACTOR), before beginning work, shall formally review the SWPPP with his site management staff, including the site superintendent, key foremen, safety officers, designated workmen, etc., as well as with any subsequent replacements. Failure to understand the details of the SWPPP will not be accepted as an excuse for violations.

1.05 OPERATION AND MAINTENANCE GUIDELINES

The CONTRACTOR's jobsite superintendent and project manager shall familiarize themselves with the SWPPP and the requirements of the SOP developed by the DOE.

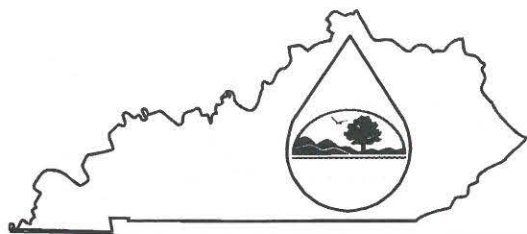
The CONTRACTOR shall assemble a Maintenance Log Book to be kept on site and accessible by DOW, Project A/E, DOE, etc. Log Book shall include the following:

- a. Copy of the NOI
- b. Copy of the General Permit
- c. Copy of the SWPPP (may be kept separate if sheet size dictates)
- d. Maintenance Log Sheets

The CONTRACTOR shall inspect all BMP's on the project at intervals as stipulated on the SWPPP or in the Log Book.

The Contractor shall promptly repair, clean out, replace, or otherwise perform required maintenance of every BMP at stipulated intervals or after a significant rain event. The CONTRACTOR shall make formal notification to the A/E of any BMP's that do not appear to be functioning properly or that may need review.

END OF SECTION

KPDES FORM NOI-SWKentucky Pollutant Discharge Elimination System
(KPDES)**Notice of Intent (NOI)
for Storm Water Discharges
Associated with Industrial Activity Under the
KPDES General Permit**

Submission of this Notice of Intent constitutes notice that the party identified in Section I of this form intends to be authorized by a KPDES permit issued for storm water discharges associated with industrial activity. Becoming a permittee obligates such discharger to comply with the terms and conditions of the permit.

ALL NECESSARY INFORMATION MUST BE PROVIDED ON THIS FORM (See Instructions on back)

I. Facility Operator Information

Name:		Phone:	
Address:		Status of Owner/Operator:	
City, State, Zip Code:			

II. Facility/Site Location Information

Name:			
Address:			
City, State, Zip Code:			
County:			
Site Latitude: (degrees/minutes/seconds)		Site Longitude: (degrees/minutes/seconds)	

III. Site Activity Information

MS4 Operator Name:					
Receiving Water Body:					
Are there existing quantitative data?	Yes <input type="checkbox"/>	If Yes, submit with this form.			
	No <input type="checkbox"/>				
SIC or Designated Activity Code Primary		2nd		3rd	
If this facility is a member of a Group Application, enter Group Application Number:					
If you have other existing KPDES Permits, enter Permit Numbers:					

IV. Additional Information Required FOR CONSTRUCTION ACTIVITIES ONLY

Project Start Date:		Completion Date:	
Estimated Area to be disturbed (in acres):			
Is the Storm Water Pollution Prevention Plan in Compliance with State and/or Local Sediment and Erosion Plans?	Yes <input type="checkbox"/> No <input type="checkbox"/>		

V. Certification: I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Printed or Typed Name:		
Signature:		Date:

**Kentucky Pollutant Discharge Elimination System (KPDES)
Instructions
Notice of Intent (NOI) for Storm Water Discharges Associated with Industrial Activity
To Be Covered Under The KPDES General Permit**

WHO MUST FILE A NOTICE OF INTENT (NOI) FORM

Federal law at 40 CFR Part 122 prohibits point source discharges of stormwater associated with industrial activity to a water body of the Commonwealth of Kentucky without a Kentucky Pollutant Discharge Elimination System (KPDES) permit. The operator of an industrial activity that has such a storm water discharge must submit a NOI to obtain coverage under the KPDES Storm Water General Permit. If you have questions about whether you need a permit under the KPDES Storm Water program, or if you need information as to whether a particular program is administered by the state agency, call the **Storm Water Contact, Industrial Section, Kentucky Division of Water at (502) 564-3410.**

WHERE TO FILE NOI FORM

NOIs must be sent to the following address:

**Section Supervisor
Inventory & Data Management Section
KPDES Branch, Division of Water
Frankfort Office Park
14 Reilly Road
Frankfort, KY 40601**

COMPLETING THE FORM

Type or print legibly in the appropriate areas only. If you have any questions regarding the completion of this form call the **Storm Water Contact, Industrial Section, at (502) 564-3410.**

SECTION I - FACILITY OPERATOR INFORMATION

Give the legal name of the person, firm, public organization, or any other entity that operates the facility or site described in this application. The name of the operator may or may not be the same as the name of the facility. The responsible party is the legal entity that controls the facility's operation, rather than the plant or site manager. Do not use a colloquial name. Enter the complete address and telephone number of the operator.

Enter the appropriate letter to indicate the legal status of the operator of the facility.

F = Federal M = Public (other than federal or state)
S = State P = Private

SECTION II - FACILITY/SITE LOCATION INFORMATION

Enter the facility's or site's official or legal name and complete street address, including city, state, and ZIP code.

SECTION III - SITE ACTIVITY INFORMATION

If the storm water discharges to a municipal separate storm sewer system (MS4), enter the name of the operator of the MS4 (e.g., municipality name, county name) and the receiving water of the discharge from the MS4. (A MS4 is defined as a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) that is owned or operated by a state, city, town, borough, county, parish, district, association, or other public body which is designed or used for collecting or conveying storm water.)

If the facility discharges storm water directly to receiving water(s), enter the name of the receiving water.

Indicate whether or not the owner or operator of the facility has existing quantitative data that represent the characteristics and concentration of pollutants in storm water discharges. If data is available submit with this form.

List, in descending order of significance, up to four 4-digit standard industrial classification (SIC) codes that best describe the principal products or services provided at the facility or site identified in Section II of this application.

If the facility listed in Section II has participated in Part 1 of an approved storm water group application and a group number has been assigned, enter the group application number in the space provided.

If there are other KPDES permits presently issued for the facility or site listed in Section II, list the permit numbers.

SECTION IV - ADDITIONAL INFORMATION REQUIRED FOR CONSTRUCTION ACTIVITIES ONLY

Construction activities must complete Section IV in addition of Sections I through III. Only construction activities need to complete Section IV.

Enter the project start date and the estimated completion date for the entire development plan.

Provide an estimate of the total number of acres of the site on which soil will be disturbed (round to the nearest acre).

Indicate whether the storm water pollution prevention plan for the site is in compliance with approved state and/or local sediment and erosion plans, permits, or storm water management plans.

SECTION V - CERTIFICATION

Federal statutes provide for severe penalties for submitting false information on this application form. Federal regulations require this application to be signed as follows:

For a corporation: by a responsible corporate officer, which means: (i) president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions, or (ii) the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding \$25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

For a partnership or sole proprietorship: by a general partner or the proprietor; or

For a municipality, state, Federal, or other public facility: by either a principal executive officer or ranking elected official.

KPDES FORM NOT-SW

	<p>Kentucky Pollutant Discharge Elimination System (KPDES)</p> <p>NOTICE OF TERMINATION (NOT) of Coverage Under the KPDES General Permit for Storm Water Discharges Associated with Industrial Activity</p>
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Submission of this Notice of Termination constitutes notice that the party identified in Section II of this form is no longer authorized to discharge storm water associated with industrial activity under the KPDES program.

ALL NECESSARY INFORMATION MUST BE PROVIDED ON THIS FORM.
(Please see instructions on back before completing this form.)

I. PERMIT INFORMATION
KPDES Storm Water General Permit Number:
Check here if you are no longer the Operator of the Facility: <input type="checkbox"/>
Check here if the Storm Water Discharge is Being Terminated: <input type="checkbox"/>
II. FACILITY OPERATOR INFORMATION
Name:
Address:
City/State/Zip Code:
Telephone Number:
III. FACILITY/SITE LOCATION INFORMATION
Name:
Address:
City/State/Zip Code:

Certification: I certify under penalty of law that all storm water discharges associated with industrial activity from the identified facility that are authorized by a KPDES general permit have been eliminated or that I am no longer the operator of the facility or construction site. I understand that by submitting this Notice of Termination, I am no longer authorized to discharge storm water associated with industrial activity under this general permit, and that discharging pollutants in storm water associated with industrial activity of waters of the Commonwealth is unlawful under the Clean Water Act and Kentucky Regulations where the discharge is not authorized by a KPDES permit. I also understand that the submittal of this Notice of Termination does not release an operator from liability for any violations of this permit or the Kentucky Revised Statutes.

NAME (Print or Type)	TITLE
SIGNATURE	DATE

INSTRUCTIONS
NOTICE OF TERMINATION (NOT) OF COVERAGE UNDER THE KPDES GENERAL PERMIT
FOR STORM WATER DISCHARGES ASSOCIATED WITH INDUSTRIAL ACTIVITY

Who May File a Notice of Termination (NOT) Form

Permittees who are presently covered under the Kentucky Pollutant Discharge Elimination System (KPDES) General Permit for Storm Water Discharges Associated with Industrial Activity may submit a Notice of Termination (NOT) form when their facilities no longer have any storm water discharges associated with industrial activity as defined in the storm water regulations at 40 CFR 122.26 (b)(14), or when they are no longer the operator of the facilities.

For construction activities, elimination of all storm water discharges associated with industrial activity occurs when disturbed soils at the construction site have been finally stabilized and temporary erosion and sediment control measures have been removed or will be removed at an appropriate time, or that all storm water discharges associated with industrial activity from the construction site that are authorized by a KPDES general permit have otherwise been eliminated. Final stabilization means that all soil-disturbing activities at the site have been completed, and that a uniform perennial vegetative cover with a density of 70% of the cover for unpaved areas and areas not covered by permanent structures has been established, or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles have been employed.

Where to File NOT Form

Send this form to the following address:

**Section Supervisor
Inventory & Data Management Section
KPDES Branch, Division of Water
14 Reilly Road, Frankfort Office Park
Frankfort, KY 40601**

Completing the Form

Type or print legibly in the appropriate areas and according to the instructions given for each section. If you have questions about this form, call the Storm Water Contact, Industrial Section, at (502) 564-3410.

Section I - Permit Information

Enter the existing KPDES Storm Water General Permit number assigned to the facility or site identified in Section III. If you do not know the permit number, **call the Storm Water Contact, Industrial Section at (502) 564-3410.**

Indicate your reason for submitting this Notice of Termination by checking the appropriate box:

If there has been a change of operator and you are no longer the operator of the facility or site identified in Section III, check the corresponding box.

If all storm water discharges at the facility or site identified in Section III have been terminated, check the corresponding box.

Section II - Facility Operator Information

Give the legal name of the person, firm, public organization, or any other entity that operates the facility or site described in this application. The name of the operator may or may not be the same name as the facility. The operator of the facility is the legal entity which controls the facility's operation, rather than the plant or site manager. Do not use a colloquial name. Enter the complete address and telephone number of the operator.

Section III - Facility/Site Location Information

Enter the facility's or site's official or legal name and complete address, including city, state and ZIP code. If the facility lacks a street address, indicate the state, the latitude and longitude of the facility to the nearest 15 seconds, or the quarter, section, township, and range (to the nearest quarter section) of the approximate center of the site.

Section IV - Certification

Federal statutes provide for severe penalties for submitting false information on this application form. Federal regulations require this application to be signed as follows:

For a corporation: by a responsible corporate officer, which means: (i) president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions, or (ii) the manager of one or more manufacturing, production or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding \$25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

For a partnership or sole proprietorship: by a general partner or the proprietor; or

For a municipality, State, Federal, or other public facility: by either a principal executive

SECTION 01785

OPERATION AND MAINTENANCE (O&M) DATA

PART I GENERAL

1.01 SUMMARY

- A. Compile data and related information in manuals appropriate for OWNER'S operation and maintenance (O&M) of each item of equipment identified in other Specification sections.

1.02 QUALITY ASSURANCE A. Preparation of data shall be performed by personnel:

- A. Trained and experienced in O&M of described equipment.
- B. Familiar with requirements of this section.
- C. Skilled as technical writer to extent required to communicate essential data.
- D. Skilled as drafter competent to prepare required drawings.

1.03 FORM OF MANUALS

A. Components:

- 1. Size: 8-1/2 in. by 11 in., or 11 in. by 17 in. folded, with standard 3-hole punching.
- 2. Paper: 20-lb minimum, white, for typed pages.
- 3. Text: Manufacturer's printed data, or neatly typewritten. Handwritten data is not acceptable.
- 4. Drawings:
 - a. Bind in with text.
 - b. Fold larger drawings and place in clear plastic pockets punched for inserting into binder. Place identification on outside of each pocket.

- B. Cover Label: Label each binder cover and spine with typed or printed title "OPERATION AND MAINTENANCE INSTRUCTIONS" and following:
1. Project title.
 2. Name(s) of applicable building(s) or structure(s) as shown on Drawings in which equipment located.
 3. Name of equipment as set forth in Contract Documents.
 4. Specification section number for equipment as set forth in Contract Documents.
- C. Binders:
1. Commercial quality D-Ring binder with durable and cleanable plastic covers. Paperboard and laminated paperboard covers are not acceptable.
 2. Do not fill binders to more than 75% of capacity.
 3. When multiple binders are used for an item of equipment, organize contents into related groupings. Each binder cover shall bear identification of specific contents.

1.04 SUBMITTAL SCHEDULE

- A. Submit 4 copies of complete O&M data, bound in binders bearing identification label, for review within 30 days after time CONTRACTOR receives approved Shop Drawings and other submittals for equipment from ENGINEER.
- B. ENGINEER'S review and acceptance of O&M data will be only for conformance with requirements of this section, for form of submittal and organization of data and completeness of information provided, but not for technical content or coordination between individual suppliers of equipment or system(s).
- C. CONTRACTOR shall review O&M submittal and complete Form 1, Contractor Submittal Form, attached to this section indicating requirements of this section have been met before submitting to ENGINEER. ENGINEER will reject submittals without completed Form 1.

- D. ENGINEER will be sole judge of completeness of data.

1.05 PAYMENTS

- A. Progress payment for equipment delivered, stored or installed under these Contract Documents will not be made until O&M data is approved by ENGINEER.
- B. Progress payments for control systems packaged with equipment will not be made until O&M data incorporated into equipment and control system manual is approved by ENGINEER.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

3.01 GENERAL CONTENTS OF DATA

- A. Each manual shall contain equipment data pertaining to not more than one Specification section number indicated in Contract Documents.
- B. Title Sheet: First page in data listing following:
1. Title: "OPERATION AND MAINTENANCE INSTRUCTIONS."
 2. Title of Project: As shown on Contract Documents.
 3. Name(s) of applicable building(s) or structure(s) in which equipment is located.
 4. Name of equipment as described in Contract Documents.
 5. Specification section number for equipment.
 6. CONTRACTOR'S name, address, and telephone number.
 7. Subcontractor's name, address, and telephone number if equipment is provided by Subcontractor.
 8. CONTRACTOR'S or Subcontractor's purchase order number, manufacturer's shop order number or other such numbers

required for parts and service ordering.

9. Manufacturer's name, address, and telephone number.
 10. Name, address, and telephone number for local source of supply for parts and service.
- C. Equipment List: Immediately following title sheet containing following:
1. Completed Form 1, Contractor's Submittal Form.
- D. Table of Contents: Immediately following equipment list. Arrange in logical, systematic order and shall include as minimum each tabbed divider. Each page shall be numbered.
- E. Tabbed Dividers: Insert tabbed section dividers between each major section.
1. Provide title of section on each tab.
 2. Provide table of contents for each tabbed section, arranged in systematic order.
- F. Equipment Data Sheets: Provide catalog sheets showing configuration, manufacturer's specifications, models, options, and styles of equipment and major components being provided. Product data sheets will show project specific information with inapplicable information deleted by crossing out or removal. Include in tabbed section(s).
- G. Text:
1. Include only those sheets applicable to Project.
 2. Each sheet shall:
 - a. Identify specific equipment or part installed.
 - b. Identify text applicable to equipment or part installed.
 - c. Do not include inapplicable information.
- H. Drawings: .
1. Supplement text with drawings to clearly illustrate following:

- a. Equipment and components.
 - b. Relations of component parts of equipment and systems.
 - c. Control and flow diagrams.
2. Actual drawings of equipment from manufacturer. "Typical" drawings are not acceptable, unless they accurately illustrate actual installation.
- I. Specially written information, as required to supplement text for particular installation.
 1. Provide explanation of interrelationships of equipment and components, and effects one component has on another or entire system.
 2. Provide overall instructions and procedures for equipment tying in instructions and procedures for separate components into unified instructional package.
 3. Provide glossary of special terms used by manufacturer.
 4. Organize in consistent format under separate headings for different procedures.
 5. Provide logical sequence of instructions for each procedure.
- J. Copy of each warranty, bond or service contract issued.
 1. Provide information sheet for OWNER'S personnel to explain following.
 - a. Proper procedures in event of failure or malfunction to prevent voiding warranty.
 - b. Instances affecting validity of warranties or bonds.

3.02 SPECIFIC DATA FOR EACH EQUIPMENT AND SYSTEMS

- A. For each item of equipment and system include:
 1. Completed Equipment Data Form typewritten on copy of Form

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2 to Section 01785.

2. Description of equipment and component parts:
 - a. Function, normal operating characteristics, and limiting conditions.
 - b. Performance curves, engineering data, and tests as applicable.
 - c. Complete nomenclature and commercial number of replaceable parts.
 - d. Complete nameplate data.
 - e. P&ID numbers for equipment as indicated on Drawings.
3. Operating Procedures:
 - a. Startup, break-in, and normal operating instructions.
 - b. Regulation, control, stopping, shutdown, and emergency instructions.
 - c. Summer and winter operating instructions, as applicable.
 - d. Special operating instructions.
4. Maintenance Procedures:
 - a. Routine maintenance operations.
 - b. Guide to troubleshooting.
 - c. Disassembly, repair, and reassembly instructions.
 - d. Alignment, adjusting, and checking instructions.
5. Servicing and Lubrication Schedule:
 - a. List of lubricants required and quantity to be applied.
 - b. Schedule of lubrication.
 - c. Schedule for other routine maintenance.

6. Manufacturer's printed instructions regarding safety precautions for both (a) protection of personnel operating equipment and systems and (b) prevention of damage to equipment and systems.
 7. Description of sequence of operation of controls.
 8. Manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
 - a. Predicted life of parts subject to wear.
 - b. Items recommended to be stocked as spare parts and quantities of same.
 9. Approved control diagrams such as ladder diagrams, instrumentation loop diagrams, and electrical schematics as appropriate.
 10. Bill of material.
 11. Other data as required under applicable Specification sections.
- B. Each electric and electronic system, as applicable to equipment such as switchgear, motor control centers, panelboards, switchboards, starters, breakers, and relays shall include:
1. Description of System and Component Parts:
 - a. Function, normal operating characteristics, and limiting conditions.
 - b. Performance curves, engineering data, rating tables, and tests as applicable.
 - c. Complete nomenclature and commercial number of replaceable parts.
 - d. Complete nameplate data.
 - e. P&ID numbers for equipment as set forth on Drawings.
 2. Circuit Directories of Panelboards:

- a. Electrical service.
 - b. Controls.
 - c. Communications.
3. Complete instrumentation loop diagrams with tabulated listing of components in each control circuit or loop.
3. Operating Procedures:
- a. Routine and normal operating instructions.
 - b. Sequences required.
 - c. Special operating instructions.
4. Maintenance Procedures:
- a. Routine maintenance operations.
 - b. Guide to troubleshooting.
 - c. Disassembly, repair, and reassembly instructions.
 - d. Adjustment and checking instructions.
6. Manufacturer's printed instructions regarding safety precautions for both (a) protection of personnel operating equipment and systems and (b) prevention of damage to equipment and systems.
7. List of original manufacturer's spare parts and recommended quantities maintained in storage.
8. Other data as required under pertinent sections of Specifications.
- C. Prepare and include additional data when need for such data becomes apparent during instruction of OWNER'S personnel or as requested by OWNER.

FORM 1 TO SECTION 01785 Page 1 of 5
CONTRACTOR SUBMITTAL FORM

TO: (Engineer) (Address) (City, State, Zip) (Attn:)		DATE:	
		SPECIFICATION SECTION TITLE:	
		SECTION NO.;	
		MANUFACTURER/ VENDOR:	
FROM: (Contractor) (Address) (City, State, Zip)		NO. OF COPIES SUBMITTED TO ENGINEER:	
		SIGNATURE OF CONTRACTOR:	

GENTLEMEN:

We have checked the O&M manual submittal dated, __, 20_____, and have found it to be in accordance with the requirements of Specification Section 01785 as noted below.

FORMAT

Size: 8-1/2 x 11 or 11x17
 Paper: 20-lb minimum
 Text: Printed data/neatly typed
 Drawings: Standard size bound in text; in text-size labeled envelopes
 Tabbed Section Dividers
 Cover Label: Title
 Project name
 Building/structure ID
 Equipment name
 Specification section
 Binders: Plastic Cover

FORM 1 TO SECTION 01785 Page 2 of 5
CONTRACTOR SUBMITTAL FORM

Provided	Not Applicable	Page No.	
GENERAL CONTENTS			
			• One specification only
			• Title Page
			- Title
			- Project title
			- Building/structure ID
			- Equipment name
			- Specification section number
			- Contractor ID
			- Subcontractor ID
			- Purchase order data
			- Manufacturer ID
			- Service/parts supplier ID
			• Product List
			• Table of Contents
			• Tabbed Sections
			- Pertinent data sheets
			- Annotated as needed
			• Text
			- Pertinent to project
			- Annotated
			• Drawings
			- Illustrate product and components
			- Control and flow diagrams

FORM 1 TO SECTION 01785 Page 3 of 5
CONTRACTOR SUBMITTAL FORM

Provided	Not Applicable	Page No.	
<i>GENERAL CONTENTS</i>			
			• Special Information
			- Interrelationships of equipment and components
			- Instructions and procedures provided
			- Instructions organized in consistent format
			- Instructions in logical sequence
			- Glossary
			• Warranty, Bond, Service Contract
<i>SPECIFIC CONTENTS (EQUIPMENT/SYSTEMS ONLY)</i>			
			• Description of Unit and Components
			- Equipment functions
			- Normal operating characteristics
			- Limiting conditions
			- Performance curves
			- Engineering data
			- Test data
			- Replaceable parts list (with numbers)
			- Nameplate data
			- P&ID numbers
			• Operating Procedures
			- Startup
			- Routine/normal operation
			- Regulation and control
			- Stopping and shutdown
			- Emergency

FORM 1 TO SECTION 01785 Page 4 of 5
CONTRACTOR SUBMITTAL FORM

Provided	Not	Page No.	
<i>SPECIFIC CONTENTS (EQUIPMENT/SYSTEMSONLY)</i>			
			• Operating Procedures (continued)
			- Seasonal operation
			- Special instructions
			• Maintenance Procedures
			- Routine/normal instructions
			- Troubleshooting guide
			- Disassembly/reassembly/repair
			• Servicing and Lubrication
			- List of lubricants
			- Lubrication schedule
			- Maintenance schedule
			• Safety Precautions/Features
			• Sequence of Operation of Controls
			• Assembly Drawings
			• Parts List and Illustrations
			- Predicted life
			- Spare parts list
			• Control Diagrams/Schematics
			• Bill of Materials
			• Completed Equipment Data Form per
			• Other Data as Required

FORM 1 TO SECTION 01785 Page 5 of 5
CONTRACTOR SUBMITTAL FORM

Provided	Not Applicable	Page No.	
SPECIFIC CONTENTS (EQUIPMENT/SYSTEMS ONLY)			
			• Description
			- Equipment functions
			- Normal operating characteristics
			- Performance curves
			- Engineering data
			- Test data
			- Replaceable parts list (with numbers)
			- Nameplate data
			- P&ID numbers
			• Panelboard Directories
			- Electrical
			- Controls
			- Communications
			• Instrumentation Loops
			- Diagrams
			- Components list each circuit/loop
			• Maintenance Procedures
			- Routine/normal instructions
			- Troubleshooting guide
			- Disassembly/reassembly
			- Adjusting and checking
			• Safety Precautions/Features
			• Spare Parts List
			• Additional Data

FORM 2 TO SECTION 01785 Page 1 of 4			
EQUIPMENT DATA FORM			
PROJECT NAME			
CONTRACT NO.			
CONTRACTOR			
EQUIPMENT NO.		ASSET NO.*	
DESCRIPTION		MAINT. NO.*	
LOCATION			
MANUFACTURER			
PURCHASED FROM			
VENDOR ORDER NO.		PURCHASE \$	
DATE OF PURCHASE			
LOCAL SUPPLIER			
ADDRESS			
PHONE NO.			
MODEL NO.			
NO. OF UNITS	SERIAL NOS.		
*By Owner			

FORM 2 TO SECTION 01785 Page 2 of 4			
EQUIPMENT DATA FORM			
<i>NAMEPLATE DATA</i>			
ELECTRIC MOTOR		PUMP/HVAC UNIT	
MANUFACTURER		MANUFACTURER	
TYPE	<input type="checkbox"/> AC <input type="checkbox"/> DC	TYPE	
HORSEPOWER		SIZE	
RPM		CAPACITY	
VOLTAGE		PRESSURE	
AMPERAGE		ROTATION	
PHASE		IMPELLER SIZE	
FRAME		IMPELLER MATERIAL	
DRIVE/REDUCER		OTHER (I&C)	
MANUFACTURER		MANUFACTURER	
TYPE	<input type="checkbox"/> GEAR <input type="checkbox"/> V-BELT <input type="checkbox"/> CHAIN <input type="checkbox"/> VARIDRIVE	TYPE	
		SIZE	
SERVICE FACTOR		CAPACITY	
RATIO		RANGE	

FORM 2 TO SECTION 01785 Page 3 of 4
EQUIPMENT DATA FORM

MAINTENANCE SUMMARY

[illegible]

FORM 2 TO SECTION 01785 Page 4 of 4
EQUIPMENT DATA FORM

LUBRICANT/RECOMMENDED SPARE PARTS LIST

EQUIPMENT NO.		ASSET NO.*	
DESCRIPTION		MAINT.NO.*	

LUBRICANT LIST

REFERENCE SYMBOL	LUBRICANT TYPE (MILITARY STANDARD)	RECOMMENDED LUBRICANT AND MANUFACTURER
List symbols in "maintenance operation" (Page	List general lubricant type.	List specific lubricant name, viscosity, and manufacturer.

RECOMMENDED SPARE PARTS LIST

PART NO.**	DESCRIPTION	UNIT	QUANTITY	UNIT COST

ADDITIONAL DATA AND REMARKS

<ul style="list-style-type: none"> • By Owner • ** Identify parts provided by this contract with two asterisks. • Note: Attach additional sheets if necessary; identify each sheet at top with equipment number and description.

END OF SECTION

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SECTION 01788

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Maintain at site one record copy of:
 - 1. Drawings.
 - 2. Project Manual.
 - 3. Addenda.
 - 4. Change orders and other modifications to Contract.
 - 5. ENGINEER field orders, written instructions, or clarifications.
 - 6. Approved submittals.
 - 7. Field test records.
 - 8. Construction photographs.
 - 9. Associated permits.
 - 10. Certificates of inspection and approvals.

1.02 SUBMITTALS

- A. At Substantial Completion:
 - 1. Deliver one marked up set of Drawings to ENGINEER for use in preparation of record drawings.
- B. Accompany submittals with transmittal letter containing following.
 - 1. Date.
 - 2. Project title and number.
 - 3. CONTRACTOR'S name and address.
 - 4. Title of record document.
 - 5. Signature of CONTRACTOR or authorized representative.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

3.01 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Store documents and samples in CONTRACTOR'S field office on-site apart from documents used for construction.
 - 1. Provide files and racks for storage of documents.
 - 2. Provide secure storage space for storage of samples.
- B. Maintain documents in clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
- C. Make documents and samples available for inspection by ENGINEER or OWNER.
- D. Failure to properly maintain record documents may be reason to delay a portion of progress payments until records comply with Contract Documents.

3.02 RECORD DOCUMENTS

- A. Label each document "PROJECT RECORD" in neat, large printed letters.
- B. Maintain record set of Drawings and Specifications legibly annotated to show all changes are made during construction.
 - 1. Graphically depict changes by modifying or adding to plans, details, sections, elevations, or schedules.
 - 2. Make changes on each sheet affected by changes.
- C. Record information concurrently with construction progress.
 - 1. Do not conceal Work until required information is recorded.
 - 2. Record changes made by Written Amendment, Field Order, Change Order or Work Directive Change.
 - 3. Give particular attention to concealed equipment and materials that would be difficult to measure and record at later date.

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D. Drawings:

1. Graphically depict changes by modifying or adding to plans, details, sections, elevations, or schedules.
2. Make changes on each sheet affected by changes.
3. Dimensions:
 - a. Depths of various elements of foundation in relation to finish first floor datum.
 - b. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
4. Location of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.
5. Details not on original Drawings.
6. Location and identification of exposed interior piping, including those shown schematically on Drawings.
7. Size of equipment and location including connections.
8. Electrical and Instrumentation:
 - a. Horizontal and vertical locations and size of underground cable, conduit, and duct runs dimensioned from established building lines.
 - b. Plan location and size of interior concealed and exposed feeders.
 - c. Size and location of access panels.
 - d. Variations from original Drawings.

E. Specifications:

1. Mark Specification sections to show substantial variations in actual Work performed in comparison with text of Specifications and modifications.
2. Include variations in products delivered to site and from manufacturer's installation instructions and recommendations.

3. Give particular attention to substitutions and selection of options and similar information.
4. Note related record drawing information and Product Data.

END OF SECTION

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SECTION 02110

SITE CLEARING AND GRUBBING

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor and equipment required and perform all clearing, grubbing and stripping of topsoil complete as shown on the DRAWINGS and as specified herein.

1.02 RELATED WORK

None this section.

1.03 SUBMITTALS

None this section.

PART 2 PRODUCTS

None in this Section.

PART 3 EXECUTION

3.01 GENERAL

- A. The proposed areas designated for embankment construction, impoundments, ditches and channel changes, borrow pits, etc., (except any portions thereof that may be reserved) shall be cleared of all trees, timbers, brush, stumps, rubbish and other debris. All this material, unless otherwise specified, shall be burned or otherwise removed, as may be directed and without injury to adjoining property. Burning must be in compliance with any applicable regulations covering open burning and smoke abatement. Where clearing is to be done, all stumps and roots shall be grubbed. No debris will be allowed to be left under or in the embankments. In felling trees near structures and wire lines, necessary precaution must be exercised in order to prevent damage to wire lines, structures, the facilities of others. Payment for all clearing and grubbing shall be incidental to the prices bid for doing other work.

3.02 TREES

- A. Trees (3" caliper and larger) shall not be disturbed by construction without written permission from the OWNER, except in those areas to be cleared. Trees disturbed by construction shall be replaced by the CONTRACTOR with same size and type at no additional cost to the OWNER.

END OF SECTION

SECTION 02140

DEWATERING

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor and equipment required to dewater all excavations. Dewatering of all excavations shall be the responsibility of the CONTRACTOR, and no additional compensation will be allowed for same unless specifically included as a BID item.

1.02 RELATED WORK

- A. Earthwork is included in Division 2, Section 02200.

1.03 SUBMITTALS

Not applicable to this CONTRACT.

PART 2 PRODUCTS

Not applicable to this CONTRACT.

PART 3 EXECUTION

3.01 GENERAL

- A. Dewatering equipment shall be of adequate size and quantity to assure maintaining proper conditions for installing pipe, concrete, backfill or other material or structure in the excavation. Dewatering shall include proper removal of any and all liquid, regardless of its source, from the excavation and the use of all practical means available to prevent surface runoff from entering any excavation. No extra payment shall be made for dewatering.
- B. No sanitary sewer shall be used for the disposal of water from trenches or other excavations. (From "10-States' Standards)

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Extent of earthwork is indicated on the DRAWINGS.
 - 1. Preparation of sub-grade for embankments and outlet works is included as part of this WORK.
 - 2. Engineered fill course for support of concrete slabs is included as part of this WORK.
 - 3. Backfilling of structures, headwalls, channels, manholes and trenches is included as part of this WORK.
- B. Excavation for Mechanical/Electrical WORK

Excavation and backfill required in conjunction with underground mechanical and electrical appurtenances is included as WORK of this Section.
- C. Definition

"Excavation" consists of removal of material encountered to sub-grade elevations indicated and subsequent disposal of materials removed.

1.02 RELATED WORK

- A. Dewatering is included in this Division, Section 02140.
- B. Erosion and sedimentation control is included in this Division, Section 02270.
- C. Piping is included in this Division, Section 02610 and 02700.
- D. Landscaping is included in this Division, Section 02900.

1.03 QUALITY ASSURANCE

- A. Codes and Standards

Perform excavation WORK in compliance with applicable requirements of governing authorities having jurisdiction.
- B. Testing and Inspection Services

Employ, at CONTRACTOR'S expense, testing laboratory acceptable to the OWNER and the ENGINEER to perform soil testing and inspection service for quality control during earthwork operations.

1.04 SUBMITTALS

A. Test Reports

Submit following reports directly to the ENGINEER from the testing services, with copy to CONTRACTOR:

1. Test reports on borrow material.
2. Verification of each cutoff trench elevation and embankment sub-grade elevation.
3. Field density test reports, one per 3,000 S.F. per lift.
4. One optimum moisture-maximum dry density curve for each type of soil encountered, per ASTM D-698.

1.05 JOB CONDITIONS

A. Site Information

1. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that OWNER will not be responsible for interpretation or conclusions drawn therefrom by CONTRACTOR. Data are made available for convenience of CONTRACTOR.
2. Additional test borings and other exploratory operations may be made by CONTRACTOR at no cost to OWNER.

B. Existing Utilities

Locate existing underground utilities in areas of WORK. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

C. Use of Explosives

Do not bring explosives onto site or use in WORK without prior written permission from authorities having jurisdiction. Contact Kentucky Department of Mines and Minerals for information. CONTRACTOR is solely responsible for handling, storage, and use of explosive materials when their use is permitted.

D. Protection of Persons and Property

1. Barricade open excavations occurring as part of this WORK and post with warning lights.
 - a. Operate warning lights as directed by authorities having jurisdiction.
 - b. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

A. Definitions

1. Sub-base material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand.
2. Backfill and fill materials: Satisfactory soil materials free of debris, waste, frozen materials, vegetable, and other deleterious matter.
3. Embankment Materials

All fill materials shall be obtained from required excavations and from the proposed borrow areas if shown on the CONTRACT DRAWINGS. The selection, blending, routing and disposition of materials shall be subject to the approval of the ENGINEER.

a. Materials - Impervious Clay Core

Core fill materials shall consist of residual overburden soils within the proposed excavation and borrow areas. These soils consist primarily of brown clays classified as CH or CL using the Unified Soil Classification System.

Fill materials shall contain no sod, organic topsoil, brush, roots or other deleterious materials. Fill material shall be rock free and shall be approved by the ENGINEER prior to fill placement.

b. Materials - Random Earth and Rock Zones

Fill material shall consist of non-organic soil or weathered rock with a maximum particle size of 12 inches. Rock materials from the borrow area shall be excavated by

ripping methods. No blasting will be allowed without written permission from the OWNER.

2.02 EMBANKMENT DRAINAGE MATERIALS

- A. No. 57 crushed stone is specified in this Division, Section 02255.
- B. Filter fabric for use with the embankment drain location at the downstream face of the impervious core, where called for in this Section, on the DRAWINGS or as determined by the ENGINEER shall be Mirafi 140N as manufactured by Celanese Corporation, New York, NY 10036, or equal.

PART 3 EXECUTION

3.01 STRIPPING AND TOPSOILING

- A. Before excavation and grading is commenced for structures, the embankment, outlet works or other WORK described hereinafter (except pipelines and manholes) or before material is removed from borrow pits, (impoundment area) the topsoil shall be removed from the areas affected and stockpiled. When final grading is accomplished, the topsoil shall be spread evenly over the disturbed area, except within the impoundment area. Rough grading shall have been carried approximately 6 inches below finished grade (except solid rock, where it shall be carried 12 inches below finished grade) and brought back up to grade with topsoil as set out herein.

3.02 EXCAVATION

- A. All excavation to be unclassified standard excavation includes excavation to sub-grade elevations indicated including excavation of earth, rock (at depth shown on DRAWINGS), bricks, wood, cinders, and other debris.
- B. Differing Site Conditions
 - 1. Should the CONTRACTOR, during the course of construction, encounter subsurface or latent physical conditions differing materially from the subsurface information provided, or unknown physical conditions of an unusual nature differing materially from those ordinarily encountered and generally recognized as inherent in WORK of the character provided for in this CONTRACT, he shall immediately notify the ENGINEER in writing of the conditions encountered.
 - 2. Upon receipt of such notice, the ENGINEER shall promptly investigate the conditions described by the CONTRACTOR and shall advise the CONTRACTOR in writing of the decision and/or disposition of the conditions encountered.

C. Unanticipated Material

1. No classification of excavation will be made when unanticipated material is encountered in WORK:
 - a. Excavation includes excavation of pavements and other obstructions visible on ground surface; underground structures, utilities, and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as unauthorized excavation.

D. Unauthorized excavation consists of removal of materials beyond indicated sub-grade elevations or dimensions without specific direction of ENGINEER. Unauthorized excavation, as well as remedial WORK directed by ENGINEER, shall be at CONTRACTOR'S expense.

1. Under footings or foundation bases fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to the ENGINEER.
2. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by the ENGINEER.

E. Additional Excavation

1. When excavation has reached required sub-grade elevations, notify the ENGINEER who will make an inspection of conditions.
 - a. If unsuitable bearing materials are encountered at required sub-grade elevations, carry excavations deeper and replace excavated material as directed by the ENGINEER.
 - b. Removal of unsuitable material and its replacement as directed will be paid on basis of CONTRACT conditions relative to changes in WORK using Unit Price Modification prices.

F. Stability of Excavations

1. Slope sides of excavations to comply with Federal, State and local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
2. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

G. Shoring and Bracing

Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross-braces, in good serviceable condition.

1. Establish requirements for trench shoring and bracing to comply with Federal, State and local codes and authorities having jurisdiction.
2. Maintain shoring and bracing in excavations regardless of time period excavation progresses.
3. Provide permanent steel sheet piling or pressure creosoted timber sheet piling wherever subsequent removal of sheet piling might permit lateral movement of soil under adjacent structures. Cut off tops as required and leave permanently in place.

H. Dewatering

1. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding PROJECT site and surrounding area.
 - a. Do not allow water to accumulate in excavation. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of sub-grades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
 - b. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavation to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.
2. Prevent impoundment of water behind embankment during construction and prior to acceptance of OWNER.
3. See this Division, Section 02140 for additional requirements.

I. Material Storage

1. Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
 - a. Dispose of excess soil material and waste materials as herein specified.

J. Excavation for Structures

1. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
2. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other WORK.

K. Excavation for Pavements

1. Cut surface under pavements to comply with cross-sections, elevations, and grades as shown on DRAWINGS.

L. Trench Excavation

1. The CONTRACTOR shall include in his lump sum BID all trenching and backfill necessary for installation of all pipelines as planned and specified. Trenching shall include clearing and grubbing of all trash, weeds, briars, trees and stumps encountered in the trenching. The CONTRACTOR shall dispose of such material at no extra cost to the OWNER. Shrubs shall be removed, maintained and replanted in the same or adjacent location as the ENGINEER may direct. Trenching also includes such items as pipe and small creek crossings; cutting, moving or repairing damage to fences, posts, gates, and other surface structures regardless of whether shown on the DRAWINGS.
2. All existing facilities shall be protected from danger or damage while pipelines are being constructed and backfilled, and from damage due to settlement of the backfill.
3. In the event any existing structure is damaged, repair and restoration shall be made at once and backfill shall not be replaced until this is done. Restoration and repair shall be such that the damaged structure is equal to or better than its original condition and can serve its purpose as completely as before. All such restoration and repair shall be done without extra cost to the OWNER.
4. Trenches must be dug to lines and grades shown on the DRAWINGS. Hand trenching will be required in areas where machine trenching would result in undue damage to existing structures and facilities.
5. Excavation shall be open trenches.

6. Sheeting and shoring of trenches shall be provided at the expense of the CONTRACTOR where necessary to protect life, property and the new or existing structures from damage or to maintain maximum permissible trench widths at top of pipe. All necessary materials, including, but not limited to, sheeting, sheet piling, trench jacks, braces, shores and stringers, shall be used to hold trench walls. Sheeting and shoring may be withdrawn as the trenches are being backfilled, after backfill has been tamped over top of the pipe at least 18 inches. If removal before backfill is completed to surface endangers adjacent structures, such as buildings, pipelines, street paving, and sidewalks, then the sheeting and shoring shall be left in place until such danger has passed, and then pulled if practical. Voids caused by sheeting withdrawal shall be backfilled and tamped. If not withdrawn, sheeting shall be cut off at least 18 inches below final surface grade, so there is no obstruction at the ground level.
7. Where sub-grade of trench has insufficient stability to support the pipeline and hold it to its original grade, the ENGINEER may order stabilization by various means. Exclusive of dewatering normally required for construction, and instability caused by neglect of the CONTRACTOR, the necessary stabilization shall be paid for at unit price set up in the CONTRACT. In the event no particular BID price is applicable, then the payment for stabilization will be negotiated.
8. The location of the pipelines and their appurtenances as shown are those intended for the final construction. However, conditions may present themselves before or after construction on any line is started that would indicate desirable changes in location. The OWNER reserves the right to make reasonable changes in line and structure locations without extra cost, except as may be determined by extra units of materials and construction actually involved. The OWNER is under no obligation to locate pipelines, so they may be excavated by machine.
9. Tunneling may be used as an alternate to open-cut trenching, at no extra cost to the OWNER. The annular space between plates and excavation shall be either permanently placed pea gravel or sand, pumped grout (3 parts sand and 1 part Portland cement by volume) or other suitably installed material approved by the ENGINEER. Backfilling shall be kept close to the heading and completed after each day's WORK. Where grout is used for backfill, injection holes with threaded plugs shall be provided in liner plates at various levels and in sufficient number to effectively grout the void around the tunnel. A minimum of 3 grout holes shall be provided in each 8 feet of tunnel length. Grout shall be injected in the lower holes first, proceeding upward as the void is filled. Plugs shall be installed after each hole is filled and grout stops shall be provided behind plates as necessary to ensure complete filling of the void. In tunneling under buildings, the CONTRACTOR

will be responsible for all damage resulting from his operations and methods of excavation and backfilling. Boring may also be used as an alternate to tunneling or open-cut trenching, at no extra cost to the OWNER.

10. Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 6" to 9" clearance on both sides of pipe or conduit.
 - a. Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.
 - b. Where rock is encountered, carry excavation 6 inches below required elevation and backfill with a 6-inch layer of crushed stone or gravel prior to installation of pipe.
 - c. For pipes or conduit 3 inches or less in nominal size and for flat-bottomed, multiple-duct conduit units, excavate to sub-base depth indicated or, if not indicated, then to 2 inches below bottom of WORK to be supported.
 - d. For pipes or conduit 6 inches or larger in nominal size, tanks, and other mechanical/electrical WORK indicated to receive sub-base, excavate to sub-base depth indicated or, if not otherwise indicated, to 6 inches below bottom of WORK to be supported.
 - e. Except as otherwise indicated, excavate for exterior water-bearing piping (water, steam, condensate, drainage) so top of piping is no less than 2 feet 6 inches below finish grade.
 - f. Grade bottoms of trenches as indicated on DRAWINGS, notching under pipe bells to provide solid bearing for entire body of pipe.
 - g. Concrete is specified in Division 3.
 - h. Do not backfill trenches until tests and inspections have been made and backfilling authorized by the ENGINEER. Use care in backfilling to avoid damage or displacement of pipe systems.
 - i. For piping or conduit less than 2 feet 6 inches below surface of roadways, provide 4-inch thick concrete base slab support. After installation and testing of piping or conduit, provide minimum 4-inch thick encasement (sides and top) of concrete prior to backfilling or placement of roadway sub-base.

M. Cold Weather Protection

1. Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F (1°C).

3.03 COMPACTION

A. General

1. Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.
 - a. Percentage of maximum density requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture density relationship (cohesive soils) determined in accordance with ASTM D698; and not less than the following percentage of relative density, determined in accordance with ASTM D2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils). CONTRACTOR is responsible for providing one optimum moisture content - maximum dry density curve in accordance with the above referenced ASTM standards for each soil type encountered.
 - b. Structures, building slabs and steps, pavements: Compact top 12 inches of sub-grade and each 8 inch loose, uncompacted layer of backfill or fill material at 100 percent maximum density for cohesive material or 95 percent relative density for cohesionless material.
 - c. Lawn or unpaved areas: Compact to 6 inches of sub-grade and each 8 inch loose, uncompacted layer of backfill or fill material at 90 percent maximum density for cohesive soils and 90 percent relative density for cohesionless soils.
 - d. Walkways: Compact top 6 inches of sub-grade and each 8 inch loose, uncompacted layer of backfill or fill material at 95 percent maximum density for cohesive material or 95 percent relative density for cohesionless material.
2. Subgrade and backfill for sewers located in fill areas shall be compacted to not less than 95 percent maximum density.

B. Moisture Control

1. Where sub-grade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface or sub-grade, or layer of soil material, to prevent free water from

appearing on surface during or subsequent to compaction operations.

2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
3. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by deicing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.04 BACKFILL AND FILL

A. General

1. Place acceptable soil material in layers to required sub-grade elevations, for each area classification listed below.
 - a. In excavations, use satisfactory excavated or borrow material.
 - b. Under grassed areas, use satisfactory excavated or borrow material.
 - c. Under walks and pavements, use sub-base material, or satisfactory excavated or borrow material, or combination of both.
 - d. Under steps, use sub-base material.
 - e. Under building slabs, use engineered fill material for a minimum depth of 6 inches.
 - f. Sub-base material or satisfactory excavated or borrow material may be used below engineered fill at building slabs.
 - g. Under piping and conduit, use sub-base material where sub-base is indicated under piping or conduit; shape to fit bottom 90° of cylinder.

B. Backfill excavations as promptly as WORK permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
2. Inspection, testing, approval, and recording locations of underground utilities.
3. Removal of concrete formwork.

4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
5. Removal of trash and debris.
6. Permanent or temporary horizontally supported walls.

C. Ground Surface Preparation

1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface, except as otherwise specified in Section 02200-3.05 for embankments.
2. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, adjust moisture condition to optimum moisture content, and compact to required depth and percentage of maximum density.

D. Placement and Compaction

1. 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.
 - a. Before compaction, add moisture to each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 - b. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

E. Backfilling Trenches

1. Backfilling shall be accomplished as soon as practical after pipe has been laid and jointing and alignment approved. Packing of crushed rock between joints shall be the usual procedure as the laying progresses. This is in order to avoid danger of

misalignment from slides, flooding or other causes. The ENGINEER shall be given a maximum of 24 hours for inspection before backfilling.

2. The backfill over the pipe shall be in accordance with the standard details shown on the DRAWINGS for bedding and backfilling pipe.
3. In case maximum permissible trench widths (as designated by the pipe manufacturer) are exceeded, the CONTRACTOR shall furnish crushed rock backfill to a minimum of 12 inches over the top of pipe at no extra cost to the OWNER.
4. After the foregoing cover requirements over top of the pipe have been met, rock may be used in the backfill in pieces no larger than 12 inches in any dimension and to an extent not greater than one-half the backfill materials used. If additional earth is required for backfilling, it must be obtained and placed by the CONTRACTOR at no additional cost to the OWNER. Filling with rock and earth shall proceed simultaneously, such that no voids are left in the rock. After cover requirements over top of pipe have been met, backfilling may be employed without tamping, provided caution is used in quantity per dump and uniformity of level of backfilling. Surplus material shall be uniformly ridged over trench and excess rock hauled away, with no rock over 1-1/2 inch diameter in the top 6 inches. Ridged backfill shall be confined to the width of the trench and no higher than needed for replacement of settlement of backfill. All rock over 1-1/2 inch diameter shall be broomed to remove all earth and loose rock, all immediately following backfilling.
5. In the case of street, highway, railroad, sidewalk and driveway crossings; or within any roadway paving; or about manholes, valve and meter boxes; the backfill must be mechanically tamped in not over 6 inch layers, measured loose. Alternate method of compacting backfill shall be used, if refill material is in large hard lumps (crushed rock excepted) which cannot be consolidated without leaving voids.
6. In the case of tunnels, the annular space between plates and excavation shall be either permanently placed pea gravel or sand, pumped grout (3 parts sand and 1 part Portland cement by volume) or other suitably installed material approved by the ENGINEER. Backfilling shall be kept close to the heading and completed after each day's WORK. Where grout is used for backfill, injection holes with threaded plugs shall be provided in liner plates at various levels and in sufficient number to effectively grout the void around the tunnel. A minimum of 3 grout holes shall be provided in each 3 feet of tunnel length. Grout shall be injected in the lower holes first, proceeding upward as the void is filled. Plugs shall be installed after each hole is filled and grout stops

shall be provided behind plates as necessary to ensure complete filling of the void.

7. Where traffic on streets, driveways, railroads, sidewalks and highways requires temporary surfacing, backfilling shall be terminated 4 inches below original ground level and 4 inches to 6 inches of dense graded aggregate shall be placed on the trench. Backfills shall be maintained easily passable to traffic at original ground level, until acceptance of PROJECT or replacement of paving or sidewalks.
8. Excavated materials from trenches and tunnels in excess of that required for backfill shall be disposed of on the plant lot, as directed by the ENGINEER.
9. The CONTRACTOR shall protect all sewer, gas, electric, telephone, water, and drain pipes or conduits from damage while pipelines are being constructed and backfilled, and from danger due to settlement of trench backfill.
10. No extra payment shall be made for backfilling of any kind, except as specified herein before. Backfilling shall be included as a part of the Unit Price BID. No extra payment will be made to the CONTRACTOR for supplying outside materials for backfill.
11. On completion of the PROJECT, all backfills shall be dressed; holes filled; and surplus material hauled away. All permanent walks, street paving, roadway, etc., shall be restored and seeding and sodding performed as required.

3.05 EMBANKMENTS

A. Borrow Excavation

Should insufficient quantities of suitable soil fill material for construction of the embankment be located within the designated areas, where shown on the PLANS, the CONTRACTOR shall obtain suitable soil material conforming to the requirements of the "Materials" SPECIFICATIONS at no additional cost to the OWNER.

Excavation areas shall be excavated and finally dressed in a manner such that no steep or unstable side slopes or other hazardous or unsightly conditions exist.

To the extent that they are needed, all suitable materials shall be used in the construction of permanent earth fill or rock fill. The suitability of materials for specific purposes will be determined by the ENGINEER. The CONTRACTOR shall not waste or otherwise dispose of suitable excavated materials.

B. Foundation Preparation

Foundations for earth fill shall be stripped of all topsoil to remove vegetation and other deleterious materials or shall be excavated as specified.

Except as otherwise specified for foundation benches, earth foundation surfaces shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the fill or otherwise acceptably scored and loosened to a minimum depth of 2 inches. The moisture content of the loosened material shall be controlled as specified for the earth fill, and the surface materials of the foundation shall be compacted and bonded with the first layer of earth fill as specified for subsequent layers of earth fill.

When the original ground surface is sloping at rate of 15 percent or greater, perpendicular to the embankment axis, embankment foundation benches shall be constructed as shown on the CONTRACT DRAWINGS. Preparation of the foundation shall proceed as described in the previous paragraph.

Earth abutment surfaces shall be free of loose, uncompacted earth in excess of two inches in depth normal to the slope and shall be at such a moisture content that the earth fill can be compacted against them to effect a good bond between the fill and the abutments.

C. Fill Placement

Fill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by the ENGINEER. Fill shall not be placed upon a frozen surface, nor shall snow, ice or frozen material be incorporated in the fill.

Fill shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed twelve inches (12"). Materials placed by dumping in piles or windrows shall be spread uniformly to not more than the specified thickness before being compacted. Hand compacted fill, including fill compacted by manually directed power tampers, shall be placed in layers whose thickness before compaction does not exceed six inches (6").

Adjacent to pipe or structures, fill shall be placed in a manner which will prevent damage to the pipes or structures and will allow the pipes or structures to assume the loads from the fill gradually and uniformly. The height of the fill adjacent to a structure shall be increased at approximately the same rate on all sides of the structures.

Earth fill for embankments shall also be placed so as to meet the following additional requirements:

1. The distribution of materials, throughout the zone shall be essentially uniform, and the fill shall be free from voids, pockets, streaks or layers of material differing substantially in texture or gradation from the surrounding material.

2. If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches before the next layer is placed.
3. The top surfaces of embankments shall be maintained approximately level during construction, except that a crown or cross-slope of not less than 2 percent shall be maintained to insure effective drainage. If the DRAWINGS or SPECIFICATIONS require or the ENGINEER directs that fill be placed at a higher level in one part of an embankment than another, the top surface of each part shall be maintained as specified above.
4. Embankments shall be constructed in continuous layers except where openings to facilitate construction or to allow the passage of stream flow during construction are specifically authorized.
5. Embankments built at different levels as described under (3) or (4) above shall be constructed so that the slope of the bonding surfaces between embankment in place and embankment to be placed is not steeper than 3 feet horizontal to 1 foot vertical. The bonding surface of the embankment in place shall be stripped of all loose material, and shall be scarified, moistened and recompacted when the new fill is placed against it as needed to insure a good bond with the new fill and to obtain the specified moisture content and density in the junction of the in place and new fill.
6. Embankment materials shall be placed in the zones (impervious core and random earth and rock) shown on the CONTRACT DRAWINGS. Prior to fill placement in the cutoff trench, the bottom of the cut off trench shall be inspected by the ENGINEER. All fractures or joints shall be clean and filled with mortar or concrete unless otherwise directed by the ENGINEER.
7. Fill placement shall then proceed in accordance with CONTRACT PLANS AND SPECIFICATIONS and in a manner such that no steep or unstable slopes or other hazardous or unsightly conditions exist. Fill material used shall conform to requirements of the "Materials" SPECIFICATIONS previously mentioned.
8. Rocks placed in the random earth and rock zones shall be kept at least 2 feet below the embankment surface. The rock shall not be dumped into final position, but shall be distributed by blading or dozing in a manner that will ensure proper placement in the embankment so that voids, pockets and bridging will be eliminated.

D. Compaction

Each layer of fill shall be compacted as necessary to make density of the fill matrix not less than the minimum density specified. The fill matrix is defined as the portion of the fill material finer than the maximum particle size used in the compaction test method specified. Embankment fill shall be compacted to minimum field densities equal to or greater than 95 percent of maximum dry density as determined by the Standard Proctor Maximum Dry Density test method ASTM D-698. Moisture content may vary optimum, -2 percent to +1 percent as also determined by ASTM D-698.

CONTRACTOR shall provide one moisture content vs. dry density relationship curve as determined by standard test method ASTM D-698 to help determine optimum moisture content and maximum dry density for each soil type encountered during construction prior to placement in the embankment.

Fill adjacent to structures shall be compacted to a density equivalent to that of the surrounding fill by means of hand tamping or manually directed power tampers or plate vibrators. Heavy equipment shall not be operated within 2 feet of any structure. Vibrating rollers shall not be operated within 5 feet of any structure. Compaction by means of drop weights operating from a crane or hoist will not be permitted.

The passage of heavy equipment will not be allowed: (a) over cast-in place conduits prior to 14 days after placement of the concrete; (b) over cradled pre-cast conduits prior to 7 days after placement of the concrete cradle; or (c) over any type of conduit until the backfill has been placed above the top surface of the structure to a height equal to one-half of the clear span width of the structure or pipe or 2 feet, whichever is greater.

E. Testing

During the course of the WORK, the CONTRACTOR will perform such tests as are required to identify the materials, to determine compaction characteristics, to determine moisture content, and to determine density of fill in place. These tests performed by the CONTRACTOR will be used to verify that the fills conform to the requirements of the SPECIFICATIONS. Such tests are intended to provide the CONTRACTOR with the information required by him for the proper execution of the WORK.

Submittals shall be per Section 02200, paragraph 1.04 A.

F. Removal and Replacement of Defective Fill

Fill placed at densities lower than the specified minimum density or at moisture contents outside the specified acceptable range of moisture content or otherwise not conforming to the requirements of the SPECIFICATIONS shall be reworked to meet the requirements or removed and replaced by acceptable fill. The replacement fill, the foundation, and the surfaces upon which the fill is placed shall conform to

all requirements of the SPECIFICATIONS for foundation preparation, approval, placement, moisture control and compaction.

3.06 GRADING

A. General

1. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between such points and existing grades.

B. Grading Outside Building Lines

1. All materials used for backfill around structures shall be of a quality acceptable to the ENGINEER and shall be free from large or frozen lumps, wood and other extraneous material. All spaces excavated and not occupied by footings, foundations, walls or other permanent WORK shall be refilled with earth up to the surface of the surrounding ground, unless otherwise specified, with sufficient allowance for settlement. In making the fills and terraces around the structures, the fill shall be placed in layers not exceeding 12 inches in depth and shall be kept smooth as the WORK progresses. Each layer of the fill shall be rolled with an approved type roller and/or be compacted. When it is not practicable to compact sections of the fill immediately adjacent to buildings or structures by rolling, then such sections shall be thoroughly compacted by means of mechanical tamping or hand tamping as may be required by the conditions encountered. All fills shall be placed so as to load structures symmetrically.
2. As set out herein before, rough grading shall be held below finished grade and then the topsoil which has been stockpiled shall be evenly spread over the surface. The grading shall be brought to the levels shown on the DRAWINGS or to the elevations established by the ENGINEER. Final dressing shall be accomplished by hand WORK or machine WORK, or a combination of these methods as may be necessary to produce a uniform and smooth finish to all parts of the re-grade. The surface shall be free from clods greater than 2 inches in diameter. Excavated rock (6 inches maximum size) may be placed in the fills, but it shall be thoroughly covered. Rock placed in fills shall not be closer than 12 inches from finished grade.
3. Grade areas adjacent to building lines to drain away from structures and to prevent ponding.
 - a. Finish surfaces free from irregular surface changes, and as follows:

- (1) Lawn or unpaved areas: Finish areas to receive topsoil to within not more than 0.10 ft. above or below required sub-grade elevations.
- (2) Walks: Shape surface of areas under walks to line, grade, and cross-section, with finish surface not more than 0.10 ft. above or below required sub-grade elevation.
- (3) Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 0.04 ft. above or below required sub-grade elevation.

C. Grading Surface of Fill Under Building Slabs

1. Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 0.04 ft. when tested with a 10ft. straightedge.

D. Compaction

1. After grading, compact sub-grade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.07 PAVEMENT SUB-BASE COURSE

A. General

1. Sub-base course consists of placing sub-base material, in layers of specified thickness, over sub-grade surface to support a pavement base course.

B. Grade Control

1. During construction, maintain lines and grades including crown and cross-slope of sub-base course.

C. Shoulders

1. Place shoulders along edges of sub-base course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each sub-base course layer. Compact and roll at least a 12 inch width of shoulder simultaneously with compacting and rolling of each layer of sub-base course.

D. Placing

1. Place sub-base course material on prepared sub-grade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting sub-base material during placement operations.
2. When a compacted sub-base course is shown to be 6 inches thick or less, place material in a single layer. When it is shown to be more than 6 inches thick, place material in equal layers, such that no single layer shall be more than 6 inches or less than 3 inches in thickness when compacted.

3.08 BUILDING SLAB ENGINEERED FILL COURSE

A. General

1. Engineered fill course consists of placement of fill material, in layers of indicated thickness, over sub-grade surface to support concrete building slabs.

B. Placing

1. Place fill material on prepared sub-grade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.
2. When a compacted course is shown to be 6 inches or less, place material in a single layer. When it is shown to be more than 6 inches thick, place material in equal layers, such that no single layer shall be more than 6 inches or less than 3 inches in thickness when compacted.

3.09 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction

1. Allow testing service to inspect and report to the ENGINEER on findings and approve sub-grades and fill layers before further construction WORK is performed.
 - a. Perform field density tests in accordance with ASTM D 1556 (sand cone method), ASTM D 2167 (rubber balloon method), or ASTM D 2992 (nuclear density method), as applicable.
 - b. Footing sub-grade: For each strata of soil on which footings will be placed, conduct at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing sub-grade may be based on a visual comparison of each sub-grade with related tested strata, when acceptable to ENGINEER.

- c. Paved areas and building slab sub-grade: Make at least one field density test of sub-grade for every 2,000 square feet of paved area or building slab, but in no case less than three tests. In each compacted fill layer, make one field density test for every 2,000 square feet of overlaying building slab or paved area, but in no case less than three tests.
 - d. Foundation wall backfill: Take at least two field density tests, at locations and elevations as directed.
- B. If in the opinion of the ENGINEER, based on testing service reports and inspection, sub-grade or fills which have been placed are below specified density, CONTRACTOR shall provide additional compaction and testing at no additional expense to the OWNER.

3.10 MAINTENANCE

- A. Protection of Graded Areas
- 1. Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- B. Reconditioning Compacted Areas
- 1. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.
- C. Settling
- 1. Where settling is measurable or observable at excavated areas during general PROJECT warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent WORK, and eliminate evidence of restoration to greatest extent possible.

3.11 BASIS FOR PAYMENT

Payment for excavation shall be made on a unit price or a lump sum basis where a separate bid item is provided. Otherwise payment for all excavation, trenching and backfilling required for other work, such as structures, pipelines, etc., shall be made on a unit price or lump sum basis bid for that work.

END OF SECTION

SECTION 02255

CRUSHED STONE AND DENSE GRADED AGGREGATE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish and install crushed stone for miscellaneous uses as shown on the Drawings, as called for in the Specifications, or as may be directed in writing by the ENGINEER.
- B. Sizes, types, and quality of crushed stone are specified in this Section, but its use for replacement of unsuitable material, pavement base, and similar uses is specified in detail elsewhere in the Specifications. The ENGINEER may order the use of crushed stone for purposes other than those specified in other sections, if, in his opinion, such use is advisable.

PART 2 PRODUCTS

2.01 MATERIALS

- A. When referred to in these Specifications, crushed stone shall be Number 57 graded in accordance with the Kentucky Transportation Cabinet, Department of Highways, Standard Specifications for Road and Bridge Construction, 2000 Edition.
- B. When referred to in these Specifications, dense graded aggregate (DGA) shall be crushed stone classified by the Kentucky Transportation Cabinet, Department of Highways, Standard Specifications for Road and Bridge Construction, 2000 Edition, and conforming to the following requirements:

Sieve Size	Percent Passing
1 Inch	100
3/4 Inch	70 - 100
3/8 Inch	50 - 80
#4	30 - 65
#30	10 - 40
#200	4 - 13

PART 3 EXECUTION

3.01 INSTALLATION

- A. Crushed stone shall be placed in uniform layers not greater than 6 inches deep and shaped by power equipment to required lines, grades, cross sections, and depths. No minimum compacted density, method of

compaction, or compaction equipment is required since a nominal amount of compaction effort with vibration can establish the desired inter-granular locking of the aggregate under controlled placement depth. Acceptable compaction can be achieved with pneumatic-tired and tracked vibratory equipment and vibratory rollers.

- B. All compaction operations shall be performed to the satisfaction of the ENGINEER.
- C. Crushed stone shall be placed in those areas as shown on the Drawings and as may be directed by the ENGINEER.

3.02 BASIS FOR PAYMENT

Payment for crushed stone or DGA shall be made on a unit price or a lump sum basis where a separate bid item is provided. Otherwise payment for crushed stone or DGA required for other work show on the PLANS shall be made on a unit price or lump sum basis bid for that work.

END OF SECTION

SECTION 02270

EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and equipment required for erecting, maintaining and removing temporary erosion and sedimentation controls as shown on the Drawings and as specified herein.
- B. Temporary erosion controls include, but are not limited to grassing, mulching, seeding, watering, and reseeding on all disturbed surfaces including waste area surfaces and stockpile and borrow area surfaces; scheduling work to minimize erosion and providing interceptor ditches at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits.
- C. Temporary sedimentation controls include, but are not limited to, silt dams, silt fences, traps, barriers, staked straw-bale diversions and appurtenances at the foot of sloped surfaces, which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits.
- D. CONTRACTOR is responsible for providing and maintaining effective temporary erosion and sediment control measures during construction or until final controls become effective.
- E. The erosion and sedimentation controls where shown on the Drawings and/or specified herein are intended to provide the required environmental protection. However, should additional controls be directed by the ENGINEER, CONTRACTOR shall furnish, install and maintain additional mulching and straw-bale diversions to control erosion and sedimentation to the satisfaction of the ENGINEER at no additional cost to OWNER.
- F. Construction methods that will minimize siltation and erosion shall be employed. The CONTRACTOR shall take steps to minimize unnecessary excavation and disturbing or uprooting trees and vegetation. The CONTRACTOR is prohibited from dumping soil or debris, or pumping silt-laden water into a stream. Cleanup, grading, seeding and planting or restoration of all work areas shall begin immediately. Exposed areas shall not remain unprotected for more than seven days. (From "10-States' Standards")

1.02 RELATED WORK NOT INCLUDED

- A. Site clearing and grubbing is included in this Division, Section 02110.
- B. Dewatering is included in this Division, Section 02140

- C. Landscape work is included in this Division, Section 02900.
- D. Final erosion protection measures are included in this Division, Section 02200.

PART 2 PRODUCTS

- A. Erosion control blanket where called for in this Section, on the Drawings, or as determined by the ENGINEER, shall be AMXCO Curlex Blanket as manufactured by American Excelsior Company, Arlington, TX 76011, or equal.
- B. Rip-rap lining where called for in this Section, on the Drawings or as determined by the ENGINEER shall be Class III or Class II lining as shown on the Drawings and as specified in Section 703 of the 2000 edition of the Kentucky Department of Highways "Standard Specifications for Road and Bridge Construction."

For Class III, no less than 80 percent, by volume, of individual stones shall range in size from 1/4 to 1-1/2 cubic feet. Stones of smaller sizes are permissible for use in filling voids in the upper surface and dressing to the proper slope. In addition to the above referenced specifications, individual stone dimensions are limited to 4 inches (minimum) and 24 inches (maximum).

For Class II lining, no more than 20 percent of the finished product shall pass through square openings 5 inches by 5 inches.

- C. Filter fabric for use with rip-rap where called for in this Section, on the Drawings, or as determined by the ENGINEER, shall be Mirafi 700X as manufactured by Celanese Corporation, New York, NY 10036, or equal.
- D. Silt fence fabric where called for in this Section, on the Drawings or as determined by the ENGINEER shall be Mirafi 100X as manufactured by Celanese Corporation, New York, NY 10036, or equal.

PART 3 EXECUTION

3.01 GENERAL

- A. Erosion control practices shall be adequate to prevent erosion of all disturbed and/or all regraded areas.
- B. Earthwork procedures shall be as specified in this Division, Section 02200.

- C. Silt fences shall be located and staked in all disturbed locations and/or all regraded where erosion may occur.

3.02 TEMPORARY SEEDING

- A. This item shall consist of seeding a temporary cover of grass, or grass and small grain, on areas disturbed on the construction site, which will not be redisturbed within a 60 day period. The determination of the area to be temporarily seeded and the time of seeding shall be made by the ENGINEER.
- B. The seed mixtures to be used for temporary cover will be governed by the time of year the seeding is accomplished. The mixture of seeding shall be as follows:
 - 1. Time of Seeding - February 15 to June 1

Rye 1-1/2 bushels and rye grass 25 pounds per acre; or tall fescue 30 pounds and rye grass 20 pounds per acre.
 - 2. Time of Seeding - June 2 to August 15

Tall fescue 30 pounds and rye-grass 20 pounds per acre; or, spring oats 2 bushels and rye grass 30 pounds per acre.
 - 3. Time of Seeding - August 16 to February 14

Rye 2 bushels and rye grass 20 pounds per acre; or, tall fescue 30 pounds and rye- grass 20 pounds per acre.
 - 4. Lime will not be required for temporary seeding.
 - 5. Fertilizer at the rate of 400 pounds per acre of 10-10-10 fertilizer, or equivalent, broadcast uniformly on the area to be seeded.
 - 6. All seed shall be broadcast evenly over the area to be seeded and culti-packed or otherwise pressed into the soil. Seed and fertilizer may be mixed together and applied after the seed has been prepared.
 - 7. Mulch for temporary seeding will not be required except on those areas, in the ENGINEER'S opinion, which are too steep to hold the seed without protective cover.

3.03 RIP-RAP LINING

- A. Rip-rap lining shall be constructed to the lines and grades and at the location designated on the Drawings.

The filter fabric shall be placed at the locations shown on the Drawings. The surface to receive the fabric shall be prepared to a relatively smooth

condition free of obstructions, debris or sharp objects that may puncture the fabric. Construction equipment will not be permitted to operate directly on the fabric.

The fabric shall be placed with long dimension parallel to the channel or embankment centerline and shall be laid smooth and free of tension, stress, folds, wrinkles, or creases. If more than one strip is necessary, the strips shall overlap a minimum of 3 feet. Transverse laps shall be placed so the upstream strip laps over the downstream strip.

Fastener pins shall be installed through both strips of overlapped fabric at no less than 5 foot intervals along a line through the midpoint of the lap, and at any other locations as necessary to prevent any slippage of the fabric.

Fabric shall be covered with the rip-rap lining within 14 calendar days after placement of the fabric. Fabric not covered within this time shall be removed and replaced at the CONTRACTOR'S expense if the ENGINEER determines that damage or deterioration is evident.

The fabric shall be protected from damage due to the placement of the channel lining by limiting the height of drop of the material at no greater than 3 feet or by placing a cushioning layer of sand on top of the fabric before dumping the material, at the CONTRACTOR'S option. The CONTRACTOR shall demonstrate that the placement technique will prevent damage to the fabric.

Placement of channel lining shall begin at the toe of the channel and proceed upstream. The lining shall be placed to conform to the template shown on the Drawings. The lining need not be compacted but shall be placed upgrade in a manner to ensure that the larger rock fragments are uniformly distributed and the smaller rock fragments serve to fill the spaces between the larger rock fragments in such a manner as will result in a well keyed, densely placed, uniform layer of lining of the specified thickness. Hand placing will be required only to the extent necessary to secure the results specified above.

3.04 MAINTENANCE OF CONTROLS AND PERFORMANCE

- A. Erosion and sedimentation controls shall be inspected weekly and after significant rainstorms. Replace silt fencing which is damaged filter stone which is dislodged, erosion control blanket which is damaged, and make other necessary repairs.
- B. Should any of the temporary erosion and sediment control measures employed by the CONTRACTOR fail to produce results consistent with normal and acceptable standards of the industry. The CONTRACTOR shall immediately take whatever steps are necessary to correct the deficiency at his own expense.

- C. Remove all temporary erosion and sedimentation controls as final landscaping and grading is performed.

3.05 CONSTRUCTION ALONG OR ACROSS AN INTERMITTENT OR PERENNIAL STREAM

The following special considerations shall be given to construction along or across an intermittent or perennial stream:

- A. Development/excavation shall be performed during low flow periods to minimize disturbance.
- B. When crossing a stream, the pipe shall be laid perpendicular to the stream bank to minimize the direct impacts to the streambed.
- C. When working adjacent to a stream, soil erosion control structures shall be placed parallel to all streams to minimize entry of silt into the stream.
- D. All disturbed instream habitat shall be returned to its original condition upon completion of construction in the area.
- E. The contractor shall take every possible measure to preserve the tree canopy overhanging the stream.
- F. Streambanks shall be reseeded immediately with the stream bank seed mix described in Section 02900, following completion of the stream crossing, disturbed surfaces shall be restored to original contours, and excess materials removed to a properly confined upland area.

END OF SECTION

SECTION 02320

HORIZONTAL DIRECTIONAL DRILLING

PART 1 GENERAL

1.01 SECTION DESCRIPTION

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.

1.02 REFERENCES

Specification 02610 – High Density Polyethylene (HDPE) Pipe and Fittings shall be used as a reference.

1.03 QUALITY ASSURANCE

The requirements set forth in this document specify a wide range of procedural precautions necessary to insure 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. Adherence to the specifications contained herein, or the Engineer's approval of 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.

1.04 SUBMITTALS

A. WORK PLAN

Prior to beginning work, the Contractor must submit to the Engineer a general work plan outlining the procedure and schedule to be used to execute the project. Plan should document the thoughtful planning required to successfully complete the project.

B. EQUIPMENT

Contractor will submit specifications on directional drilling equipment to be used to ensure that the equipment will be adequate to complete the project.

C. MATERIALS

Specifications on material to be used shall be submitted to Engineer. Material shall include the pipe, fittings and any other item which is to be an installed component of the project.

PART 2 EQUIPMENT REQUIREMENTS

2.01 EQUIPMENT

The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a drilling fluid mixing & delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations and trained and competent personnel to operate the system. All equipment shall be in good, safe 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.

2.02 DRILLING SYSTEM

A. DRILLING RIG

The directional drilling machine shall consist of a hydraulically powered 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 machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the crossing. The hydraulic 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.

B. DRILL HEAD

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

C. MUD MOTORS (if required)

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

D. 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.

2.03 GUIDANCE SYSTEM

The Guidance System shall be of a proven type and shall be setup and operated by personnel trained and experienced with this system. The Operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of the guidance system if using a magnetic system.

2.04 DRILLING FLUID (MUD) SYSTEM

A. MIXING SYSTEM

A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid composed of bentonite clay, potable water and appropriate additives. Mixing system shall be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping and ensure thorough mixing. The drilling fluid reservoir tank shall be sized for adequate storage of the mud. Mixing system shall continually agitate the drilling fluid during drilling operations.

B. DRILLING FLUIDS

Drilling fluid shall be composed of clean water and an appropriate additive. Water shall be from a clean source with a pH of 8.5 – 10 and/or as per mixing requirements of the Manufacturer. 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 hazardous additives may be used. Drilling fluid shall be maintained at a viscosity sufficient to suspend cuttings and maintain the integrity of bore wall.

C. DELIVERY SYSTEM

The mud pumping system shall have a minimum capacity to supply mud in accordance with the drilling equipment pull-back rating at a constant required pressure. 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 properly disposed of. A berm, minimum of 12" high, shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system (if used) 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 facilities.

2.05 OTHER EQUIPMENT

A. PIPE ROLLERS

Pipe rollers, if required, shall be of sufficient size to fully support the weight of the pipe while being hydro-tested and during pull-back operations. Sufficient number of rollers shall be used to prevent excess sagging of pipe.

B. PIPE RAMMERS

Hydraulic or pneumatic pipe rammers may only be used if necessary and with the authorization of Engineer.

C. RESTRICTIONS

Other devices or utility placement systems for providing horizontal thrust other than those previously defined 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 project.

PART 3 - EXECUTION

3.01 GENERAL

The Engineer must be notified 48 hours in advance of starting work. The Directional Bore shall not begin until the Engineer is present at the job site and agrees that proper preparations for the operation have been made. The Engineer approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the Contract. It shall be the responsibility of Engineer to provide inspection personnel at such times as appropriate without causing undue hardship by reason of delay to the Contractor.

3.02 PERSONNEL REQUIREMENTS

All personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety.

3.03 DRILLING PROCEDURE

A. SITE PREPARATION

1. Prior to any alterations to work-site, contractor shall photograph or video tape entire work area, including entry and exit points. One copy of which shall be given to Engineer and one copy to remain with contractor for a period of one year following the completion of the project.

2. Work site as indicated on drawings, within right-of-way, shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made. Contractor shall confine all activities to designated work areas.

B. DRILL PATH SURVEY

Entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings. If contractor is using a magnetic guidance system, drill path will be surveyed for any surface geo-magnetic variations or anomalies.

C. ENVIRONMENTAL PROTECTION

Contractor shall place silt fence between all drilling operations and any drainage, wetland, waterway or other area designated for such protection by contract documents, state, federal and local regulations. 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. Contractor shall adhere to all applicable environmental regulations. Fuel or oil may not be stored in bulk containers within 200' of any water-body or wetland.

D. SAFETY

Contractor shall adhere to all applicable state, federal and local safety regulations and all operations shall be conducted in a safe manner.

E. PIPE

Pipe shall be welded/fused together in one length, if space permits. Pipe welds will be X-rayed prior to being placed in bore hole. Pipe will be placed on pipe rollers before pulling into bore hole with rollers spaced close enough to prevent excessive sagging of pipe.

F. PILOT HOLE

1. Pilot hole shall be drilled on bore path with no deviations greater than 5% of depth over a length of 100'. In the event that pilot does deviate from bore path more than 5% of depth in 100', Contractor will notify Engineer and Engineer may require Contractor to pull-back and re-drill from the location along bore path before the deviation.
2. In the event that a drilling fluid fracture, inadvertent returns or returns loss occurs 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

then wait another 30 minutes. If mud fracture or returns loss continues, contractor will cease operations and notify Engineer. Engineer and contractor will discuss additional options and work will then proceed accordingly.

G. REAMING

Upon successful completion of pilot hole, contractor will ream bore hole to a minimum of 25% greater than outside diameter of pipe using the appropriate tools. Contractor will not attempt to ream at one time more than the drilling equipment and mud system are designed to safely handle.

H. PULL-BACK

1. After successfully reaming bore hole to the required diameter, contractor will pull the pipe through the bore hole. In front of the pipe will be a swivel. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into borehole. During pull-back operations contractor will not apply more than the maximum safe pipe pull pressure at any time.
2. In the event that pipe becomes stuck, contractor will cease pulling operations to allow any potential hydro-lock to subside and will commence pulling operations. If pipe remains stuck, contractor will notify Engineer. Engineer and contractor will discuss options and then work will proceed accordingly.

3.04 PIPE TESTING

- A.** Sections 02620 and 02715 shall be followed in its entirety following pull-back of the pipe.
1. All mains shall be swabbed.
 2. All mains shall be chlorinated.

3.05 Basis For Payment

- A.** Piping shall be paid for at the unit price bid or lump sum bid and shall include all work incidental to making a complete installation such as excavation, bedding, backfill, painting, testing, disinfection, cleanup, seeding, etc.

END OF SECTION

SECTION 02326

STEEL CASING PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Steel casing pipe shall be furnished and installed as shown on the DRAWINGS and specified herein.

1.02 RELATED WORK

- A. Erosion and sedimentation control is included in this Division, Section 02270.
- B. Piping is included in this Division, Section 02700.
- C. Landscaping is included in this Division, Section 02900.

PART 2 PRODUCTS

2.01 STEEL CASING PIPE

- A. Steel casing or jack pipe shall be plain end steel pipe with a minimum yield strength of 35,000 psi and tensile strength of 60,000 psi per API-5L Grade B material. The steel pipe supplied shall be manufactured by the seamless, electric-weld, submerged arc weld or gas metal-arc weld process as specified in API-5L. Certifications of 35,000 psi minimum yield strength shall be furnished by the CONTRACTOR.
- B. The inside diameter shall be at least 2 inches greater than the largest outside diameter of the carrier pipe, joint or couplings for carrier pipe less than 6" in diameter and at least 4" greater for carrier pipe 6" and over in diameter unless otherwise noted on the plan sheets. In all cases, the casing pipe shall be great enough to allow the carrier pipe to be removed subsequently without disturbing the casing pipe or roadbed.
- C. Casing pipe shall have minimum wall thickness as shown in the following table:

Nominal Diameter (Inch)	Nominal Thickness (Inch)	Nominal Diameter (Inch)	Nominal Thickness (Inch)
Under 10	0.188	24	0.438
10 - 12	0.250	26	0.438
14 - 16	0.281	28 - 30	0.500

PART 3 EXECUTION

3.01 TUNNELING, BORING OR JACKING

- A. Boring or jacking as specified herein shall be located as shown on DRAWINGS. All other casing pipe installations shall be open cut trench.
- B. Tunneling under paving, railroads, buildings and underground structures is included as an alternate to boring or repaving required by open cut trenching at no extra cost to the OWNER. Bore and casing pipe is also included as an alternate to tunneling. Backfilling of tunnels shall be mechanically tamped in not more than 3-inch layers and with material rendered suitable for tamping before being placed in tunnel unless otherwise shown on the DRAWINGS. No payment will be made for tunnels less than 3 feet long.
- C. In tunneling under buildings, the CONTRACTOR will held responsible for all damage by his operations and methods of excavation and backfilling.
- D. Should the CONTRACTOR elect and receive permission to tunnel and bore, other than locations designated on the DRAWINGS or required by the ENGINEER to be tunneled or bored, the entire compensation therefore shall be the same as the unit prices bid for installation in open trench, including paving replacement, but not including bore or unit prices.
- E. At locations where tunneling or boring or jacking is called for on the DRAWINGS, in addition to the unit prices for permanent tunnel, tunnel liner, temporary tunnel, boring or jacking and/or casing pipe, payment will be made for furnishing and laying carrier pipe inside the tunnel or casing pipe. No payment will be made for separate trench and backfill unit price items where permanent tunnel, tunnel liner, temporary tunnel, boring or jacking and/or casing pipe unit prices is paid.
- F. Boring or jacking under highways, railroads, sidewalks, pipelines, etc., shall be done at the locations shown on the DRAWINGS. It shall be performed by mechanical means and accurate vertical and horizontal alignment must be maintained. When shown on the DRAWINGS, casing pipe shall be used and shall be installed inside bored holes concurrently with boring, or jacking.

3.02 STEEL CASING PIPE INSTALLATION

- A. Steel casing pipe shall be of the size and wall thickness as shown on the DRAWINGS or specifications.
- B. When casing pipe is jacked, concurrent with boring, all joints shall be solidly welded. The weld shall be such that the joint shall be of such strength to withstand the forces exerted from the boring and jacking operation as well as the vertical loading imposed on the pipe after installation. The weld shall also be such that it provides a smooth, non-

obstructing joint in the interior of the pipe, which will allow easy installation of the carrier pipe without hanging or abrasion to the carrier pipe upon installation.

- C. When casing pipe is installed in open trench or permanent tunnel, it shall be bedded and backfilled as specified in Division 2. When casing pipe is installed in temporary tunnel, it shall be laid accurately to alignment of proposed pipeline and at an elevation below proposed pipeline necessary to support it at the planned elevation. Bedding and backfill for casing pipe in temporary tunnel shall be as specified in Division 2.
- D. Casing pipe in open trench, permanent tunnel and temporary tunnel shall be joined by welding such that it will not be moved out of alignment or grade and will prevent backfill material from entering joint. Where casing pipes are shown on the DRAWINGS to be equipped with vent pipes, vents shall be installed as shown on the DRAWINGS with cost of the same included in the price bid for the casing pipe unless otherwise specified.

3.03 CARRIER PIPE IN CASING PIPE INSTALLATION

A. Pipeline Spacers

Carrier pipes shall be centered inside casing pipe throughout the length of the casing pipe. Centering shall be accomplished by the installation of polyethylene pipeline spacers attached to the casing pipe in such a manner as to prevent the dislodgment of the spacers as the carrier pipe is pulled or pushed through the casing pipe. Spacers shall be of such dimensions to provide (1) full supportive load capacity of the carrier pipe and contents; (2) of such thickness to allow installation and/or removal of the pipe; and (3) to allow no greater than 1/2 inch movement of the carrier pipe within the casing pipe after the carrier pipe is installed. Installation shall be in accordance with manufacturer's recommendations.

- B. Upon completion of installation of the carrier pipe, the annular space at the ends of the cover pipe shall be sealed to prevent the entrance of groundwater, silt, etc., into the casing pipe. The seal shall be a manufactured product specially made for this purpose. The seal shall be the best seal type constructed of synthetic rubber with stainless steel banding straps. Seals may be of the "pull-on" or "wrap around" type as manufactured by Advance Products and Systems, Inc. or equal.

3.04 BASIS FOR PAYMENT

Steel Casing Pipe shall be paid for at the unit price bid or lump sum bid and shall include all work incidental to making a complete installation such as excavation, carrier pipe, bedding, backfill, painting, testing, disinfection, cleanup, seeding, etc.

END OF SECTION

SECTION 02411
FOUNDATION DRAINAGE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Extent of foundation drainage system work is shown on the DRAWINGS and includes the following:
 - 1. Footing drainage system.

1.02 RELATED WORK

- A. Dewatering is included in this Division, Section 02140.
- B. Earthwork is included in this Division, Section 02200.

PART 2 PRODUCTS

2.01 DRAINAGE PIPE AND FITTINGS

- A. Furnish drainage pipe complete with bends, reducers, adapters, couplings and joint materials.
- B. Perforated Polyvinyl Chloride Pipe: ASTM D 2729-latest revision.
- C. Joint Screening
 - 1. Furnish joint screening for each open-joint portion of drain lines of the following:
 - a. Synthetic drainage fabric.

2.02 SOIL MATERIALS

- A. Impervious Fill
 - 1. Clay gravel and sand mixture capable of compacting to a dense composite.
- B. Drainage Fill
 - 1. Evenly graded mixture of natural or crushed gravel, crushed stone, and natural sand with 100 percent passing a 1-1/2 inch sieve and 0-5 percent passing a No. 4 sieve.
- C. Filtering Material

1. Crushed stone shall be No. 57 graded in accordance with the Kentucky Transportation Cabinet, Department of Highways, Standard Specifications for Road and Bridge Construction, latest edition.

PART 3 EXECUTION

3.01 INSTALLATION

A. Impervious Fill at Footings

1. After concrete footings have been cured and forms removed, place impervious fill material on sub-grade adjacent to bottom of footing. Place and compact impervious fill to dimensions indicated or, if not indicated, not less than 6 inches deep and 12 inches wide.

B. Filtering Material

1. Place supporting layer of filtering material over compacted sub-grade where drainage pipe is to be laid to depth indicated or, if not indicated, to a compacted depth of not less than 4 inches.
 - a. After testing drain lines, place additional filtering material to a 4 inch depth around sides and top of drains.

C. Laying Drain Pipe

1. Lay drain pipe solidly bedded in filtering material. Provide full bearing for each pipe section throughout its length, to true grades and alignment, and continuous slope in direction of flow.
 - a. Lay perforated pipe with perforations down and joints tightly closed in accordance with pipe manufacturer's recommendations. Provide collars and couplings as required.

D. Testing Drain Lines

1. Test or check lines before backfilling to assure free flow. Remove obstructions, replace damaged components, and retest system until satisfactory.

E. Drainage Fill

1. Place drainage fill over drain lines after satisfactory testing and covering of drain lines with filtering material. Completely cover drain lines to a width of at least 6 inches on each side and above top of pipe to within 12 inches of finish grade.

2. Place fill material in layers not exceeding 3 inches in loose depth and compact each layer placed.
 - a. Overlay drainage fill material with one layer of 15 pound asphalt - or tar-saturated felt, or synthetic drainage fabric, overlapping edges at least 4 inches.
3. Fill to grade: Apply impervious fill material over compacted drainage fill at footing drains, placing material in layers not exceeding 6 inches in loose depth and thoroughly compacting each layer. Carry impervious fill to indicated finish elevations and slope away from building perimeter.

END OF SECTION

SECTION 02500

BITUMINOUS PAVEMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Extent of bituminous pavement paving, as applicable, is shown on the Drawings, including roads, driveways, and parking areas.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Unless noted, all specification designations refer to the Kentucky Transportation Cabinet Department of Highways Standard Specification for Road and Bridge Construction, latest edition. Appropriate portions of the referenced sections of the Specifications shall apply, but all work shall be included in lump sum bid items described herein unless otherwise specified or shown on the Drawings.
- B. Preparation of sub-base is specified in this Division, Section 02200.
- C. Crushed stone and dense graded aggregate are specified in this Division, Section 02255.

1.03 QUALITY ASSURANCE

- A. Performance: Bituminous seal coat that fails as the result of not meeting the requirements of these Specifications shall be corrected as directed by the ENGINEER at the CONTRACTOR'S expense.
- B. The design plant mix shall be submitted to the ENGINEER for review and acceptance. The submittal shall include the last date the mixture was approved by the Kentucky Transportation Cabinet Department of Highways for use on a state road project; and the location where the mixture was recently used, and the name and address of the paving contractor.

PART 2 PRODUCTS

2.01 BITUMINOUS CONCRETE SURFACE MATERIAL

- A. Aggregates shall meet the applicable requirements of Sections 804 and 805.
- B. Bituminous materials shall meet the applicable requirements of Section 806.
- C. Bituminous materials for tack coat shall be one of the following:

SS-1, SS-1h, CSS-1, CSS-1h, AE-60, RS-1, CRS-1, RC-70 or RC-250.

- D. Steel, wood, or other suitable material shall be of size and strength necessary to resist movement during bituminous placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

2.02 BITUMINOUS SEAL COAT MATERIAL

- A. Coarse aggregate shall be Kentucky Transportation Cabinet Department of Highways Standard No. 8, graded 3/8 inch to No. 8, meeting applicable requirements of Section 805.
- B. Bituminous materials shall meet applicable requirements of Section 806.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

- A. The road shall be swept with an approved mechanical sweeper and with wire hand brooms, when necessary. Special care shall be taken to clean the edges of the surface so that full width of the roadway to be treated shall be uniformly clean. Where any mud or earth exists, it shall be removed sufficiently in advance of application of bituminous material to allow the surface to become thoroughly dry.

3.02 BITUMINOUS CONCRETE PAVING

- A. Composition of Mixtures: Surface pavement mixture, meeting requirements of Sections 401.02 through 401.05 shall be used as determined by local plant mix availability. The mixture shall have been approved recently by the Kentucky Transportation Cabinet Department of Highways, used recently on a state project, and conform to the requirements below when tested in accordance with ASTM D 1559-latest revision:

Stability, minimum pounds	750
Flow, 0.01 inch	Min. 8, Max. 16
Percent air voids	Min. 3, Max. 5
Minimum voids in mineral aggregate, percent: 3/4 inch	14
1 inch	13
Voids filled, percent	Min. 75, Max. 85

- B. Construction Methods: Construction requirements shall conform to applicable requirements of Sections 401, 402, and 407.
- C. A tack coat shall be required to bond new paving to the surface of concrete or brick pavements and bases or existing bituminous surfaces. It

shall be applied at the rate of 0.8 pound (0.1 gal.) per square yard at the following range of application temperatures:

SS-1, SS-1h, CSS-1, CSS-1h, AE-60	70-160°F
RS-1, CRS-1	70-140°F
RC-70	120°F
RC-250	165°F

* These temperatures should be used unless higher temperatures are required for satisfactory coverage. Caution must be exercised to prevent fire or explosion.

- D. When SS-1, SS-1h, CSS-1, CSS-1h, or AE-60 is furnished for tack material, it shall be diluted with an equal quantity of water conforming to Section 803, shall be thoroughly mixed prior to application, and shall be applied a sufficient time in advance of the paver to ensure that all water has evaporated before the bituminous concrete mixture is placed. The application rate shall be 0.8 pound (0.1 gal.) per square yard of the diluted SS-1, SS-1h, CSS-1, CSS-1h, or AE-60.
- E. Where bituminous paving is placed against vertical surfaces such curbs, gutters, manhole frames, valve boxes, etc., the vertical face shall be tack coated to seal the surface. Where these surfaces are inaccessible to pressure distributor, the tack coat may be brushed or broomed into place. The tack coat shall not be allowed to spill over onto any horizontal surface outside the area to be paved.
- F. Unless otherwise indicated on the Drawings or in these Specifications, the compacted thickness of the bituminous concrete paving shall be a minimum of 2 inches and the minimum ambient temperature for placing shall be 40°F. Mixing and laying temperatures shall be as follows:

Aggregates	Min. 240°F - Max. 325°F
Asphalt Cement	Min. 225°F - Max. 325°F
Mixture at Plant (measured in truck)	Min. 240°F - Max. 325°F
Mixture when Placed (measured in truck when discharging)	275° + 20°F **

** The 275°F + 20°F mixture placing temperature is based on 275°F being about the ideal temperature for obtaining optimum compaction under average conditions. However, when the distance between the asphalt plant and the job is such that specified placing temperatures are covered, insulated hauling equipment as described below are used, the minimum placing temperature shall be 225°F.

- G. Trucks for hauling bituminous mixtures shall have tight, clean, and smooth metal beds that have been sprayed with a minimum amount of soap emulsion, paraffin oil, or other approved material that is not detrimental to the mixture to prevent the mixture from adhering to the beds. All trucks shall be equipped with covers of sufficient size to completely cover the loaded material and all covers shall be securely fastened in place before

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the truck leaves the plant. Truck beds shall be insulated, when necessary, to maintain the specified temperature to the point of delivery. Any truck causing excessive segregation of material by its spring suspension or other contributing factors shall be discharged from the work until such conditions are corrected.

- H. The CONTRACTOR shall have an accurate thermometer on the job at all times for verifying all temperature requirements and for taking temperature measurements whenever requested by the ENGINEER or OWNER. The CONTRACTOR shall closely control temperature and compaction requirements to achieve quality bituminous paving and related work.
- I. Bituminous paving that fails as the result of not meeting the requirements of these Specifications shall be removed and replaced as directed by the ENGINEER at the CONTRACTOR's expense.

3.03 BASIS FOR PAYMENT

Payment for Bituminous Pavement shall be made on a unit price or a lump sum basis where a separate bid item is provided.

END OF SECTION

SECTION 02515

PORTLAND CEMENT CONCRETE PAVING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Extent of portland cement concrete paving for driveways and walks is shown on the DRAWINGS.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Prepare sub-base as specified in this Division, Section 02200.
- B. Concrete and related materials are specified in Division 3.
- C. Bituminous pavement is specified in this Division, Section 02500.
- D. Crushed stone and dense graded aggregate are specified in this Division, Section 02255.

1.03 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.

1.04 JOB CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Utilize flagmen, barricades, warning signs and warning lights as required.

PART 2 PRODUCTS

2.01 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.
- B. Use flexible spring steel forms or laminated boards to form radius bends as required.
- C. Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.

- D. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185-85.
- E. Furnish in flat sheets, not rolls, unless otherwise acceptable to ENGINEER.
- F. Concrete Materials: Comply with requirements of Division 3, Section 03300, for concrete materials, admixtures, bonding material, curing materials, and others as required.
- G. Expansion Joint Materials: Comply with requirements of Division 7, Section 07900 for preformed expansion joint fillers and sealers.
- H. Anti-spalling Compound: 50% (by volume) boiled linseed oil and 50% (by volume) commercial grade kerosene or mineral spirits.

2.02 CONCRETE MIX, DESIGN AND TESTING

- A. Comply with requirements of Division 3, Section 03300 for concrete mix design, sampling and testing, and quality control, and as herein specified.
- B. Design mix to produce normal-weight concrete consisting of portland cement, aggregate, water-reducing or high-range water-reducing admixture (super plasticizer), air-entraining admixture and water to produce the following properties:
 - 1. Comprehensive Strength: 4,000 psi, minimum at 28 days.
 - 2. Slump Range: 8 inches for concrete containing HRWR admixture (super-plasticizer); 3 inches for other concrete.
 - 3. Air Content: 5% to 8%.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

- A. Remove loose material from compacted sub-base surface immediately before placing concrete.
- B. Proof-roll prepared sub-base 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.

3.02 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 twenty-four (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 inch in 10 feet.
 - 2. Vertical face on longitudinal axis, not more than 1/4 inch in 10 feet.
- C. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

3.03 REINFORCEMENT

- A. Locate, place and support reinforcement as specified in Division 3, Section 03300, unless otherwise indicated.

3.04 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 sub-base and forms have been checked for line and grade. Moisten sub-base 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 and care to prevent dislocation of reinforcing, dowels, and joint devices.
- D. 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.

3.05 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.
- B. Weakened-plane (contraction) Joints (Wk-PIJt): 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.

- C. Construction Joints (CnsJt): 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.
- D. Construct joint as shown or, if not shown, use standard metal keyway-section forms.
- E. Expansion Joints (ExpJt): Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects unless otherwise indicated.
- F. Locate expansion joints at 50 ft. o.c. for each pavement lane, unless otherwise indicated.
- G. Extended joint fillers full-width and depth of joint, and not less than 1/2 inch or more than 1 inch below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.
- H. 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.
- I. 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.
- J. Fillers and Sealants: Comply with the requirements of Division 7, Section 07900, for preparation of joints, materials, installation, and performance.

3.06 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 foot straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.
- C. Work edges of slab, gutters, back top edge of curb and formed joints with an edging tool, and round to a 1/2 inch 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.

2. On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a stiff-bristled broom, perpendicular to lien of traffic.
- E. Do not remove forms for twenty-four (24) hours after concrete has been placed. Any form removal, clean ends of joints and point up any minor honeycombed areas. Remove and replace areas or sections with major defects.

3.07 CURING

- A. Protect and cure finished concrete paving, complying with requirements of Division 3, Section 03300. Use curing and sealing compound or approved moist-curing methods.
- B. Do not use liquid membrane-forming material where anti-spalling treatment will be applied.
- C. Anti-spalling Treatment: Apply compound to concrete surfaces no sooner than twenty-eight (28) days after placement. Apply to clean, dry concrete free of oil, dirt, and other foreign materials, in two sprayed applications. First application, 60 sq. yd. per gallon. Allow complete drying between applications.

3.08 REPAIRS AND PROTECTIONS

- A. Repair or replace broken or defective concrete.
- B. Protect concrete from damage until acceptance of WORK. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface 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

SECTION 02610

GENERAL PIPING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals necessary to install and test pipe and fittings as shown on the Drawings and required by the Specifications.
- B. Piping shall be located substantially as shown. The ENGINEER reserves the right to make such modifications in locations as may be found desirable to avoid interference between pipes or for other reasons. Pipe fitting notation is for the CONTRACTOR'S convenience and does not relieve him from laying and jointing different or additional items where required without additional compensation.
- C. Wherever the word pipe or piping is used it shall mean pipe and fittings unless otherwise noted.
- D. All references to Standards/Specifications shall mean the latest revision.

1.02 RELATED WORK

- A. Trenching, backfilling and compacting are included in this Division, Section 02200.
- B. Concrete is included in Division 3, Section 03300.

1.03 DESCRIPTION OF SYSTEM

- A. Piping shall be installed substantially as shown on the Drawings so as to form a complete smooth flow path and workable system.
- B. The piping and materials specified herein are intended to be standard types of pipe for use in transporting the fluids as indicated on the Drawings. The pipe and fittings shall be designed, constructed, and installed in accordance with the best practices and methods and the manufacturer's recommendations.

1.04 QUALIFICATIONS

- A. All pipe and fittings under this section shall be furnished by manufacturers who are fully experienced, qualified, and regularly engaged in the manufacture of the materials to be furnished.

1.05 SUBMITTALS

- A. The CONTRACTOR shall submit to the ENGINEER for review in accordance with Division 1, Section 01300, complete sets of shop drawings showing layout and details of materials, joints and methods of construction and installation of the pipe, specials and fittings required.
- B. Before fabrication and/or shipping of the pipe is begun, the CONTRACTOR shall submit for approval a schedule of pipe lengths for the entire job. All pipe furnished under the Contract shall be fabricated in full accordance with the approved Drawings.

1.06 INSPECTION

- A. The manufacturer shall inspect all pipe joints for out-of-roundness and pipe ends for squareness. The manufacturer shall furnish to the ENGINEER a notarized affidavit stating all pipe meets the requirements of applicable ASTM Specifications, these Specifications, and the joint design with respect to square ends and out-of-round joint surfaces.

PART 2 PRODUCTS

2.01 DUCTILE IRON PIPE

- A. General
 - 1. Ductile iron pipe shall be centrifugally cast of ductile iron conforming to ASTM Specifications A 746 latest revision. The pipe design conditions shall be as follows:
 - a. Pressure: Minimum of 250 psi operating plus 100 psi surge allowance.
 - b. Trench Loading: Laying condition Type 4 unless otherwise specified on Drawings. Trench depth not less than 2' nor more than that shown on the Drawings.
 - c. Metal Design Strengths:

Bursting Tensile	40,000 psi
Modulus of Rupture	90,000 psi
 - 2. The manufacturing tolerances included in the nominal thickness shall not be less than specified by ANSI/AWWA C150/A21.50, latest revision.
 - 3. Minimum wall thickness shall be 0.33 inches (Class 52), or more if required for minimum operating pressure of 250 psi.
 - 4. Pipe may be furnished in 18', or 20' nominal laying lengths; and the weight of any single pipe shall not be less than the tabulated

weight by more than 5 percent for pipe 12" or smaller in diameter, nor by more than 4 percent for pipe larger than 12" in diameter.

5. The hydrostatic and acceptance tests for the physical characteristics of the pipe shall be as specified in ANSI/AWWA C151/A21.51, latest revision.
6. Any pipe not meeting the ANSI/AWWA specifications quotes above shall be rejected in accordance with the procedure outlined in the particular specification.
7. The ENGINEER shall be provided with 3 copies of a certification by the manufacturer that the pipe supplied for this Contract has been tested in accordance with the referenced specifications and is in compliance therewith.
8. The net weight, class or nominal thickness and sampling period shall be marked on each pipe. The pipe shall also be marked to show that it is ductile iron.
9. Unless otherwise noted, joints for ductile iron pipe will be "push-on" type consisting of a rubber gasket installed in a recess in the bell.
10. Ductile iron pipe must be used within 200 feet of underground petroleum storage tanks and shall have gaskets designed for this purpose such as Nitrile Butadiene (NBR), approved equal or better.

B. Lining and Coating Ductile Iron Pipe

1. All buried ductile iron pipe shall have manufacturer's outside coal tar or asphaltic base coating and a cement lining and bituminous seal coat on the inside. Cement mortar lining and bituminous seal coat inside shall conform to ANSI/AWWA C104/A21.4 latest revision.

C. Fittings for Ductile Iron Pipe-3" and larger

1. Ductile Iron fittings only shall be used with the ductile iron pipe.
2. Mechanical joint fittings shall be used with underground pipe.
3. Rubber-gasket joints shall conform to ANSI/AWWA C111/A21.11 latest revision for centrifugally cast ductile iron water pipe.
4. All Working Pressures - Fittings shall conform to ANSI/AWWA Specifications C110/A21.10 latest revision for 250 psi water working pressure plus water hammer. Ductile iron fittings shall be ductile cast iron per ASTM Specifications A536, latest revision.

5. All fittings shall be cement lined and bituminous coated per Federal Specifications WW-P-421b.

D. Ductile Iron Pipe and Fittings - Smaller than 3"

1. Small size ductile iron pipe shall conform to ANSI Specifications A21.12 (AWWA C 112) latest revision. Fittings shall conform to ANSI Specifications A21.10 (AWWA C 110) latest revision.
2. Pipe may be furnished with either mechanical joints or slip-on joints. Buried fittings shall be furnished with mechanical joints.

E. Flanged Cast Iron Pipe and Flanged Coupling Adapters for Flexible Couplings

1. Non-buried ductile iron pipe and fittings shall be flanged unless otherwise specified.
2. Flanged cast iron pipe and fittings shall have dimensions facing and drilling for ANSI Class 125 flanges (125 psi steam working pressure; 250 psi water working pressure).
3. Where flanges are pit cast integrally with pipe in vertical position in dry sand molds, flanged pipe shall be AWWA Class "B" or latest revision of ANSI Specifications A21.2, Class 50 pipe for sewage, sludge, gas and air service and Class 150 pipe for all types of water service.
4. Where flanged pipe is made up by threading plain end, centrifugally cast pipe, screwing on specially designed long hub flanges, and refacing across both the face of the flange and the end of pipe, flange shall be per ANSI Specification B16.1 latest revision and pipe shall be Class 150 per ANSI Specification A21.6 latest revision.
5. Either of the foregoing methods of manufacture of flanged pipe will be acceptable, but when plain ends of flanged pipe are to fit into mechanical joint bells, then the outside diameter of the pipe shall be such that the joint can be made.
6. CBS (rubber and cloth both sides) gaskets 1/16" in thickness shall be used in connecting flanged piping. Nuts and bolts for use in making flanged connections shall have hexagonal heads, be of proper lengths and with U.S. standard threads. The tensile strength of steel used in the bolts shall be not less than 55,000 psi.
7. Flanged Coupling Adapters for flanged pipe shall be a mechanical joint cast to a special flanged joint using a neoprene "O-ring", in place of the usual 1/16" rubber ring gasket. The mechanical bell and special flanged joint piece shall be of high grade gray cast iron with bolt circle, bolt size and spacing conforming to ASA B16.1

Specifications latest revision. Mechanical joint follower flange shall be of ductile or malleable iron with high strength/weight ratio design. Bolts shall be fine grained, high tensile, malleable iron with malleable iron hexagon nuts.

8. Flanged Coupling Adapters for 12" and smaller cast iron pipe shall be Smith-Blair #912; Dresser style 127; or approved equal. For pipe larger than 12", flexible couplings shall be Smith-Blair #913; Dresser style 128; or approved equal. All flexible couplings shall be furnished with anchor studs.

F. Mechanical Joint Restraints

1. Gland body, wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536.
2. Ductile iron gripping wedges shall be heat treated within a range of 370 to 470 BHN.
3. Three (3) test bars shall be incrementally poured per production shift as per Underwriter's Laboratory (U.L.) specifications and ASTM A536. Testing for tensile, yield and elongation shall be done in accordance with ASTM E8.
4. Chemical and nodularity tests shall be performed as recommended by the Ductile Iron Society, on a per ladle basis.

2.02 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. PVC pipe shall comply with ASTM D01784 and shall be Type 1, Grade 1, with pressure and SDR rating as shown on the drawings or indicated in the proposal form. All PVC pipe shall conform to the latest revisions of the following specifications:

ASTM D2241 (PVC plastic pipe SDR-PR and Class T)
Commercial Standard CS 256 (pressure rated type)
National Sanitation Foundation Testing Laboratories (NSF)

- B. The name of the manufacturer of the plastic pipe to be used must be found on the current listing of Plastic Materials for Potable Water Application, published by the NSF (National Sanitation Foundation), Ann Arbor, Michigan, and must meet the requirements of the Standard Specifications for Polyvinyl Chloride (PVC) Plastic Pipe, D1785, published by ASTM (American Society for Testing and Materials).
- C. Pipe lengths shall not exceed 40 feet. Wall thickness shall be in accordance with CS-256 and ASTM D-2241. Pipe ends shall be beveled to accept the gasketed coupling. Rubber gasketing shall conform to ASTM 1869.

- D. Samples of pipe, physical and chemical data sheets shall be submitted to the ENGINEER for approval and his approval shall be obtained before pipe is purchased. The pipe shall be homogenous throughout and free from cracks, holes, foreign inclusions or other defects. The pipe shall be as uniform as commercially practical in color. Pipe shall have a ring painted around spigot ends in such a manner as to allow field checking of setting depth of pipe in the socket.
- E. Pipe must be delivered to the job site by means which will adequately support it, and not subject it to undue stresses. In particular, the load shall be so supported that the bottom rows of pipe are not damaged by crushing. Pipe shall be unloaded carefully and strung or stored as close to the final point of placement as is practical.
- F. The couplings and fittings shall be furnished by the pipe manufacturer and shall accommodate the pipe for which they are to be used. They shall have a minimum pressure rating of 200 psi. Insertion depth of the pipe in the coupling shall be controlled by an internal PVC mechanical stop in the coupling which will allow for a thermal expansion and contraction. Couplings method shall allow for half of each end of the pipe. Couplings shall permit 5 degree deflection (2-1/2 degrees each side) of the pipe without any evidence of infiltration, cracking or breaking. Couplings shall have rubber seals factory installed.
- G. Pipe markings shall include the following, marked continuously down the length:
 - Manufacturer's Name
 - Nominal Size
 - Class Pressure Rating
 - PVC 1120
 - NSF Logo, and
 - Identification Code
- H. Lubricant shall be water soluble, nontoxic, be non-objectionable in taste and odor imparted to the fluid, be non-supporting of bacteria growth and have no deteriorating effect on the PVC or rubber gaskets.

2.03 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS (SCHEDULE 80)

A. General

Schedule 80 PVC pipe shall be as manufactured by the Celanese Piping Systems, Inc., or approved equal. To ensure installation uniformity, all piping system components shall be the products of one manufacturer.

B. Materials

- 1. Pipe and fittings shall be manufactured from a PVC compound which meets the requirements of Type 1, Grade 1 polyvinyl chloride as outlined in ASTM D-1784. A Type 1, Grade 1

compound is characterized as having the highest requirements for mechanical properties and chemical resistance. Fittings shall be socket type and shall conform to the requirements of ASTM D-2467.

2. Compound from which pipe is produced shall have a design stress rating of 200 psi at 73° F., listed by the Plastics Pipe Institute (PPI).
3. Materials from which pipe and fittings are manufactured shall have been tested and approved for conveying potable water by the National Sanitation Foundation (NSF).

C. Solvent Cement

All socket type connections shall be joined with PVC solvent cement complying to ASTM D-2564. Cement shall have a minimum viscosity of 2000 cps.

D. Installation

Installation shall be in strict accordance with the manufacturer's printed instructions. Printed installation instructions shall be submitted and approved by the ENGINEER prior to shipment of the pipe.

E. Testing

1. Pressure Pipe - Refer to Paragraph 3.02 of this Division.
2. Vacuum Pipe - All pipe intended for use under partial vacuum shall be tested by subjection to 24 inches of mercury vacuum; allowing 15 minutes to stabilize and thereafter lose not more than 1% vacuum pressure per hour over a minimum 4 hour test period. This test must be met or exceed prior to final acceptance.

2.04 HIGH DENSITY POLYETHYLENE PIPE

A. General

1. High density polyethylene pipe shall be Adyl "D" polyethylene pipe manufactured by E.I. DuPont DeNemours and Co., Inc., or "Driscopipe" as manufactured by Phillips Product Co., Inc., or approved equal.

B. Materials for Polyethylene Pipe

1. The polyethylene pipe and fittings shall be made of polyethylene resins classified in ASTM D 1248 as Type III, Category 5, Grade P34 (pipe designation PE 3408 defined per ASTM D 3035 latest revision), having specific base resin densities of 0.942 g/cc minimum and 0.955 g/cc maximum, respectively; and having melt

indexes of 0.4 g/10 min. maximum and 0.15 g/0.10 min. minimum, respectively.

2. Pipe made from these resins must have a long-term strength rating of 1,600 psi or more.
3. The polyethylene resin shall contain antioxidants and shall be stabilized with carbon black against ultra-violet degradation to provide protection during processing and subsequent weather exposure.
4. The polyethylene resin compound shall have a resistance to environmental stress cracking as determined by the procedure detailed in ASTM D 16930 latest revision, Condition B with sample preparation by procedure C of not less than 200 hours.

C. Polyethylene Pipe and Fittings

1. Polyethylene pipe furnished and installed under this Contract shall be of nominal outside diameter shown on the Drawings, and shall be designed for a normal internal working pressure and earth cover over top of the pipe to suit the conditions of proposed use.
2. Each length of pipe shall be marked, at no more than 10 foot intervals, with the following information:

Nominal pipe size
Type plastic material - PE3408
Pipe pressure rating
Manufacturer's name, trademark and code

3. All pipe shall be made from virgin material. No rework compound.
4. Pipe shall be homogenous throughout, and be free of visible cracks, holes, foreign material, blisters, or other deleterious faults.
5. Fittings for the polyethylene pipe line shall be molded for fabricated from the same material as specified hereinbefore for the high density polyethylene pipe.
6. Fittings for bends 22-1/2 degrees or greater shall be provided as shown on the Drawings. For alignment changes of less than 20 degrees deflection, the pipe may be laid in curves with a radius of 80 feet or greater.
7. All run-of-the-pipe fittings shall be fusion welded into the pipe line. Tee branches shall be of the size shown on the Drawings and shall be furnished with flanged ends per ANSI B-16.1. All fittings shall be factory made.
8. Fittings shall be capable of withstanding the same pressure and loading conditions specified for the pipe.

9. Wye Branches shall be true wyes.

D. Pipe Jointing

1. Pipe to be joined by leak-proof, thermal, butt fusion joints. All fusion must be done by personnel trained by the pipe supplier using tools approved by the pipe supplier.
2. The fusion machine shall have hydraulic pressure control for fusing 2 pipe ends together; it shall include pressure fusion indicating gauges to correctly monitor fusion pressures. The machines shall be equipped with an electric or gasoline engine powered facing unit to trim irregularities from the pipe ends. The heating plate on the fusion machine shall be electrically heated and thermostatically controlled and shall contain a temperature gauge for monitoring temperature.
3. Joint strength must be equal to that of adjacent pipe as demonstrated by tensile test. In addition, results of tensile impact testing of joint should indicate a ductile rather than a brittle fracture. External appearance of fusion bead should be smooth without significant juncture groove.
4. Threaded or solvent cement joints and connections are not permitted.

E. Joining, Terminating or Adapting by Mechanical Means

1. The polyethylene pipe shall be connected to systems or fittings of other materials by means of an assembly consisting of a polyethylene flange adapter butt-fused to the pipe, a backup ring of either cast iron, steel, or high silica aluminum alloy made to ANSI B-16.1 dimensional standards (with modified pressure ratings), bolts of compatible material (insulated from the fittings where necessary) and a gasket of reinforced black rubber, asbestos-rubber compound or other material approved by the ENGINEER, cut to fit the joint. In all cases, the bolts shall be drawn up evenly and in line.
2. Termination of valves, or fittings such as tees, bonds, etc., made of other materials shall be by the flange assemblies specified hereinbefore. The pipe adjacent to these joints and to joints themselves must be rigidly supported for a distance of one pipe diameter or 1 foot, whichever is greater, beyond the flange assembly.

F. Tools and Procedures

1. Fusion jointing and other procedures necessary for correct assembly of the polyethylene pipe and fittings will be done only by personnel trained in those skills by the pipe supplier.
2. Only those tools designed for aforementioned procedures and approved by the pipe supplier shall be used for assembly of pipe and fittings to ensure proper installation.

2.05 COPPER PIPE AND FITTINGS

- A. Exterior copper pipe shall be Type K pipe (ASTM B88 latest revision), with compression fittings. Joints shall be drawn up firmly and shall be tested before backfilling and any leakage stopped.
- B. Wherever copper pipes pass through walls or floors, they shall have wrought or cast iron sleeves, for easy removal. Pipes passing through structural beams shall be placed as near as possible to the top of the beam under the floor slab.

2.06 UNDERGROUND UTILITY WARNING TAPES

- A. Non-metallic underground utility warning tapes shall be installed 12" above all buried pipe.
- B. The tape shall a pigmented polyolefin film with a printed message on one side that is impervious to all known alkalis, acids, chemical reagents and solvents found in the soil.
- C. The minimum overall thickness of the tape shall be 4.0 mils and the width shall not be less than 3" and a minimum unit length of 1000 ft/roll. The tape shall be color coded and imprinted with the message as follows:

Type of Utility	Color Code	Legends
Water	Safety Precaution Blue	Caution Buried Water Line Below
Sewer	Safety Green	Caution Buried Sewer Line Below

- D. Underground marking tape shall be "Terra Tape" as manufactured by Reef Industries, or approved equal.
- E. Installation of marking tapes shall be per manufacturer's recommendations and shall be as close to the grade as is practical for optimum protection and detectability. Allow a minimum of 18" between the tape and the line.

- F. Payment for detectable tapes shall be included in the linear foot price BID of the piping BID item(s).

2.07 DETECTABLE TRACER WIRE AND FLEXIBLE PIPELINE MARKERS

10 gauge, single strand TRACER WIRE shall be placed directly on top of all PIPE and shall be attached to the pipe at 5 ft intervals maximum. Tracer wire segments shall be 800 feet maximum and shall terminate at each air release valve manhole, or a structure the same as a valve box. Contractor shall leave three feet of coiled slack at each termination point.

A FLEXIBLE FIBER REINFORCED flat composite pipeline marker shall be installed above the pipe approximately every 2000 feet at a location designated by the ENGINEER.

The marker shall be manufactured of a fiber reinforced composite material. The reinforcement material shall be comprised of both lineal strands and horizontal mesh mats. The marker post must be flat in shape with rails on both sides. Marker shall be at least 3 3/4" wide. A 2 7/8" wide decal must fit on each side of the marker. The back side of the post shall have a rounded rib down the center and two small ribs on the sides to act as guides for the decals. Decals will be placed on both sides to ensure that a warning message can be seen from both directions.

The marker shall be capable of withstanding a minimum of 10 vehicle impacts at 55 M.P.H. with a car bumper.

The marker shall be coated with a coloring which matches the color of the post. The coating shall totally stop ultraviolet light from reaching the resin portion of the post. The coating shall not fade, peel, or blister after a minimum of 2,000 hours in a QUV Weatherometer.

Red – Electric	Orange - Communication
Yellow – Gas	Blue – Potable Water
Green – Sewer	Purple – Reclaimed water

The marker post shall remain flexible from -40° F to +140° F.

Decals shall be fade resistant and remain legible after a minimum of 2,000 hours in a QUV Weatherometer. Decal graphics shall include the international DoD Dig symbol. Decals shall be placed on both sides of the post.

Marker shall be Rhino brand, or approved equal.

PART 3 EXECUTION

3.01 LAYING PIPE IN COMMON TRENCH

- A. Pipelines, force mains and sewers laid in same trench shall, in all cases, be laid on original earth, regardless of divergence in their elevations. Pipe shall never be laid in backfill or one above the other. The CONTRACTOR shall include payment for all trenching and backfilling in his lump sum bid.

3.02 PRESSURE PIPE INSTALLATION - GENERAL

A. General

1. Pipe shall be handled with such care as necessary to prevent damage during installation. The interior of the pipe shall be kept clean and the pipe shall be installed to the lines and grades shown on the Drawings. Pipe shall be installed according to instructions and with tools recommended by the manufacturer. Whenever pipe laying is stopped, the end of the pipe shall be securely plugged or capped.
2. Ductile Iron fittings only shall be used with the PVC pipe.
3. Mechanical joint fittings shall be used with underground pipe.
4. Fittings less than 4-inches in diameter shall be of the mechanical joint type and be firmly blocked to original earth or rock to prevent water pressure from springing pipe sideward or upward. Concrete or other blocking material approved by the ENGINEER shall be placed such that it does not cover the pipe joints, nuts, and bolts.
5. Fittings 4-inches in diameter and greater shall be of the mechanical joint type and firmly restrained to prevent water pressure from springing pipe sideward or upward. The mechanical restraint shall be the Series 2000PV produced by EBAA Iron, Inc. or approved equal.
6. Pipes shall be free of all structures other than those planned. Openings and joints to concrete walls shall be constructed as shown on the Drawings.
7. Ductile iron or steel pressure pipe, 4 inch diameter or larger, entering a structure below original earth level, unsupported by original earth for a distance of more than 6 feet shall be supported by Class "2500" concrete, where depth of such support does not exceed 3 feet, and by Class "4000" concrete piers each 6 feet, where depth exceeds 3 feet. All other pressure pipe entering buildings or basins below original earth and having a cover of more than 24 inches of earth, or under roadway, shall be supported as shown in detail on the Drawings. All piers required will be paid for in accordance with the appropriate specification hereinbefore. Class "2500" concrete required will be included in the payment for furnishing and laying the particular pipe, in order to discourage excessive excavation outside the limits of structures. Pipes entering structures shall have flexible joint within 18 inches of exterior of structure, and also from point of leaving concrete support to original earth or crushed stone bedding.

B. Pressure Pipe Laying

1. Pressure pipe shall first be thoroughly cleaned at joints, then joined according to instructions and with tools recommended by the manufacturer. A copy of such instructions shall be available at all times at the site of the work.
2. All pipes must be forced and held together, or "homed" at the joints, before sealing ground level and unsupported by original earth for a distance of more than 6 feet shall be supported by concrete to original ground where depth of such support does not exceed 3 feet. When depth exceeds 3 feet, beams with piers shall be used for support.
3. Trench excavation for pipe laying must be of sufficient width to allow the proper jointing and alignment of the pipe. Trenches in earth or rock shall be dug deep enough to ensure 30" minimum cover over top of the pipe, unless otherwise indicated on the Drawings.
4. Trench line stations shall be set ahead of the trenching at least each 100 feet of pipeline. Trenches shall be dug true to alignment of stakes. Alignment of trenches or pipes in trench must not be changed to pass around obstacles such as poles, fences and other evident obstructions without the approval of the ENGINEER. Lines will be laid out to avoid obstacles as far as possible, consistent with maintenance of alignment necessary to finding the pipeline in the future and avoiding obstruction of future utilities and structures.
5. Cut pieces of pressure pipe 18" or more in length may be used in fitting to the specials and valves and fitting changes in grade and alignment. Cut ends shall be even enough to make first class joints.

C. Testing Pressure Pipe

1. Pressure and leakage tests shall be conducted in accordance with ANSI/AWWA C600.
2. The CONTRACTOR shall furnish all necessary equipment for pressure testing.
3. Inspection of pipe laying shall in no way relieve the CONTRACTOR of the responsibility for passing tests, stopping leakage, or correcting poor workmanship.
4. Underground pipelines will not be finally accepted until leakage is less than allowable by ANSI/AWWA C600. In case leakage exceeds this amount, the CONTRACTOR shall locate and repair leaks until the entire pipeline will pass the required test. All

leakage shall be stopped in exposed piping. The pumping equipment shall be disconnected during test.

5. The CONTRACTOR shall furnish meter or suction tank, pipe test plugs and bypassing piping and make all connections for conducting the above tests. The pumping equipment used shall be compressed air, centrifugal pump or other pumping equipment which will not place shock pressures on the pipeline. Power plunger pumps will not be permitted or us on closed pipe system for any purpose.

3.03 DUCTILE IRON PIPE INSTALLATION

- A. Pipe shall be handled with such care as necessary to prevent damage during installation. The interior of the pipe shall be kept clean and the pipe shall be laid to the lines and grades shown on the Drawings and/or as established by the ENGINEER.
- B. Whenever pipe laying is stopped, the end of the pipe shall be securely plugged or capped. Care should be taken to prevent flotation of pipe in the event the trench should flood.
- C. Fitting shall be firmly blocked to original earth or rock to prevent water pressure from springing pipe sideward or upward. Concrete or other blocking material shall be placed such that it does not cover the pipe joints, nuts and bolts.
- D. Pipes shall be free of all structures other than those planned. Openings and joints to concrete walls shall be constructed as shown on the Drawings. Any cast iron pipe entering a structure below original ground level and unsupported by original earth for a distance of more than 6 feet shall be supported by concrete to original ground where depth of such support does not exceed 3 feet. When depth exceeds 3 feet, beams with piers shall be used for support.
- E. All pipes entering buildings or basins below original earth level, which have less than 6 feet span between wall and original earth and having a cover of more than 24 inches of earth, or under roadway, must be adequately supported as approved by the ENGINEER or shown on the Drawings. All such supports are to be included in the contract price and no extra payment will be made for same.
- F. Pipes entering structures shall have a flexible joint within 18" of exterior of structure, or from point of leaving concrete support to original earth or rock bedding.
- G. Cast iron pipe shall be thoroughly cleaned at joints, then joined according to instructions and with tools recommended by the manufacturer.
- H. All pipes must be forced and held together, or "homed" at the joints, before sealing or bolting. Pipe must be aligned as each joint is placed, so

as to obtain straight lines and grades. Curves and changes in grades shall be laid in such a manner that maximum allowable joint deflection is not exceeded.

- I. Cut pieces of cast iron pipe 18" or more in length, may be used in connecting valves and fittings and for changes in grade and alignment. Cut ends shall be even enough to make first class joints.
- J. Sufficient excavation for bell holes will be required for tightening of bolts. No pipe shall be laid resting on rock, blocking, or other unyielding objects except where laid above ground on piers or in permanent tunnels.

3.05 HIGH DENSITY POLYETHYLENE PIPE INSTALLATION

A. General

- 1. High density polyethylene pipe shall be installed in strict accordance with the manufacturer's recommendations and these Specifications.
- 2. The CONTRACTOR shall have the manufacturer furnish all necessary technical assistance, installation instruction and jointing supervision required to ensure that the pipe is properly installed. The CONTRACTOR shall furnish the services of a technical representative of the manufacturer to supervise the joining, bedding, laying and backfilling of at least the first 200 feet of pipe.
- 3. Upon satisfactory completion of the initial jointing, bedding, laying and backfilling of the first 300 feet of pipe, the CONTRACTOR shall furnish the ENGINEER a written statement from the manufacturer's technical representative certifying that he has witnessed the work in progress and approves the techniques being used and the results obtained by the CONTRACTOR.
- 4. The manufacturer's technical representative shall have had previous experience with similar work, and be fully qualified to supervise and demonstrate proper procedures for jointing and laying the high density polyethylene pipe.

B. Bedding

- 1. The laying condition for the high density polyethylene pipe will be on a 6" pad of loose soil with mechanically compacted earth (to a 90 percent of maximum density as determined by Standard Proctor density test) to the centerline of the pipe.
- 2. At the CONTRACTOR'S option, he may substitute a 6" pad of No. 8 crushed stone below the bottom of the pipe and backfill to the centerline of the pie with No. 8 crushed stone.

C. Grade and Alignment

1. Polyethylene pipe shall be laid to predetermined grades and lines as indicated by the Contract Drawings. Grade lines shall be established either by means of offset grade stakes or by direct levels.

3.06 INSTALLING FLANGED OR THREADED PIPE AND FITTINGS

- A. The CONTRACTOR shall clean off all rust and dirt and paint all threads with red lead, before assembling, and the pipe shall be installed with flanges and pipes plumb and level, showing no leakage. Unions shall be included in threaded pipe runs to allow for easy removal of pipes. All valve operating devices shall be in locations and of types shown on the Drawings. They shall be accurately plumbed, leveled, supported and braced for smooth operation. Flanged joints shall be assembled with appropriate flanges, gaskets, and bolting. The clearance between flange faces shall be such that the connections can be gasketed and bolted tight without imposing undue strain on the piping system. Flange faces shall be parallel and the bores concentric; gaskets shall be centered on the flange faces so as not to project into the bore. Bolting shall be lubricated before assembly to ensure uniform bolt stressing. The flange bolts shall be drawn up and tightened in staggered sequence in order to prevent unequal gasket flange spacing. When a raised face is joined to a companion flange with a flat face, the raised face shall be machined down to a smooth matching surface and a full face gasket shall be used.

3.08 PVC PIPE INSTALLATION

PVC pipe shall be installed in accordance with the manufacturer's instructions and the "General" provisions under 3.01 and 3.02 in this Section.

3.09 STERILIZATION OF POTABLE WATER PIPE

- A. Upon completion of the work and cleaning up, and prior to final acceptance, the CONTRACTOR shall sterilize all new distribution system improvements which will be in contact with drinking water, including potable water pipe and connections thereto (including pumps and pump piping).
- B. Sterilization shall be accomplished by filling the facilities with water containing at least fifty (50) parts per million available chlorine utilizing a contact time of 24 hours. A residual of at least 25 parts per million, at the end of the 24 hour contact time, is required. No portion of the new work shall be placed in service prior to sterilization. At the end of the sterilization period, all sterilized surfaces and areas shall be thoroughly flushed with treated water and drained from the system, as directed by the OWNER.
- C. CONTRACTOR shall make an allowance in his bid to cover cost of filling the new water mains. The CONTRACTOR shall be billed for all water used for the construction and testing at a rate equal to the rate that the OWNER must pay the supplier.
- D. CONTRACTOR will be responsible for notifying the Health Department to observe sterilization test and shall be responsible for all sampling, including coordination, mailing and retesting, if required.

3.10 Testing Waterline Pipe

- 1. Pressure and leakage tests shall be conducted in accordance with ANSI/AWWA C600.
- 2. The CONTRACTOR shall furnish all necessary equipment for pressure testing.
- 3. Inspection of pipe laying shall in no way relieve the CONTRACTOR of the responsibility for passing tests, stopping leakage, or correcting poor workmanship.
- 4. The piping shall be complete, and thrust blocks shall have been in place for less than 10 days prior to be tested.
- 5. Piping shall be tested at a static pressure of 150 pounds per square inch over a period of not less than eight consecutive hours. The test will be considered successful when the pressure drop

over the test period is 5 psi or less. If the pressure drop exceeds 5 psi, repair the leaks and repeat the test. After repairs have been made the test shall be conducted, again. Piping will be accepted once pressure loss does not exceed 5 psi.

6. Underground pipelines will not be finally accepted until leakage is less than allowable by ANSI/AWWA C600. In case leakage exceeds this amount, the CONTRACTOR shall locate and repair leaks until the entire pipeline will pass the required test. All leakage shall be stopped in exposed piping. The pumping equipment shall be disconnected during test. Allowable leakage is calculated by the following:

L: Allowable leakage, gallons per hour
S: Length of pipe, feet
D: Nominal diameter, inches
P: Average test pressure, psi

$$L = \frac{(SD\sqrt{P})}{133,200}$$

7. The CONTRACTOR shall furnish meter or suction tank, pressure recorder, pressure gauges, pipe test plugs and bypassing piping and make all connections for conducting the above tests. The pumping equipment used shall be compressed air, centrifugal pump or other pumping equipment which will not place shock pressures on the pipeline. Power plunger pumps will not be permitted or used on closed pipe system for any purpose.

3.10 BASIS FOR PAYMENT

Piping shall be paid for at the unit price bid or lump sum bid and shall include all work incidental to making a complete installation such as excavation, bedding, backfill, painting, testing, disinfection, cleanup, seeding, paving, etc.

END OF SECTION

SECTION 02640

METERS, INDIVIDUAL PRESSURE REDUCING VALVES, AND SERVICE LINES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section describes the service meters, individual pressure reducing valves, and service lines to be provided, their materials, construction, type, and installation.
- B. All meters shown on the plan sheets shall be 5/8 inch by 3/4 inch, unless otherwise noted.
- C. All meters and appurtenances shall be compatible with the OWNERS existing Radio Read System as shown in Section 11500 of these Specifications.

PART 2 PRODUCTS

In order to provide continuity in materials the Breathitt County Water District requires the following materials to be used for their projects.

Saddles	Mueller H-16000
Corp Stop	Mueller H-15000
Setter (Yoke)	Mueller H-1400 w/ meter stop
Lid	Ford HDPE pmhc-3-br lockable lid
Meter	Badger Recordall Model 25 w/ Orion Radio Read
IPRV	Wilkins 600

2.01 INDIVIDUAL PRESSURE REDUCING VALVES

- A. Individual pressure reducing valves shall be installed with service meters where shown on the plan sheets.
- B. Individual pressure reducing valves shall include a bronze strainer. Every regulator shall have an adjustable pressure range of 50 to 125 pounds per square inch. Upon installation, the outlet pressure shall be set at 65 pounds per square inch.
- C. Individual pressure reducing valves shall be installed on the inlet/supply side of the service meter using a tandem copper setter. The CONTRACTOR shall ensure the meter boxes proposed for installation will accommodate the tandem copper setter, reducing valve and service meter.

- D. The reducing valve shall not be buried or otherwise housed outside the meter box.

2.02 METERS

A. SERVICE METER ASSEMBLY

1. Service meters to be furnished under this Contract shall be cold water rotating disc type with hermetically sealed and magnetically driven registers. Meters shall be first-line quality of the manufacturer and be in compliance with AWWA Standard C700, or latest revisions. Any type or make of meter supplied must have been manufactured and marketed in the U.S.A. for at least five (5) years. A bond may be submitted to waive this experience clause. The bond, if needed, shall be of an amount adequate for replacement of the meters and shall be held for five (5) years.
2. The main case shall be high grade waterworks bronze, with hinged, single lid cover and raised characters cast on them to indicate the direction of flow. Each meter must have the manufacturer's serial number stamped on the lid. Working pressure shall be not less than 150 pounds per square inch. Standard frost bottom meters with non-ferrous strainers snug against the main case shall be provided.
3. The measuring chamber shall be of corrosion-resistant thermoplastic material. The chamber shall be of the two piece design, equipped with a disc made of hard rubber and as near to the specific gravity of water as possible. Discs shall be of the three piece design of the thrust roller type.
4. The register shall be straight reading U.S. gallon type. The register unit shall be completely encased and hermetically sealed, and driven by permanent magnets. There shall be a test index circle, divided into 100 equal parts, and shall have a red center sweep test hand. Registers shall be guaranteed by the manufacturer for a period of at least fifteen (15) years.
5. New Service Meters shall include meter box and cover, meter, copper setter, four feet (4') of pipe and corporation stop, plus six feet (6') of pipe and adapter on the customer's side of meter. (This latter item is to prevent the customer or his plumber from disarranging or loosening the meter after the CONTRACTOR has already set the meter in its proper position.) Where the main line is in the highway right-of-way, meter shall be set as close to the right-of-way fence as practicable, but no meter on the same side of the road as the main line shall be set with more than ten feet (10') of service line unless prior approval has been obtained from the ENGINEER or his representative.

6. Meters shall be installed at each service connection unless directed otherwise by the ENGINEER. Meter boxes shall be concrete or PVC pipe twenty-four inches (24") deep. The box shall be twenty inches (20") in diameter. Meter box cover shall be eleven and one-half inches (11 1/2") diameter by four inches (4") deep. Meters shall be five-eighths inch by three-fourths inch (5/8" x 3/4"), unless shown otherwise on the plans. Meter connections shall be made by means of copper setters having a cutoff and three-fourths inch (3/4") spud. When shown on the plans (Standard Details) an angle check valve shall be furnished on the meter outlet side of the copper setter. (The size of meter box stated is for five-eighths inch by three-fourths inch (5/8" x 3/4") meter. For larger meters, meter box size shall be in accordance with standard practice). Alternative boxes may be considered upon submittal of shop drawings and performance data.
7. Meters shall be set in a workmanlike manner with backfill neatly compacted in place. In yards, pastures and other grassed areas, top of meter box will be one-half inch (1/2") above grade, otherwise two inches (2") above grade.

2.03 SERVICE LINES

- A. Unless indicated otherwise on the plans, all service lines shall be three quarter inch (3/4-inch) 250 psi Polyethylene tubing. A generous loop of Polyethylene tubing shall be included with the length required for the meter setting. A corporation stop shall be used on each service line at the main line connection.
- B. Service lines crossing a county road or city street will be jacked beneath paved or black topped city streets or county roads, unless rock prevents using this method. Open cut shall be used on all unpaved city streets, county roads and private driveways. Black topped private driveways shall also be jacked under. In all cases where lines are under traffic, a minimum cover of thirty inches (30") shall be provided. All backfill shall be puddled or compacted by air tampers in layers no greater than six inches (6") in depth.
- C. Existing service meters shall be disconnected from existing water mains where indicated, and shall be reconnected to the new line. This work shall include up to thirty (30) lineal feet of matching type/diameter service line in the unit price bid for meter reconnection. Compression couplings with inserts shall be used to reconnect flexible (plastic) service line and sweat joints used for copper service line.

END OF SECTION

SECTION 02900

LANDSCAPING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Landscape development work in this phase is generally limited to seeding and sodding.

1.02 RELATED WORK

- A. Sub-grade elevations, excavation, filling, and grading required to establish elevations shown on Drawings are not specified in this Section. Refer to this Division, Section 02200.
- B. Erosion and sediment control are included in this Division, Section 02270.

1.03 SCOPE OF WORK

- A. Sod shall be placed on all slopes steeper than 3:1 except for dam embankment slopes. All other surfaces including dam embankment slopes shall be fertilized and seeded as specified hereinafter, except for those surfaces to be paved or rip-rapped.
- B. Fertilizing and seeding shall be performed on all disturbed areas within the limits of work of this contract which are not specified to be sodded and are not occupied by structures, road, concrete slab walls, etc. or within the impoundment area.

PART 2 PRODUCTS

2.01 QUALITY OF SOD

- A. Sod shall be well-rooted Kentucky Blue Grass sod or other approved pasture sod, completely free from noxious weeds, and reasonably free from objectionable grasses, weeds and stones or other foreign materials. The source of the sod shall be available for inspection and approval by the ENGINEER prior to stripping.
- B. Sections of sod stripped may vary in length not to exceed 8 feet but shall be of uniform width of not less than 10 inches nor more than 18 inches, and shall be cut to a depth of not less than 1 inch and not more than 2 inches. The above widths and lengths are required to ensure proper handling without undue tearing and breaking. Sod from light sand or heavy clay will not be accepted. When cut in strips, the sod shall be rolled

with the grass folded inside. The sod shall be cut by means of an approved mechanical sod cutter. During dry weather, the sod shall be watered before stripping to ensure its vitality and to prevent the loss of soil from the roots. Sod shall be rejected if permitted to decay or dry out to the extent that, in the judgment of the ENGINEER, its survival is doubtful.

2.02 PLACING SOD

- A. The sod bed shall be shaped to a smooth even surface and shall be graded such that the sod, when in place, shall be flush with any adjacent turfed area, pavement or other structures, except when otherwise directed by the ENGINEER. Prior to placing of the sod, fertilizer (10-20-10 - Ratio - 25 lbs. per one thousand square feet), Agricultural Limestone (Ratio - 75 lbs. per one thousand square feet), shall be applied, harrowed, raked or otherwise incorporated into the soil. After application of above, the sod bed, if dry, shall be moistened to the loosened depth.
- B. No sod shall be placed when the temperature is below 32°F. No frozen sod shall be placed, nor shall any sod be placed on frozen soil. Sod shall not be placed during extremely dry weather unless authorized, in writing, by the ENGINEER and provided that immediately after placing, the wood is covered with a 1 inch thickness of straw mulch.
- C. The sod shall be carefully placed by hand so that each section closely joins the adjacent sections without overlapping. All open spaces or gaps shall be plugged with sod cut to the same size and shape.
- D. The sod, after it is placed, shall be wetted thoroughly and tamped or rolled to incorporate the roots with the sod bed and to ensure tight joints between strips.
- E. All sodded areas shall be kept thoroughly moist for 2 weeks after sodding.

2.03 FERTILIZING AND SEEDING

- A. This work consists of furnishing all labor, equipment and materials and in performing all operations in connection with the fertilizing and seeding of all the finished graded areas not specified to be sodded or occupied by structures, roads, concrete slabs, sidewalks, walls, etc., and including grassed areas destroyed or damaged by the CONTRACTOR.
- B. The areas to be seeded shall be thoroughly tilled to a depth of at least 4" by deicing, harrowing, or other approved methods until the condition of the soil is acceptable to the ENGINEER. After harrowing or deicing, the seed bed shall be dragged and/or hand raked to finished grade.
- C. Fertilizer shall be 25 lbs. of 10-20-10 or equivalent per 1,000 square feet. The incorporation of the fertilizer and the agricultural lime (Ratio - 75 lbs. per one thousand square feet) may be a part of the tillage operation and shall be applied not less than 24 hours nor more than 48 hours before the seed is to be sown.

- D. The seed mixture to be sown for dry land areas shall be in the following proportions:

Common Name	Proportion By Weight	% of Purity	% of Germination
Kentucky Bluegrass	40	90	85
Chewings Fescue	25	90	85
Italian Rye Grass	20	90	85
Red Top	10	90	85
White Clover	5	95	90

The seed mixture for stream bank and wet soil areas shall be in the following proportions and applied at the noted rates:

Scientific Name	Common Name	Pure Live Seed (PLS) Ounces/Acre
<i>Andropogon gerardii</i>	Big bluestem grass	66
<i>Calamagrostis canadensis</i>	Blue joint grass	4
<i>Elymus canadensis</i>	Canada wild rye	16
<i>Panicum virgatum</i>	Switch grass	2
<i>Sorghastrum nutans</i>	Indian grass	2
Scientific Name	Common Name	Pure Live Seed (PLS) Ounces/Acre
<i>Spartina pectinata</i>	Prairie cord grass	6
<i>Agrostis alba</i>	Redtop	8
<i>Avena sativa</i>	Seed oats	360
<i>Lolium multiflorum</i>	Annual rye	100
<i>Phleum pratense</i>	Timothy	20
<i>Aster ericoides</i>	Heath aster	2
<i>Aster novae-angliae</i>	New England aster	1.25
<i>Baptisia leucantha</i>	White wild indigo	1.5
<i>Cassia fasciculata</i>	Partridge pea	3.5
<i>Coreopsis tripteris</i>	Tall coreopsis	1.25
<i>Desmodium illinoense</i>	Illinois tick trefoil	1
<i>Eryngium yuccifolium</i>	Rattlesnake master	3
<i>Gentiana andrewsii</i>	Bottle gentian	1
<i>Helenium autumnale</i>	Snicezweed	1.25

<i>Helianthus grosseserratus</i>	Sawtooth sunflower	2
<i>Lespedeza capitata</i>	Round-headed bush clover	3
<i>Liatris spicata</i>	Marsh blazing star	4
<i>Monarda fistulosa</i>	Prairie bergamot	0.75
<i>Parthenium integrifolium</i>	Wild quinine	2.5
<i>Physostegia virginiana</i>	False dragon; Obedient plant	1
<i>Pycnanthemum virginianum</i>	Common mountain mint	0.5
<i>Ratibida pinnata</i>	Yellow coneflower	3.5
<i>Rudbeckia hirta</i>	Black-eyed susan	1.5
<i>Rudbeckia laciniata</i>	Wild golden glow	2
<i>Rudbeckia subtomentosa</i>	Sweet black-eyed susan	1.25
<i>Silphium integrifolium</i>	Rosin weed	2
<i>Silphium laciniatum</i>	Compass plant	3
<i>Silphium perfoliatum</i>	Cup plant	3
<i>Silphium terebinthinaceum</i>	Prairie dock	2
<i>Solidago juncea</i>	Early goldenrod	2
<i>Solidago rigida</i>	Stiff goldenrod	2
<i>Solidago rugosa</i>	Rough goldenrod	2.5
<i>Tradescantia ohioensis</i>	Common spiderwort	1.25
<i>Vernonia altissima taeniotricha</i>	Hairy tall ironweed	3
<i>Veronicastrum virginicum</i>	Culver's root	1
<i>Zizia aurea</i>	Golden alexanders	0.5

- E. All seed shall be fresh and clean and shall be delivered mixed, in unopened packages, bearing a guaranteed analysis of the seed and mixture.
- F. Seed shall be broadcast either by hand or approved sowing equipment at the rate of ninety (90) pounds per acre (two pounds per 1,000 square feet), uniformly distributed over the area. Broadcasting seed during high winds will not be permitted. The seed shall be drilled or raked into a depth of approximately 1/2 inch and the seeded area shall be lightly raked to cover the seed and rolled. Drill seeding shall be done with approved equipment with drills not more than 3 inches apart. All ridges shall be smoothed out, and all furrows and wheel tracks, shall be removed.
- G. Seed may be sown during the following periods:

February 1 to April 15
August 15 to October 15
- H. Seed may not be sown at any other time except with the written approval of the ENGINEER.

- I. After the seed has been sown, the areas so seeded shall be mulched with clean straw at the rate of one (1) bale per 2,000 feet (approximately 1 inch loose depth). Mulch on slopes shall be held in place with binder twine staked down at approximately 18 inch centers or by other equally acceptable means.
- J. Areas seeded shall be protected until a uniform stand develops, when it will be accepted and the CONTRACTOR relieved of further responsibility for maintenance. Displaced mulch shall be replaced or any damage to the seeded area shall be repaired promptly, both in a manner to cause minimum disturbance to the existing stand of grass. If necessary to obtain a uniform stand, the CONTRACTOR shall re-fertilize, re-seed and re-mulch as needed. Scattered bare spots up to one (1) square yard in size will be allowed up to a maximum of 10 percent of any area.

PART 3 EXECUTION

3.01 SEQUENCE OF WORK

- A. All finish grading in a general area shall be complete before sodding or fertilizing and seeding begins.

3.02 BASIS FOR PAYMENT

- A. Payment for sod or fertilizing and seeding shall be made on a unit price or a lump sum basis where a separate bid item is provided. Otherwise payment for all landscaping required for other work, such as structures, pipelines, etc., shall be made on a unit price or lump sum basis bid for that work.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This section includes cast-in-place concrete, formwork, reinforcing steel and related accessories in conformance with the requirements of ACI 301-latest revision, Specifications for Structural Concrete, which is hereby made a part of these Specifications except as modified by the Supplemental Requirements under PART 3. - EXECUTION, this Section.
- B. ACI 301 - latest revision is the latest consensus standard publication on concrete work and, as modified by the Supplemental Requirements in PART 3 - EXECUTION, this Section, is a complete specification. ACI 301-latest revision is part of Field Reference Manual ACI Publication SP-15 (latest revision) which includes pertinent ACI and ASTM standards considered helpful and necessary job-site reference. The Supplemental Requirements can easily be noted or clipped and taped in SP-15 (latest revision) for ready referral. The CONTRACTOR shall keep at least one copy of SP-15 (latest revision) in the field office at all times.
- C. PART 2 - PRODUCTS, this Section, includes the common concrete ingredients of cement, aggregate and water as well as admixture and grout and other concrete related items such as reinforcing steel, waterstop and joint materials. These products are also generally addressed under PART 3 - EXECUTION in ACI 301-latest revision with modifications.
- D. The work also includes furnishing all labor, materials, equipment and incidentals required to place anchor bolts, inserts, reglets, flashing, pipe sleeves, conduits and other items to be embedded or passed through the concrete as specified under other sections or as shown on the Architectural, Mechanical, Electrical and Instrumentation and Heating and Ventilating Project Drawings.
- E. Quality assurance (ACI Section 1.6). The CONTRACTOR shall employ a qualified testing agency to measure the slump, air, temperature and age of the concrete mixture delivered to the site. The CONTRACTOR'S testing agent will also make three test cylinders from each 50 cubic yards, or fraction thereof, of each concrete mixture placed in any one day.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, including

reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, shrinkage-resistant grout, and any others that may be requested by ENGINEER.

- B. Shop Drawings, General: All shop drawings submitted shall be a complete set of original drawings created by the Supplier. No partial or incomplete submittals nor duplication of ENGINEER original documents will be permitted.

All shop drawing submittals shall include 6 sets of prints for structural consultant to review and mark up. (Note number of prints may be increased by ENGINEER at the Preconstruction Conference.)

Shop drawings must not only bear the Contractor's stamp of approval but shall also show evidence that each item has been thoroughly checked. Failure to comply with this requirement shall result in the ENGINEER'S return of the submission (without review or action) for the Contractor's proper submission and review. No exceptions shall be taken.

The ENGINEER has set aside time to examine shop drawings one time only and to briefly reexamine a resubmission one time. Should it be required that shop drawings or product data be reviewed again, the Contractor shall reimburse the ENGINEER at the cost of 3.25 times the hourly rate of the ENGINEER'S personnel to reexamine them.

Copies of shop drawings used in the field shall bear the ENGINEER'S review stamp with items checked to indicate a satisfactory final review.

- C. Shop Drawings; Reinforcement: Prior to fabrication, submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required and openings through concrete structures.
- D. Shop Drawings; Formwork: Submit shop drawings for fabrication and erection of specific finished concrete surfaces as indicated. Show general construction of forms including jointing, special form joint or reveals, location and pattern of form tie placement, and other items which affect exposed concrete visually.

ENGINEER'S review is for general architectural applications and features only. Design of formwork for structural stability and efficiency is Contractor's responsibility.

- E. Samples: Submit samples of materials as specified and as otherwise requested by ENGINEER, including names, sources and descriptions.

- F. Laboratory Test Reports: Submit laboratory test reports for concrete materials and mix design test as specified.
- G. Materials Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by ENGINEER. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

1.03 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified.

ACI 301 "Specifications for Structural Concrete for Buildings".

ACI 304 "Recommended Practices for Measuring, Mixing, Transporting and Placing Concrete".

ACI 318 "Building Code Requirements for Reinforced Concrete".

Concrete Reinforcing Steel Institute, "Manual of Standard Practice".

ANSI/AWS D1.4 "Structural Welding Code -- Reinforcing Steel".

ACI 117 – 90 "Standard Tolerances for Concrete Construction and Materials".

- B. Materials and operations shall be tested and inspected as work progresses. Failure to detect defective work shall not prevent rejection when defect is discovered, nor shall it obligate the Owner for final acceptance.
- C. All sampling and/or testing in the field shall be made by an ACI Concrete Field Testing Technician Grade I in accordance with ACI CP1 or equivalent.
- D. Testing agencies shall meet the requirements of "Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction," ASTM E 329, latest edition.
- E. Concrete Testing Service:

Engage a testing laboratory acceptable to ENGINEER at Contractor's expense to perform the following services:
 - 1. Qualification of proposed materials and the establishment of mix designs in accordance with "Building Code Requirements for

Reinforced Concrete," ACI 318, latest edition and as noted under Proportioning and Design of Mixes listed elsewhere in this section.

2. See Section 3.19 Quality Control Testing During Construction For Required Tests.
3. Testing services needed or required by the Contract.
4. Correct deficiencies in structural work which inspections have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

F. Materials and installed work may require testing and retesting, as directed by ENGINEER at anytime during progress of work. Allow free access to material stockpiles and facilities. Tests including retesting of rejected materials and installed work, shall be done at Contractor's expense.

G. Pre-installation Conference:

At least 14 days prior to the start of the concrete construction schedule, the Contractor shall conduct a pre-installation conference at the project site to review the proposed mix designs and to discuss the required methods and procedures to achieve the required concrete construction.

The Contractor shall require representatives of every party who is concerned with the concrete work to attend the conference, including, but not limited to, the following:

Contractor's superintendent
Material Testing Agency
Concrete subcontractor
Engineer
Construction Manager
Owner

1.04 PROJECT CONDITIONS

- A. Protection of Footings Against Freezing: Cover completed work at footing level with sufficient temporary or permanent cover as required to protect footings and adjacent subgrade against possibility of freezing; maintain cover for time period as necessary.
- B. Protect adjacent finish materials against spatter during concrete placement.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. After award of the Contract, the CONTRACTOR shall submit in writing to the ENGINEER the name, address and qualifications of the ready-mix supplier who will furnish concrete for the project. The CONTRACTOR shall also submit the supplier and source of the sand, coarse aggregate, cement, admixtures, and the proposed mix design. The testing laboratory selected by the CONTRACTOR and approved by the ENGINEER shall receive from the ENGINEER a copy of this Section 03300, this Division, of the Project Specifications. The CONTRACTOR shall send the required materials to the testing laboratory for mix design testing unless pre-qualified mixes are on hand that have adequate test results per ACI 301.
2. Each material submitted for tests shall be from the same single source as material proposed for the concrete work unless otherwise required or permitted.
3. Also refer to ACI 301-latest revisions and Supplemental Requirements under PART 3 - EXECUTION, this Section.

B. Cement (ACI Section 4.2.1.1.a)

1. Portland cement for concrete and mortar shall conform to ASTM C 150-latest revision, Type I.
2. The ENGINEER may require the CONTRACTOR to deliver cement to the testing laboratory for tests according to ASTM Specification C 150-latest revision for Type I. Should cement fail the tests, the CONTRACTOR shall pay for the tests and the ENGINEER shall have the right to reject the brand.
3. Cement for tests shall be delivered in four-ply paper bags with supplier and source identified in writing. Cement shall be stored in a dry location for not longer than 90 days after delivery from the mill.

C. Admixtures (ACI Section 4.2.1.4)

1. The air-entraining admixture for concrete shall conform to ASTM C 260-latest revision.
2. Water-Reducing Admixture: ASTM C 494, Type A, and contain not more than 0.1% chloride ions. Type A, Water-Reducing admixture shall be a hydroxolated polymer type admixture.

Admixtures that are predominantly composed of hydroxylated carboxylic acid or lignin sulfonates are not permitted.

3. The non-chloride accelerating admixture for concrete shall conform to ASTM C494-latest revision for Type C or E (accelerating admixtures).
4. The water-reducing, set retarding admixture for concrete shall conform to ASTM C 494-latest revision for Type D, and contain not more than 0.1% chloride ions (water-reducing and retarding admixtures).
5. The high range water-reducing admixture for concrete shall conform to ASTM C 494-latest revision for Type F, and contain not more than 0.1% chloride ions (high range super plasticizer water-reducing admixtures).
6. The high range water-reducing and retarding admixture for concrete shall conform to ASTM C 494-latest revision for Type G, and contain not more than 0.1% chloride ions (high range super plasticizer water-reducing and retarding admixtures).
7. The shrinkage reducing admixture (REQUIRED for all cell structural floors, walls, beams, control area floor slab and maintenance building floor slab) for concrete shall conform to ASTM C157- latest revision (shrinkage-reducing admixtures). Available materials are as follows:
 - a. Eclipse Plus or Eclipse Floor by W. R. Grace & Co.
 - b. Approved equivalent.
8. The plastic crack control fibers in the concrete (NOT REQUIRED for this project) shall be in accordance to ASTM C1116. They shall be virgin polypropylene, 3/4" in length, colated, fibrilated, or microfilament. Dosage rate range 1/2 to 1-1/2# pounds per cubic yard of concrete. Available materials are as follows:
 - a. Grace Fibers, Microfibers, or Gilco by W. R. Grace & Co.
 - b. Approved Equivalent.
9. The temperature and shrinkage or post-crack control high volume fibers in the concrete (REQUIRED for the dumpster support slab only) shall be in accordance to ASTM C1116. They shall have a minimum tensile strength of 78ksi, minimum modulus of elasticity of 1300ksi, and a minimum length of 1.5". They shall have the ability to attain a minimum average residual flexural strength ($f'e_3$) of 150psi residual in accordance to ASTM C1018-97. Fiber

dosage rate is based on f'e3, f'c, and concrete slab thickness.
Available materials are as follows:

- a. "Strux 90/40" by W. R. Grace & Co.
 - b. Approved equivalent.
10. Corrosion resistant additive such as Xypex ADMIX C-1000 (dye) or approved equal concrete waterproofing admix (REQUIRED for floor, walls and top of the plant sump, Dwg 20-2-23) shall be added to the concrete during the batching operation to provide corrosion resistance. 3% of the required weight of Portland Cement shall be added as Xypex. The amount of cement shall remain the same and not be reduced. A colorant shall be added to verify the Xypex ADMIX was added to the concrete. Colorant shall be added at the ADMIX manufacturing facility, not at the concrete batch plant. Xypex ADMIX must be added to the concrete at the time of batching. It is recommended that the ADMIX powder be added first to the rock and sand and blended thoroughly for 2-3 minutes before adding cement and water. The total concrete mass should be blended using standard practices to insure homogeneous mixture.
 11. The admixture manufacturer shall furnish a qualified concrete technician employed by the manufacturer, to assist in the proper field batching and use the specified admixtures if requested by the Engineer. The technician shall visit the site at the beginning of concrete operations and as requested during construction. In addition, the manufacturer shall furnish the ready mix plant with accurate and dependable equipment for the proper dispensing of admixture.
 12. Substitute admixtures will be acceptable provided they meet or exceed all properties of the specified materials and specified field service is provided.
 13. The CONTRACTOR shall deliver, to the testing laboratory selected by the OWNER, 12 fluid ounces of each admixture required in the concrete design mix such as air entraining, water-reducing, and water-reducing, set-retarding admixtures. Admixture samples shall be labeled with printed identification indicating trade name, strength, dosage instructions and manufacturer.
 14. Pozzolan admixtures according to "Specification for Fly Ash and Raw or Calcined Natural Pozzolans for Use in Portland Cement Concrete" (ASTM C 618 type F-latest revision) and ACI 301, 4.2.1.1.c shall be limited to 15% of the minimum cement by weight.

15. Prohibited Admixtures: Calcium chloride thyocyanates or admixtures containing more than 0.1% chloride ions are not permitted..

D. Water (ACI 301 Section 4.2.1.3)

1. Water shall be clean and free from injurious amounts of oils, acid, alkali, organic matter, or other deleterious substances. Potable tap water will normally fulfill the above requirements, but the requirements of ASTM C 94 shall be met.
2. When subjected to the mortar strength test described in ASTM C 94-latest revision, the 28-day strength of mortar specimens made with the water under examination and normal portland cement shall be at least 100 percent of the strength of similar specimens made with distilled water.

E. Fine Aggregate (ACI 301 Section 4.2.1.2)

1. Fine aggregate shall consist of clean, well graded particles of hard, durable sand and shall contain limited amounts of deleterious substances. Fine aggregates shall meet the requirements of KTC Section 805 or ASTM C 33.
2. The CONTRACTOR shall deliver sand as requested by the ENGINEER to the testing laboratory for initial and periodic tests. Usually 150 pounds of sand for initial and periodic tests will be sufficient. All material delivered to the laboratory shall be accompanied by identification in writing as to supplier and source.
3. Sand shall be graded in accordance with Section 804-latest revision of the Kentucky Transportation Cabinet, Department of Highways Standard Specifications for Road and Bridge Construction - latest edition.

	Percent
Passing 3/8 inch Sieve	100
Passing No. 4 Sieve	90-100
Passing No. 16 Sieve	45-85
Passing No. 50 Sieve	5-25
Passing No. 100 Sieve	0-8

4. Sand shall meet the requirements of these Specifications and the specifications and tests listed below:

Deleterious Substances	Par. 5 - ASTM Designation C 33-latest revision.
Soundness	Par. 6 - ASTM Designation C 33-latest revision.

Organic Impurities ASTM Designation C 33-latest revision.

F. Coarse Aggregate (ACI 301 Section 4.2.1.2)

1. Coarse aggregate shall be washed river gravel or crushed limestone of hard durable particles and shall contain limited amounts of deleterious substances. Crushed limestone shall come from ledges of a quarry approved by the Kentucky Transportation Cabinet, Department of Highways for use in reinforced concrete untreated bridge superstructures above the tops of the caps excluding pedestals.
2. The CONTRACTOR shall deliver coarse aggregate as requested by the ENGINEER to the testing laboratory for initial tests and periodic tests. Usually 200 pounds of coarse aggregate for initial and periodic tests will be sufficient. All material delivered to the laboratory shall be accompanied by identification in writing as to supplier and source.
3. Coarse aggregate shall be graded in accordance with ASTM C 33 and Section 805 of the Kentucky Transportation Cabinet, Department of Highways Standard Specifications for Road and Bridge Construction-latest edition. Refer to ACI 301 Section 4.2.2.3 for maximum size of coarse aggregate.

	Percent By Weight	
	No. 57	No. 67
Passing 1-1/2-Inch Square Sieve	100	--
Passing 1-Inch Square Sieve	95-100	100
Passing 3/4-Inch Square Sieve	--	90-100
Passing 1/2-Inch Square Sieve	25-60	--
Passing 3/8-Inch Square Sieve	--	20-55
Passing No. 4 Square Sieve	0-10	0-10
Passing No. 8 Square Sieve	0- 5	0- 5

4. Coarse aggregate shall meet the requirements of these Specifications and the specifications and tests listed below:

Deleterious Substances	Par. 9 - ASTM Designation C 33-latest revision
Soundness	Par. 9 - ASTM Designation C 33-latest revision
Abrasion	Par. 9 - ASTM Designation C 33-latest revision

G. Reinforcing Steel (ACI Section 3)

1. Unless otherwise required or permitted, concrete reinforcing bars shall conform to grade 60 deformed bars and shall meet requirements of Deformed and plain Billet-Steel Bars for Concrete Reinforcement (ASTM A 615-latest revision), Rail-Steel Deformed and Plain Bars for Concrete Reinforcement (ASTM A 616-latest revision) or Axle-Steel Deformed and Plain Bars for Concrete Reinforcement (ASTM A 617-latest revision). All other reinforcement and details shall conform to ACI Standard Building Code Requirements for Reinforced Concrete (ACI 318-latest revision).
2. Before steel is shipped to job, the reinforcing steel supplier shall submit to the ENGINEER, 2 certified copies of mill tests on all steel to be used in the work. The tests shall substantiate that chemical and physical properties of the steel comply with the requirements of the governing specifications.
3. The CONTRACTOR shall carry in stock at the beginning of the concrete work the following amounts of extra reinforcing steel for replacement of lost steel or additional steel considered necessary by the ENGINEER.

5	3/8-Inch Rods	30 Feet	-	0-Inch Long
5	1/2-Inch Rods	30 Feet	-	0-Inch Long
5	5/8-Inch Rods	30 Feet	-	0-Inch Long

H. Non-shrink Grout

1. Unless otherwise required or permitted, the grout for non-shrink waterproof joints, waterproof mortar patches, filling under handrail floor flanges and anchoring bolts into existing concrete shall be Sonneborn-Contech SonogROUT, Master Builders' Masterflow 713 grout, or approved equal. The grout for use under base plates of columns, pumps, compressors, generators and similar heavy equipment, and for rebar grouting shall be Sonneborn-Contech FerroLith GNC, Master Builders' Embeco 636 or approved equal.

I. Waterstop for Construction and Control Joints

1. Waterstops shall be 6-inches wide, 3/16-inch minimum thickness, ribbed with center bulb, virgin polyvinyl chloride, in accordance with Corps of Engineers Specifications CRD-C-572, latest revision, as manufactured by Vinylex Corp., W. R. Grace Co., Southern Metal and Plastics, or approved equal.
2. Waterstops shall be furnished in maximum lengths available to reduce the number of joints to the minimum. All joints shall be

lapped, as recommended by manufacturer, to make the stops continuous and watertight.

J. Waterstop for Expansion Joints

1. Waterstops, where required in expansion joints, shall be 9-inches wide, 1/4-inch minimum thickness, ribbed with center bulb, virgin polyvinyl chloride, in accordance with Corps of Engineers Specification CRD-C-572, latest revision, as manufactured by Vinylex Corp., W. R. Grace Co., or approved equal.

K. Premolded Joint Fillers

1. Joint fillers, where required, shall be Sonneborn-Contech Sonoflex F foam expansion joint filler (closed cell, ultraviolet stable, polyethylene foam), or equivalent W. R. Grace Co. products, or approved equal. Where application requires cementing the joint filler into place, such as in a wall expansion joint, a pressure-sensitive adhesive recommended by the filler manufacturer shall be used.

L. Joint Sealants and Backing for Sealants

1. For sealing vertical exposed faces of joint filters, use Sonneborn-Contech Sonolastic NPI (one component urethane) or equivalent W. R. Grace Co. products, or approved equal. For water immersion, prime with Sonneborn-Contech Primer No. 733 for concrete and masonry and Primer No. 758 for glass and metals or as required by manufacturers of equivalent acceptable sealants.
2. For sealing horizontal exposed faces of joint fillers, use Sonneborn-Contech Sonolastic SL1, one-part, self-leveling, polyurethane sealant with Primer No. 733 or equivalent W.R. Grace Co. products, or approved equal.
3. Where additional sealant backing is needed to control the depth of sealant in relation to joint width, use Sonneborn-Contech Sonoflex F foam expansion joint filler or Sonofoam Backer Rod (closed cell polyethylene foam) or equivalent W. R. Grace Co. products, or approved equal.

M. Self-Leveling Floor, Deck and Sidewalk Joint Sealant

1. One-part self-leveling polyurethane sealant for concrete floors, decks, sidewalks and other horizontal contraction and expansion joints shall be Sonolastic SL1 as manufactured by Sonneborne-Contech or equivalent by W. R. Grace Company, or approved equal.

2. Sealant shall comply with Federal Specification TT-S-00230C, Type 1 Class A and ASTM C 920-latest revision, Type S, Grade P, Class 25. Joint primer shall be Sonolastic Joint Primer No. 733, or equal, shall be used where joints will be subjected to continuous or protracted periods of water immersion. When required in deep joints, backing material shall be Sonofoam Backer-Rod, or approved equal, which should not be primed and/or punctured.
3. Sealant color shall be limestone gray, tan, and/or mortar (stone) as selected by the ENGINEER unless otherwise required or permitted.

N. Concrete Floor Curing and Sealing System

1. System shall be a pigmented, ready to use, non-yellowing, acrylic curing and sealing compound which seals by providing a tough scuff resistant film over freshly finished concrete and complies with ASTM C309 and AASHTO M-148. System shall be Gray Kure-N-Seal as manufactured by Sonneborn-Contech or equivalent by W. R. Grace Company, or approved equal.

O. Vibration Isolating Pit Liners

1. Liner material shall be specifically engineered to provide optimum compression rates for inertia block foundation. Liner material shall be unaffected by oils, coolants, cutting fluids and other liquids normally found in industrial environments.
2. Liner material shall be manufactured by the traditional felting process in two densities. A less dense material shall be used to isolate sidewalls of inertia block. A more dense material shall be applied to the base surface of the pit.
3. Liner material shall be 1/2" thick 1B-500-S2 for the sidewalls and 1/2" thick 1B-500-B1 for each of two base layers in 3 feet by 5 feet sheets as manufactured by Unisorb, or approved equal.
4. Vinyl or duct tape shall be used to seal joints between sheets of materials to assure that no fluid concrete enters the joints causing "short-circuiting" of the inertia block insulation.

P. Reglets: Where resilient or elastomeric sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 26gage galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

Q. Dovetail Anchor Slots: Hot-dip galvanized sheet steel, not less than 0.03363 inch thick (22 gauge) with bent tab anchors. Fill slot with

temporary filler or cover face opening to prevent intrusion of concrete or debris.

- R. Granular Base: Compacted layer of #57 stone, unless otherwise approved or directed by ENGINEER.
- S. Vapor Barrier: Provide vapor barrier cover [above/under] prepared base material for slabs on grade and where indicated. Use only materials which are resistant to decay when tested in accordance with ASTM E 154, as follows:

Polyethylene sheet not less than 10 mills thick.

- T. Moisture-Retaining Cover: One of the following, complying with ANSI/ASTM C 171.
 - a. Waterproof paper.
 - b. Polyethylene film.
 - c. Polyethylene-coated burlap.
- U. Bonding Compound: Polyvinyl acetate, rewettable type.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - "Weldcrete"; Larson Products.
 - "Everbond"; L & M Construction Chemicals.
 - "Euroweld"; Euclid Chemical Co.
 - "Daraweld C"; W.R. Grace
 - "Sonocrete"; Sonneborn-Contech.
- V. Epoxy Adhesive: 100% solids, two component material suitable for use on dry or damp surfaces.
 - b. Products: Subject to compliance with requirements, provide one of the following:
 - "Thiopoxy"; W.R. Grace.
 - "Sikadur Hi-Mod"; Sika Chemical Corp.
 - "Euco Epoxy"; Euclid Chemical Co.

PART 3 EXECUTION

3.01 SUPPLEMENTAL REQUIREMENTS TO ACI 301-latest revision

A. ACI 301- SECTION 4 – CONCRETE MIXTURES

1. Also refer to PART 2 – PRODUCTS, for required admixtures
2. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.
 - a. Delete references for allowing additional water to be added to batch for material with insufficient slump. Addition of water to batch will not be permitted.
 - b. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.
 - c. When air temperature is between 85°F (30°C) and 90°F (32°C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90°F (32°C), reduce mixing and delivery time to 60 minutes. Mixing and delivery time will not have to be reduced if Type D retarder is incorporated in the mix.
 - d. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

B. ACI 301 – SECTION 4 – PROPORTIONING

1. General - concrete shall be composed of portland cement, fine aggregate, coarse aggregate, water, and as specified, admixtures. Proportions of ingredients shall produce concrete that will work readily into corners and angles of forms, bond to reinforcement, without segregation or excessive bleed water forming on surface. Proportioning of materials shall be in accordance with ACI 211.1-91, "Recommended Practice for Selecting Proportions for Normal, Heavyweight & Mass Concrete."
2. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method is used, use an independent testing facility acceptable to ENGINEER for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to ENGINEER.
3. Submit written reports to ENGINEER of each proposed mix for each class of concrete at least 45 days prior to start of work. Do not begin concrete production until mixes have been reviewed and approved by ENGINEER.

4. Required Average Strength Above Specified Strength:
Determinations of required average strength (fcr) shall be in accordance with ACI 318, "Building Code Requirements for Reinforced Concrete," and evaluations of compressive strength results of field concrete shall be in accordance with ACI 214-88, "Recommended Practice for Evaluation of Strength Test Results of Concrete."
 - a. Trial Mixes when the ready-mix producer does not have a record of past performance, the combination of materials and the proportions selected shall be selected from trial mixes having proportions and consistencies suitable for the work based on ACI 211.1, using at least three different water-cement ratios which will produce a range of strengths encompassing those required.
 - 1) Average strength (fcr) required shall be 1200 psi (8.3 MPa) above specified strength.
 - b. Past Field Experience - proportions shall be established on the actual field experience of the ready-mix producer with the materials proposed to be employed. Standard deviations shall be determined by 30 consecutive tests (or two groups of tests totaling 30 or more).
 - 1) Average strength (fcr) shall exceed specified strength (f'c) by at least:

400 psi (2.8 MPa) - standard deviation is less than 300
550 psi (3.8 MPa) - standard deviation is 300 to 400
700 psi (4.8 MPa) - standard deviation is 400 to 500
900 psi (6.2 MPa) - standard deviation is 500 to 600
1200 psi (8.3 MPa) - standard deviation is above 600 or unknown
5. Design mixes to provide normal weight concrete with the design strengths as indicated on drawings. The average strength shall exceed specified compressive strength as required in accordance with ACI 318.
6. High Early Strength Concrete: If early strength development is a requirement to meet construction schedules, the mix shall be proportioned to develop the necessary compressive strength at the required age, and data will be provided to the engineer for review.

7. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by ENGINEER. Laboratory test data for revised mix design and strength results must be submitted to and accepted by ENGINEER before using in work.

8. ACI Section 4.2.2. Performance and Design Requirements

Add the following final paragraph:

Specified strength of concrete, f'_c for each structure or portion of structures shall be as follows unless otherwise required or permitted:

- a. Class 4,000 concrete ($f'_c = 4,000$ psi, minimum cement factor of 620 lb/cu.yd.) for all reinforced concrete structures except as otherwise noted on the Drawings and surface courses of highway and street paving except as required for Class 4,500 concrete.
- b. Class 3,500 concrete ($f'_c = 3,500$ psi, minimum cement factor 564 lb/cu. yd.) for non-reinforced portions of manholes, control chambers, interceptor structures, grout for two-course slab toppings, grout to be screeded in place by process mechanical equipment, curbs, gutters, driveways, sidewalks, and base courses for highway and street paving.
- c. Class 2,500 concrete ($f'_c = 2,500$ psi, minimum cement factor of 450 lb./cu. Yd. And 3 to 6 inch slump) for encasement around sewers and branches for cradle or refill under conduits and fill under structures as specified or indicated on the Project Drawings.

9. ACI Section 7 – Weight

Lightweight concrete shall not be used unless otherwise required or permitted.

10. ACI Section 4 – Durability

a. ACI Section 4.2.2.4 – Air Entrainment

Substitute the following:

Classes 4,000 and 3,500 concrete required to be watertight or subjected to potentially destructive exposure (other than wear and loading) such as freezing and

thawing, severe weathering or deicer chemicals shall have an entrained air content of 5 +1% by volume (6+/-1% for SRA Concrete). Measurement of air content shall meet the requirements of ASTM C231-latest revision, ASTM C173-latest revision or ASTM C138-latest revision.

11. ACI 301 Section 4.2.2 – Water-Cement Ratio/Watertightness

Substitute the following:

Classes 4,000 and 3,500 concrete which must be watertight shall have a maximum water-cement ratio of 0.45. Where watertightness is the primary concern, refer to ACI 350.

12. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

- a. Slabs, ramps and sloping surfaces: Not more than 3" with ordinary WRA, or 6" with MRWR.
- b. Reinforced foundation systems: Not less than 2-1/2" and not more than 4" except Foundation Walls slump to be 5" to 6".
- c. Other concrete: Not less than 1" nor more than 4".
- d. Concrete containing MRWR admixture (mid-range): Not more than 6".
- e. Concrete containing HRWR admixture (super plasticizer): Not more than 8".

C. ACI 301 Section 5 – HANDLING, PLACING, AND CONSTRUCTING.

1. ACI 301 Section 5 – Use

Add the following final paragraph:

The ENGINEER may require a set-retarding admixture if required by construction conditions. Otherwise, the CONTRACTOR shall have the option to use a retarding, a water reducing, or a water reducing set-retarding admixture. However, once accepted by the ENGINEER, the CONTRACTOR shall be consistent in admixture use, for example in all wall pours of a structure. Accelerating admixture shall not be used unless otherwise required or permitted.

2. ASTM C157-93 - Modified Testing Procedure

- a. Wet cure specimens for a period of 7 days (including the period of time the specimens are in the mold). Wet cure may be achieved either through storage in a moist cabinet or room in accordance with ASTM C 511, or through storage in lime saturated water.
- b. Report results in accordance with ASTM C 157-93 at 0, 7, 14 & 28 days of curing.

3. ASTM C157-93 Test Results – Shrinkage Requirements

- a. Shrinkage Test Results: Floor slab design requires using materials with combined shrinkage characteristic of 0.032% maximum at 28 days when tested per ASTM C-157-93. Provide documentation that the proposed mix design, using actual aggregates, additives, and cement of the proposed mix for this project as called for in Structural Notes, meets this criteria. Submit results for at least three (3) specimens. Each test takes 28 days. Start tests as soon as Contract is let so final test results are available for submittal.
- b. If a concrete mix is proposed for use without adequate documentation of the shrinkage test described above, or if mix does not meet 0.032% maximum at 28 days when tested per ASTM C-157-93, then use shrinkage reducing admixture (SRA).
 - 1) Use 1.5 gallons of SRA per cubic yard for mixes with no documentation or where tested shrinkage values exceed 0.050%.
 - 2) Use 1 gallon of SRA per cubic yard for mixes with tested shrinkage values between 0.033% and 0.050%.

D. ACI 301 SECTION 2 – FORMWORK AND FORMWORK ACCESSORIES

1. ACI Section 2.1 – General

a. ACI Section 2.1.2 – Submittals

Substitute the following:

Formwork is the CONTRACTOR'S responsibility and shop drawings will not be required.

2. ACI Section 2.2 - Products

- a. ACI Section 2.2.1 Materials
2.2.1.3 - Formwork Release Agents

Add the following paragraph:

For potable water treatment facilities, the form coating shall be non-toxic after a specified period, usually 30 days.

- b. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
- 1) Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
- c. Forms for Unexposed Finish Concrete: Plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- d. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration to match ENGINEER'S brick face control sample. Provide solid backing and form supports to ensure stability of textured form liners.
- e. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
- f. Form Ties: Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units which will leave no metal closer than 1-1/2" to surface.
- g. Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

- h. Provide ties which, when removed, will leave holes not larger than 1" diameter in concrete surface.
- i. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

3. ACI Section 2.3 – Execution

- a. ACI Section 2.3.1 Construction and erection of formwork
- b. ACI Section 2.3.2 Removal of formwork

Add the following:

Forms and shoring in the formwork used to support the weight of concrete in beams, slabs and other structural members shall remain in place until the concrete has reached 75 percent of the specified strength if, after stripping the forms, the structural system is reshored the same day of stripping and shores remain in place until the specified concrete strength is reached. Deviation from these requirements shall not occur unless otherwise required or permitted.

When shores and other vertical supports are so arranged that the non-load-carrying form facing material may be removed without loosening or disturbing the shores and supports, the facing material may be removed when the concrete has reached 50 percent of the specified strength unless otherwise required or permitted.

- c. ACI Section 2.3.3 Reshoring and backshoring
- d. ACI Section 2.3.4 Strength of concrete required for removal of formwork.
- e. ACI Section 2.3.5 Field quality control – horizontal and vertical location.
 - 1) Establish and maintain controls and benchmarks in an undisturbed condition until final completion and acceptance of the project.
 - 2) Variations from plumb and designated building lines shall not exceed the tolerances specified in ACI 117.

E. VAPOR BARRIER INSTALLATION

1. Place vapor barrier above compacted granular base.
2. Lap joints 6" and seal with appropriate tape

F. ACI SECTION 3 – REINFORCEMENT AND REINFORCEMENT SUPPORTS

1. ACI Section 3.1 – General

- a. ACI Section 3.1.1 Submittals, data, and drawings

Add the following:

Submit cut sheets describing any coated reinforcement, placement spacers, or other accessories.

- b. Reinforcing Bars: ASTM A 615, Grade 60, deformed. Bars indicated to be welded shall conform to ASTM A706 and have the approval of the ENGINEER.
- c. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations, unless otherwise acceptable.
 - 1) For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2) For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class I) or stainless steel protected (CRSI, Class 2).
 - 3) For elevated slabs on metal deck, use standard chairs to position reinforcement at mid-height above deck ribs, unless otherwise shown.
- d. Mechanical Couplers: Couplers used for reinforcing bar splices must develop a minimum of 125% of bar yield strength. Approved manufacturers include but are not limited to "Bar-Grip System" or "Grip-Twist System" by Barsplice Products Inc.

2. ACI Section 3.3 - Execution
 - a. ACI Section 3.3.1 – Preparation
 - b. ACI Section 3.3.2 – Placement

G. INSTALLATION OF EMBEDDED ITEMS

1. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.
2. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.
3. Install reglets to receive top edge of foundation sheet waterproofing, and to receive thru-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.
4. Install dovetail anchor slots in concrete structures as noted on drawings.

H. CONCRETE PLACEMENT

1. Preplacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.
 - a. Apply temporary protective covering to lower 2'-0" of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.
2. General: Comply with ACI 304, and as herein specified. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

When placing operations will involve dropping concrete more than 5 feet, the concrete shall be dropped through a tube fitted with a hopper head, or through other approved devices, as necessary to prevent segregation. This requirement shall not apply to cast-in-place piling or caissons when concrete placement is completed before initial set occurs in the first placed concrete.

3. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
4. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
5. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
6. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
7. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
8. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
9. Maintain reinforcing in proper position during concrete placement operations.
10. Cold Weather Placing:
 - a. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

- b. When air temperature has fallen to or is expected to fall below 40°F (4°C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F (10°C), and not more than 80°F (27°C) at point of placement.
- c. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
- d. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

11. Hot Weather Placing:

- a. When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
- b. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90° F (32° C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing.
- c. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
- d. Fog spray forms, reinforcing steel and subgrade thoroughly just before concrete is placed.
- e. Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

H. SECTION 5 – HANDLING, PLACING, AND CONSTRUCTING

1. ACI Section 5.3.3 – Finishing concrete surfaces.

- a. Rough Form Finish: For formed concrete surfaces not exposed to view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

- b. Smooth Form Finish: Provide a smooth form finish to formed concrete surfaces exposed-to-view, or that are to be covered with a coating or waterproofing material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, painting or other similar system. This is an as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas, with fins or other projections completely removed and smoothed.
- c. Grout Cleaned Finish: Provide a grout cleaned finish to concrete surfaces which have received smooth form finish treatment, where shown on drawings or in schedules. Finish shall be performed by the following procedure:
 - 1) Combine one part portland cement to 1-1/2 parts fine sand by volume, and mix with water to consistency of thick paint. Use of proprietary additives may be used at Contractor's option. Blend standard portland cement and white portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.
 - 2) Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.
- d. Related Uniform Surfaces: At tops of walls where horizontal offsets surfaces occur 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.
- e. Trowel finish shall be applied to concrete on which process water and sewage flow and to all surfaces normally intended as walking surfaces including surfaces to receive covering such as tile, and in working and operating areas except as required below for non-slip surfaces.
- f. Broom or belted finish shall be applied to all exterior sidewalks, steps, platforms, ramps and concrete walking surfaces and to interior sloped walking surfaces frequently cleaned by hosing such as garage floors. Brooming shall

be in the direction of the slab drainage maintaining the required surface tolerance to provide non-slip finish.

- g. Floated finish shall be applied to all surfaces intended to receive roofing, waterproofing membranes or sand bed terrazzo.
- h. Refer to Project Drawings for any special requirements.
- i. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete loading dock, stairs, ramps, stoops, and elsewhere as indicated. Flatness and levelness requirements are listed later in this section.
 - 1) Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with ENGINEER before application.
- j. Flatness and Levelness Requirements (unless otherwise noted):
 - 1) Slab on Grade: Check and level surface plane to a tolerance for floor flatness (F_F) = 28 overall value and minimum local value of 23 and floor levelness (F_L) = 20 overall value and minimum local value of 18.
 - 2) Supported Slabs: Check and level surface plane to a tolerance for floor flatness (F_F) = 25 overall value and minimum local value of 17 and floor levelness (F_L) = 20 overall and minimum local value of 15. Supported floors must be tested before any shoring is removed.
 - 3) All testing and sampling to conform to ASTM E11-55.

I. CONCRETE CURING AND PROTECTION

- 1. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- 2. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting; keep continuously moist for not less than 7 days.
- 3. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7

days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

4. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.
 - a. Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walks, and curbs as follows:
 - 1) Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period. Coordinate curing/sealing compounds with coating materials to verify compatibility of materials.
 - 2) Use moisture retaining covering in lieu of membrane curing compound on surfaces which are to be covered with coating materials applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, (such as ceramic or quarry tile or glue down carpet), resinous epoxy finish, painting, and other coatings and finish materials, unless it can be documented that no reaction or bonding problem will be developed. See finish schedule(s) for proper coordination and extent of these materials.
 - 3) All interior slabs that are to remain exposed and that are not to receive special coating materials shall be cleaned and covered with one additional coat of curing and sealing compound after all construction traffic is off of slab surface.
 - b. Provide moist curing by one of the following methods:
 - 1) Keep concrete surface continuously wet by covering with water.
 - 2) Continuous water-fog spray.
 - 3) Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place

absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

- c. Provide moisture-cover curing as follows:
 - 1) Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- d. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
- e. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing method.
 - 1) Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

K. BASIS FOR PAYMENT

- 1. Payment for concrete work shall include all excavation, crushed stone bedding, forms, reinforcing steel, finishing, concrete testing, etc. and shall be made on a unit price or lump sum basis where a separate bid item is provided. Otherwise payment for all concrete required for other work as shown on the PLANS shall be made on a unit price or a lump sum basis for that work.
- 2. Payment for concrete work shall be made only after an acceptable finish and compression tests results are obtained.

END OF SECTION

SECTION 04200

MASONRY

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, and equipment required to construct and install unit masonry as shown on the DRAWINGS and specified herein.

1.02 RELATED WORK NOT INCLUDED

- A. Vertical Exterior Brick Wall Water Repellent Coating, Division 9, Section 09960.
- B. Caulking compound for caulking joints in masonry is included in Division 7, Section 07900.
- C. Doors and windows are included in Division 8.
- D. Painting is included in Division 9.

1.03 QUALITY ASSURANCE FOR FIRE RESISTANCE

- A. Where fire-resistance ratings are indicated for unit masonry work, provide materials and construction which are identical to those of assemblies whose fire endurance has been determined by testing in compliance with ASTM E119 by a recognized testing and inspecting organization or by another means, as acceptable to the authority having jurisdiction.

1.04 SUBMITTALS

- A. Product Data

- 1. The CONTRACTOR shall submit to the ENGINEER manufacturer's product data for each type of masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements, in accordance with the specific requirements of Division 1, Section 01300.

- B. Samples

- 1. The CONTRACTOR shall submit to the ENGINEER for verification purposes, samples of each exposed masonry unit. Include in each set of samples the full range of exposed textures to be expected in the completed WORK. For initial selection of exposed masonry units, submit samples showing full range of textures available.

PART 2 PRODUCTS

2.01 CONCRETE BLOCK

A. Sizes and Shapes

1. Blocks shall be of normal dimensions and shapes as shown on the DRAWINGS. They shall have actual dimensions 3/8 inch less than nominal dimensions to allow for width of joints. Interior blocks shall be regular units with smooth faces on both sides. Exterior blocks shall be split-faced except as noted otherwise on the plans.

B. Composition

1. Blocks shall be made of Portland cement, Ohio River sand, or clean crushed limestone fine aggregate and crushed limestone.
2. Blocks shall meet the requirements of the Standard Specifications for Hollow-Load-Bearing Concrete Masonry Units, ASTM Designation C90 – latest revision, Grade N1.
3. Blocks shall be “standard weight.” Lightweight blocks are not allowed.

C. Expense of Tests

1. Except as specified under Article 9, “Rejection,” of ASTM Designation C90 – latest revision, the expense of inspection and testing shall be borne by the OWNER.

2.02 BRICK

- #### **A.**
- Standard facing brick shall conform to Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale), ASTM C216 – latest revision, Type FBS, Grade SW and shall be standard modular brick with nominal dimensions of 4” x 8” x 2 2/3”.

2.03 MORTAR MATERIALS

- #### **A.**
- Portland Cement: Any standard brand conforming to ASTM Specification C150 – latest revision, same as specified for concrete.
- #### **B.**
- Masonry Cement: Any standard brand conforming to ASTM C91 – latest revision.
- #### **C.**
- Lime: Hydrated lime must be at least ninety-two percent (92%) hydrated, conforming to ASTM Standard C207 – latest revision.
- #### **D.**
- Sand: First quality clean natural Kentucky or Ohio River sand. When dry, one hundred percent (100%) shall pass a No. 8 sieve and not more than

thirty-five percent (35%) shall pass a No. 50 sieve, and conforming to ASTM Standard Specification C144 – latest revision.

2.04 METAL TIES AND ANCHORS

- A. Masonry wall steel wire reinforcement shall consist of Cavity-Lok, Block-Lok, Rectangular Ties and “Z” Bars as manufactured by AA Wire Products Company, Dur-O-Wal, Inc., or approved equal.
- B. Block-Lok shall have 2 galvanized (ASTM A641 – latest revision, Class 3) side rods and galvanized (ASTM A153 – latest revision, Class B-2), flush welded, cross ties spaced not greater than 16 inches on centers as follows:

<u>Heavy Duty</u>	<u>Standard</u>	<u>Spec. Std.</u>	<u>Extra Heavy Duty</u>
Knurled Side Rod	3/16" dia.	9 Ga.	8 Ga. Galv.
Cross Ties	9 G.	9 Ga.	9 Ga. Galv.

- C. Rectangular ties shall be hot dipped galvanized (ASTM A153 – latest revision, Class B-2) after fabrication, 3/16" diameter by 4 inches wide, without moisture drip.
- D. Dovetail anchor slots shall be 24-gauge galvanized (ASTM A153 – latest revision, Class B-2) steel with 1 inch wide by 1 inch deep by 5/8 inch throat equal to AA Wire Products Company AA100. Dovetail anchors shall be 1 inch wide, 12 gauge galvanized (ASTM A153 – latest revision, Class B-2) steel and corrugated. Length shall be sufficient to extend from face of concrete, through joint, to within 5/8 inch of masonry face except for partition walls where length shall be 5 1/2 inches from face of concrete to end of anchor.

2.05 BRICK VENTS

- A. Brick vents shall be made of plastic (mortar color) and designed for insertion in vertical brick joint, Brick Vents for Cavity Walls, as manufactured by Goodco Co., or approved equal.

2.06 WINDOW SILLS AND COPINGS

- A. Type of windows, sills and copings shall be shown on DRAWINGS.
- B. Cut stone window sills and copings shall be standard quality Indiana Limestone of fine to medium texture, free from defects marring appearance. Color shall be gray, selected to eliminate a spotty appearance and to obtain even distribution of texture and color. Exposed surfaces shall have a Standard Machine Smooth Finish.
- C. Precast concrete window sills and copings shall be top quality units of fine to medium texture, free from defects marring appearance. Color shall be gray. Exposed surfaces shall have a smooth stoneline finish.

- D. Sills and copings shall be cut and/or cast accurately to shape and dimensions with joints and bonding as shown on the DRAWINGS. Exposed faces shall be straight and true with sharp lines and arises. Beds and joints shall be straight and at right angles to face. Make joints 1/4 inch wide unless otherwise shown on DRAWINGS. All sills and copings shall have drip grooves.
- E. Exterior sills, copings and similar units with exposed top surfaces shall be cut or cast with a wash. Provide raised fillets at back of window sills. Provide holes and sinkages for all anchors and dowels as required. Provide Lewis holes for all units requiring metal anchorage. Located holes at least 2 inches from any soffit or exposed face. Anchors and bolts shall be steel or wrought iron, hot zinc-coated after fabrication.

PART 3 EXECUTION

3.01 MORTAR

A. Mortar Proportion

- 1. Mortar shall be in accordance with the Property Specifications, ASTM Designation C270 – latest revision. Unless otherwise indicated on the DRAWINGS, mortar shall be Type M, which shall be proportioned by volume:

1 part Portland cement, 1 part masonry cement and not less than 4 1/2 parts nor more than 6 parts sand measured in a damp loose condition (80 pounds per cubic foot, dry bases); or

1 part Portland cement, 1/4 part hydrated lime, and not less than 2 3/4 parts nor more than 3 3/4 parts sand measured in a damp loose condition.

Sand shall be adjusted to obtain specified strength. All mortar shall be used within two (2) hours after mixing.

- 2. The CONTRACTOR shall have on the job and use adequate and accurate equipment for obtaining required proportions by volume of cement, sand and lime in the mortar.
- 3. Mortar Mixing
 - 1. The mortar shall be thoroughly mixed, and only in such quantity as is needed for immediate use. Mortar shall be mixed with a maximum amount of water consistent with satisfactory workability for the mason. Only machine mixing shall be used, except for small jobs when hand mixing is specifically authorized by the ENGINEER.
 - 2. For machine mixing, while the mixer is in operation, the mortar materials shall be batched in the following order. Add

approximately 3/4 of the required water 1/2 the sand, all of the cement, then the remainder of the sand. Allow the batch to mix briefly and then add water in small quantities until satisfactory workability for the mason is attained. Caution is urged to avoid over wetting of the mix. The mortar shall then be mixed a minimum time of 5 minutes after all materials have been added. The mixer drum shall be completely empty before recharging next batch.

3. For hand mixing, the cement and sand shall be thoroughly mixed in the following manner before water is added: spread the sand in the box, spread the cement on top of the sand and mix well with hoe from both ends of the box. Add about 3/4 of the required water and mix until all materials are uniformly damp. Add water in small amounts and continue mixing until satisfactory workability for the mason is attained. Allow the batch to stand approximately 5 minutes and remix thoroughly with a hoe without additional water.

C. Cold Weather Mortar

1. In cold weather, sand and water shall be heated sufficiently to maintain the temperature of mortar when used to above 50 degrees F.

D. Admixtures

1. Antifreeze compounds to lower the freezing point of mortar shall not be used. Accelerators or other admixtures shall not be permitted without the **written** acceptance of the ENGINEER.

3.02 BRICK AND CONCRETE BLOCK CONSTRUCTION

A. General

1. Walls shall be laid up of wythes of brick and/or block and of thickness as shown on the DRAWINGS. Concrete block shall be laid in a Running Bond Pattern. Brick shall be laid in a Running Bond Pattern. Grouted construction, reinforced construction, control joints, expansion joints, roof anchors, and other special construction shall be as shown on the DRAWINGS.
2. The back of the exposed (exterior) wythe of brick of all exterior cavity walls shall be back-plastered with mortar of not less than 3/8 inch thickness. Cavity shall be of width shown on the DRAWINGS and shall be kept clean of mortar droppings and other debris by bulling a clean-out board up through the space between wythes as the wall is laid up. Brick vents shall be installed in strict accordance with the vent manufacturer's printed instructions in the vertical joints at the bottom of the exterior cavity walls on 4 foot centers and at other locations

shown on the DRAWINGS. Brick vents shall be covered from inside the cavity with stainless steel or fiberglass screening to prevent loss of masonry granular type fill insulation where required in cavity wall construction.

3. Metal wall ties shall be as hereinafter specified.

B. Handling, Protection and Storage of Materials.

1. Brick and block shall be delivered hand stacked or in original packages. In unloading, they must be carefully handled in the same manner, hand stacked or "ricked" on boards. Throwing or dumping of block or any handling as to cause chipping or otherwise marring of corners or edges will not be permitted.
2. Handle and store materials off the ground in such manner as to prevent an intrusion of foreign matter. All masonry units shall be covered. Store concrete units under a cover that permits circulation of air without excessive moisture absorption. Store cement, lime, gypsum and air setting mortars in tight sheds with elevated floors.

C. Wetting Brick

1. Except in freezing weather, all brick shall be thoroughly wetted as necessary to reduce their rate of absorption of water at the time of laying to not more than 7/10 of an ounce (20 grams per minute) per brick when placed on its flat side (30 square inches) in 1/4 inch of water for one minute. For a field check, deposit a quantity of water to the flat side of the brick to wet an area approximately the size of a 25¢ coin. If the water disappears in less than 1 1/2 minutes, they shall be re-wetted. Absorptive brick shall be thoroughly soaked in the pile each afternoon prior to the day they are to be used and covered with tarpaulin or heavy paper to prevent evaporation. They shall be re-wetted as necessary during the day to maintain the specified rate of absorption. In wetting brick, water should be sprayed on the pile in a heavy coarse sprinkle with a hose for a period long enough for water to run from all sides of the pile. In cold weather, absorptive brick shall be wetted with warm water just before laying.
2. Concrete units shall not be wetted.

D. Workmanship

1. All masonry units shall be laid plumb, level and true to line in full bed mortar. Lay out all face coursing in advance vertically and horizontally for placing doors, windows, and structural steel to minimize cutting closures or jumping bond. All head joints and bed joints in face brick and backup work shall be completely full of mortar. Mortar for the bed joints shall be spread thick, and furrow in the mortar shall be shallow, not deep. Mortar spread on the wall shall be limited to that which can be covered before the surface of the mortar has begun to dry. Ample

mortar for the head joint shall be placed on the end of each unit to ensure a full joint when the unit is shoved into place. Enough mortar shall be used to cause mortar to ooze out on both sides of the head joint and bed joint. Slushing is not permitted. Units shall be adjusted to the line immediately when first set into the wall, and they shall not be moved thereafter unless re-laid in fresh mortar.

E. Joints

1. All joints shall be of uniform thickness, approximately 3/8 inch for brick and block. All exterior joints shall be cut flush. As the mortar takes its initial set (when the mortar requires pressure to make a print with the thumb), they shall be tooled to provide a concave surface. A tool approximately twice the diameter of the joint shall be used. All masons must use jointing tooling of the same size. Head joints shall be tooled first. Sufficient pressure shall be applied during the tooling of the joints to compact the mortar firmly against the units and provide a neat smooth weather-tight joint. Exposed interior masonry work shall have neatly tooled concave joints made with same size tool used on exterior joints.

F. Cutting

1. Where cutting brick and concrete block is necessary, use motor-driven Carborundum or diamond saw or other method to produce clean cut edges. Do all necessary cutting to accommodate installation of electric outlets, conduits, plumbing fixtures, pipes, brackets, and bathroom accessories. Block with chipped or irregular cut surfaces will not be accepted.

G. Protection

1. Protect brick and concrete block facing against staining. When work is not in progress, all unfinished masonry shall be covered with a weighted down, non-staining, waterproofed material or canvas to overhang the wall at least 2 feet. When work is resumed, top surface of work shall be cleaned of all loose mortar and, in drying weather, thoroughly wetted. Concrete units shall be cleaned but not wetted.
2. No masonry shall be laid when the temperature is below 32 degrees F on a rising thermometer or below 40 degrees F on a falling thermometer, unless adequate precaution against freezing is provided. No masonry shall be constructed on or with frozen materials. All masonry units stored in the open or stacked near mortar boards shall be covered with canvas or waterproofed material to prevent excessive wetting when freezing is expected. In cold weather, masonry shall be protected against freezing for at least 48 hours after being laid with the temperature on both sides of the wall maintained above 40 degrees F.

H. Pointing and Cleaning

1. Point and fill all holes and cracks in exposed joints with additional fresh mortar. If the mortar has hardened, defects shall be chiseled out, wetted and refilled solidly with fresh mortar and tooled as specified.
2. Clean exposed masonry surfaces thoroughly from top down to remove stains and mortar deposited during construction. Cleaning with soap powder or other mild solutions shall not be attempted in less than 48 hours after the construction of the wall.
3. Brick masonry walls shall be cleaned in strict accordance with Brick Institute of America (BIA) Technical Notes, publication No. 20, Revised Sept./Oct. 1977, or latest revision, "Cleaning Brick Masonry."
4. Concrete block masonry walls shall be cleaned in strict accordance with the recommendations of the National Concrete Masonry Association.

3.03 METAL WALL TIES AND REINFORCEMENT

- A. Masonry wall ties shall be of the material specified herein and/or as shown on the DRAWINGS. Ties shall be placed as shown on the DRAWINGS and specified herein. Place additional rectangular ties around all door and window openings at jambs, heads and sills with ties not over 8 inches O.C. and within 8 inches of the opening.
- B. Use reinforcement at control joints as shown on the DRAWINGS.
- C. Anchor brick and block to adjacent columns and beams with dovetail anchors 24 inches O.C. horizontally and 16 inches O.C. vertically unless otherwise required or shown.

3.04 INSTALLING WINDOW SILLS AND COPINGS

- A. Units shall be set by experienced masons to produce a first class job. Thoroughly clean units, then sponge with clean water just before setting; when setting in cold weather, clean by brushing instead of sponging.
- B. Set each stone plumb, level, and true to line in a full bead of mortar and tap to even bearing. Sawing through mortar joints to correct bearing or adjust joint will not be permitted.
- C. Soft wood wedge, soaked in water, may be used where necessary to prevent crushing of mortar; wedges must be removed when dry and before pointing. Keep face of units free from mortar.
- D. Brush joints clean, carefully remove any wedges so that pointing will be continuous; after thorough wetting, point all joints (except those specified to be left open or caulked) flush with pointing mortar. Leave building expansion

joint open except where shown on the DRAWINGS to be filled. No pointing shall be done when temperature is below 35 degrees F.

- E. After completion of setting, all units shall be thoroughly cleaned by scrubbing with brushes and soap powder or other suitable cleaning compound or by the application of steam. Cleaning compounds shall not contain acid or other ingredients that will injure units. Cleaning shall begin at top and continue down face of building. Upon completion, leave units clean and free from mortar, stain and traces of cleaning compound and with all joints pointed.
- F. Protect offsets and walls with covering until completion of masonry work. Use galvanized nails to prevent rust stains. Protect other work as necessary to prevent damage. Replace damaged or defective units.
- G. Prepare and submit fabrication and setting DRAWINGS to the ENGINEER; do not fabricate units until DRAWINGS have been accepted. DRAWINGS shall show jointing, bonding, connection with other work, typical and special anchoring dimensions and setting number of each unit. Each piece, when delivered, shall have corresponding setting number marked on back or unexposed edge.

3.05 BUILT-IN WORK

- A. Consult other trades in advance and make provisions for installation of their work in order to avoid cutting and patching. Built-in work specified under other sections of the SPECIFICATIONS is to be installed as the WORK progresses.
- B. Set sills and copings and steel lintels in beds of mortar unless otherwise shown on DRAWINGS. Fill jambs and heads of metal door frames solid with mortar. Caulk around all sides of metal window, curtain wall, and door frames.

3.06 SAMPLE WALLS

- A. Prior to starting block work, build sample walls up to show required type of facing material, range of color and type and color of mortar joints. Accepted sample method of laying and workmanship, and may be incorporated in structures.

END OF SECTION

SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Structural steel framing members, structural steel support members, struts, and hoisting systems, with required bracing, welds and fasteners.
- B. Baseplates, shear stud connectors, and high strength bolts.

1.02 RELATED WORK

- A. Grouting base and bearing plates are included in Division 3.
- B. Masonry is included in Division 4.
- C. Metal fabrications are included in this Division, Section 05520.
- D. Cleaning and painting are included in Division 9, Section 09900.

1.03 REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM A53 - Hot-dipped, Zinc-coated Welded and Seamless Steel Pipe.
- C. ASTM A325 - High-Strength Bolts for Structural Steel Joints.
- D. ASTM A490 - Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints.
- E. ASTM A500 - Cold-formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- F. ASTM A501 - Hot-formed Welded and Seamless Carbon Steel Structural Tubing.
- G. AWS D1.1 - Structural Welding Code.
- H. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
- I. Cleaning and painting are included in Division 9, Section 09900.

1.04 SUBMITTALS

- A. Submit shop **DRAWINGS** in accordance with Division 1, Section 01300.

- B. Product Data: Submit manufacturer's technical data for each product indicated. Include test reports and certifications substantiating that product's comply with requirements.
- C. Indicate profiles, sizes, spacing and locations of structural members, connections, attachments, fasteners, cambers, loads, and shop paint primer.
- D. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Structural Steel Members: ASTM A36 and A572, Grade 50.
- B. Structural Tubing: ASTM A500, Grade B, ASTM A501 and ASTM A53, Grade B.
- C. Bolts, Nuts and Washers: ASTM A325 and A490.
- D. Welding Materials: AWS D.1.1 - latest revision; type required for materials being welded.
- E. Shop Primer: Refer to Division 9, Section 09900.

2.02 FABRICATION

- A. Fabricate structural steel members in accordance with AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, latest revision and supplements.

2.03 FINISH

- A. Clean, prepare and shop prime and/or galvanize to ASTM A525 - latest revision structural steel members. Do not prime surfaces to be field welded or in contact with concrete. Provide minimum G-90 galvanized coating where galvanizing is required.

PART 3 EXECUTION

3.01 ERECTION

- A. Erect structural steel in accordance with AISC Specification.

- B. Make provision for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb and in true alignment until completion of erection and installation of permanent bracing.
- C. Do not field cut or alter structural members without approval of ENGINEER.
- D. After erection, prime or cold galvanize (Section 05520) welds, abrasions, and surfaces not shop primed, or galvanized, except surfaces to be in contact with concrete. Use a primer consistent with shop coat according to Division 9, Section 09900.

END OF SECTION

SECTION 05520

METAL FABRICATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, and equipment required to construct and install metal fabrications as shown on the Drawings and specified herein. Included in this section are handrails, grating, nuts, bolts, anchors, hatches, ladders, and stairs.

1.02 RELATED WORK NOT INCLUDED

- A. Concrete work is included in Division 3.
- B. Castings are included in Division 5, Section 05540.
- C. Flashing and sheet metal work for roofing is included in Division 7, Section 07600.
- D. Painting is included in Division 9, Section 09900.

1.03 QUALITY ASSURANCE

- A. All fabricated materials shall be of the highest quality, free of structural, handling, and workmanship defects.
- B. Pre-assembled items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installations.

1.04 SUBMITTALS

- A. Shop Drawings
 - 1. The CONTRACTOR shall submit to the ENGINEER in accordance with Division 1, Section 01300 detailed shop drawings of all materials to be fabricated, and shall receive the ENGINEER'S certification of review before fabrication. Include plans, elevations and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor bolt installation by others. Include any requirements for surface preparation, paint products, or grout.

2. Where materials or fabrications are indicated to comply with certain requirements for design loadings, include structural computations, material properties and other information needed for structural analysis. This shall not relieve the CONTRACTOR of responsibility for all errors, omissions, and deviations of his shop drawings from the Drawings and Specifications and from requirements of final results called for in the Drawings and Specifications.

B. Samples

1. The CONTRACTOR shall submit 2 sets of representative samples of materials and finished products as may be requested by the ENGINEER, or as specified herein.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel

1. Steel fabrication shall be done in conformity with the "AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings", latest revision and supplements.
2. Prime and paint in accordance with Division 9, unless otherwise required or permitted.
3. Unless otherwise noted on the Drawings or in the Specifications, galvanizing shall be by hot-dip process in accordance with ASTM A525 - latest revision, Coating Designation G90 (previous Coating Class Commercial 1.25 oz. per sq. ft.).
4. Damaged zinc coating shall be repaired according to Federal Specification DOD-21035A (Galvanizing Repair Spec.) and ASTM A780 - latest revision as follows:
 - a. Remove foreign matter from both damaged and contiguous undamaged area by wire brushing and cleaning with metal conditioner recommended by cold galvanizing coating manufacturer.
 - b. Apply 2 coats of cold galvanizing coating to damaged area, ensuring an overlap of the surrounding undamaged galvanizing for continuity of galvanic protection. Cold galvanizing coating shall be Z.R.C. Chemical Products Co., "Z.R.C. Cold Galvanizing," or equal.

B. Aluminum

1. Aluminum shall have a high resistance to corrosion and shall be Alloys 6061-T6, 6062-T6, 6063-T5 or 6063-T6 for wrought products such as rods, bars, standard structural shapes, extrusions, and forgings; and Alloys 214 for castings, or equal.
2. Aluminum fabrication shall be in accordance with ASCE the Aluminum Association's "Specifications for Aluminum Structures," latest revision. Welding shall be done by the argon-shielded tungsten-arc method or the automatic or semi-automatic argon-shielded consumable-electrode method, or equal. Welding rod and electrodes shall be in strict accordance with above specifications.
3. Where anodic coating is required and type is not specified or shown on the Drawings, coating shall be No. 2 Clear. Anodic coatings shall conform for the following requirements:
 - a. Clear Anodic Coatings
 - 1) The exposed surfaces of aluminum shall be cleaned of all fabricating oils and foreign matter, given a medium caustic etch pretreatment and shall receive one of the following clear anodized finishes:
 - a) No. 1 - a minimum coating thickness of 0.0004 inch (0.001 mm) and a minimum coating weight of 15.5 mg per square inch (204R1).
 - b) No. 2 - a minimum coating thickness of 0.0008 inch (0.0018 mm) and a minimum coating weight of 27.0 mg per square inch (215R1).
 - b. Color Anodic Coatings
 - 1) All aluminum parts (both extrusion and sheet stock) shall be of a controlled aluminum alloy and temper suitable for receiving an electrochemically produced hard anodic oxide coating. All aluminum parts (both extrusion and sheet stock) shall receive a caustic etch pretreatment to remove all surface foreign matter followed by an electrochemically produced anodic oxide coating having a minimum coating thickness of 0.0007 inch (0.0018 mm). Color shall be specified by the Owner and range samples shall be submitted to establish the upper and lower limits of color variations.

2.02 HANDRAILS

A. General

1. All handrail components and systems shall meet applicable federal and state regulations.
2. All handrails shall be the fence-type handrail system, except where located inside of buildings or on steps which shall be standard post and rail handrail, unless otherwise noted on the Drawings.
3. Shop drawing submittals shall include verification that all components including base flanges, side mounting assemblies and anchor bolts can meet required strength capacities. Anchorages shall be identical to those shown on the Drawings or equal.
4. A vertical post sample with fittings and base connection shall be submitted for review and acceptance prior to preparation and submission of the shop drawings.

B. Standard Aluminum Pipe Handrail

1. Pipe for rails and posts shall be of 6063-T6 extruded aluminum with smooth standard mill finish. Scratches and discolorations uncommon to standard mill finish and sharp edges and rough surfaces shall be removed by rubbing with stainless steel wool lubricated with neutral soap solution.
2. Joints shall be welded and/or slip-on fitting type.
3. Welded joints shall be ground smooth, buffed and rubbed to a finish similar to the pipe.
4. Slip-on fittings shall be cast of magnesium aluminum alloy meeting Aluminum Association requirements for Alloy B-535.2 and furnished with stainless steel set screws. Fittings shall be "SpeedRail" and "NuRail" as manufactured by Hollaender Manufacturing Company, Cincinnati, Ohio, or equal.

C. Performance

1. Handrail system design, construction and installation shall meet or exceed all applicable Federal and State regulations. Handrail anchors, posts, rail and fabric shall be capable of withstanding a load of at least 200 pounds applied in any direction at any point on the top rail, with a minimum of deflection.
2. The manufacturer shall submit to the ENGINEER certified test data verifying the strength of his handrail system.

2.03 STEEL PIPE RAILINGS AND HANDRAILS

- A. Fabricated steel pipe railings and handrails to design, dimensions, and details indicated. Provide railings and handrails members formed of pipe of sizes and wall thickness indicated, but not less than that required to support design loading.
- B. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.
 - 1. At tee and cross intersections provide coped joints.
 - 2. Form bends by use of prefabricated elbow fittings and radius bends or by bending pipe, at fabricator's option.
 - 3. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross-connection of pipe throughout entire bend without buckling, twisting or otherwise deforming exposed surfaces of pipe.
 - 4. Provide wall returns at ends of wall-mounted handrails, except where otherwise indicated.
 - 5. Close exposed ends of pipe by welding 3/16" thick steel plate in place or by use of prefabricated fittings.
 - 6. Toe Boards: Where required, provide toe boards at railings around openings and at the edge of open-sided floors and platforms. Fabricate to dimensions and details indicated, or if not indicated, use 4" high x 1/4" plate secured to each railing post and intermediate brackets, as required, with stainless steel fasteners. Provide for thermal expansion and contraction, as necessary, through elongated holes, or equal.
- C. Brackets, Flanges, Fittings and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings and anchors for interconnections of pipe and attachment of railings and handrails to other work. Furnish inserts and other anchorage devices for connecting railings and handrails to concrete or masonry work.
 - 1. For railing posts set in concrete, provide sleeves of galvanized steel pipe not less than 6" long and with inside diameter not less than 1/2" greater than the outside diameter of pipe. Provide steel plate closure welded to bottom of sleeves and of width and length not less than 1" greater than outside diameter of sleeve.
 - 2. Provide friction fit, removable covers designed to keep sleeves clean and hold top edge of sleeve 1/2" below finished-surface of concrete.

- D. Galvanized steel railings, including pipe, fittings, brackets, fasteners and other ferrous metal components.

2.04 GRATINGS

- A. Gratings shall be the dimensions required on the Drawings and as required to meet deflection specifications below and of aluminum Alloy 6063-T5, 6063-T6, or 6061-T6, or equal. Gratings shall be designed for an allowable uniformly distribution load of 200 lbs./s.f. and a concentrated load of 400 lbs./ft. of width with less than 0.25 inch deflection. Gratings shall be IKG Industries "IBAR," Reliance "ILOK," or equal.

2.05 NUTS AND BOLTS

- A. Unless otherwise shown on the Drawings or required in other parts of these Specifications, all nuts and bolts shall be in accordance with ASTM A307 - latest revision, Grade A and shall be electro-galvanized according to ASTM B633 - latest revision.
- B. All nuts, bolts, washers and accessories in contact with water, in any moist atmosphere or damp area such as occurs above water, or embedded in concrete exposed to the weather, shall be Type 302 or 304 stainless steel. Stainless steel nuts, bolts, and washers shall be used to fasten aluminum to all materials including aluminum.

2.06 CONCRETE ANCHORS

- A. Sizes and spacings or numbers of anchors shall be shown on the Drawings and materials shall comply with exposure requirements listed under Nuts and Bolts above. All anchors used for securing moving or vibrating equipment (pumps, motors, gears, sluice gates, conveyors, etc.), shall be of the cast-in-place type.
- B. The size and number of anchors shall be approved by the equipment manufacturer.
- C. Unless specifically noted otherwise on the Drawings or Specifications, concrete anchors for other applications shall be chemical grout-type anchors equal to Hilti "HVA Adhesive Anchor," or Ramset "Chemset Chemical Anchors." Installation shall be in strict accordance with the manufacturer's recommendations which shall be available on the job site.

2.07 ALUMINUM LADDERS

- A. Aluminum ladders shall be fabricated as detailed on the Drawings.

2.08 HATCHES

- A. Metal hatches shall be fabricated as detailed on the Drawings.

2.09 BOLLARDS

- A. Concrete filled, steel posts as shown on Drawings.

PART 3 EXECUTION

3.01 GENERAL

- A. The CONTRACTOR shall be responsible for all errors, omissions, and deviations of the shop drawings from the Drawing and Specifications. Any errors or omissions shall be brought to the attention of the ENGINEER whose interpretation and instructions shall be received before proceeding with the fabrication of that portion of the work.
- B. Similarly, manufacturers' printed installation instructions shall be strictly followed and any conflicts with the shop drawings and/or Contract Drawings shall be directed to the ENGINEER for resolution before proceeding with installation.
- C. All base plates, inserts and anchorages shown embedded in concrete shall be accurately located and secured before placing concrete as per a manufacturer supplied template. All structural members and components shall be accurately leveled, plumbed and secured at location shown on the Drawings.
- D. Painting
 - 1. Cleaning and painting of all fabricated materials shall be in strict accordance with Division 9, Section 09900, of these specifications.
- E. Steel
 - 1. All fabrication and erection shall be done in conformity with the "AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings," - latest revision.
 - 2. Refer to Article 2.01.A of this Specification Section for repair of galvanized surfaces.
- F. Aluminum
 - 1. The contact surfaces of aluminum with steel, dissimilar materials, concrete and/or masonry shall be protected from corrosion by a thick coating of coal tar, Koppers Bitumastic No. 50, or equal.
 - 2. Aluminum surfaces embedded in concrete shall be protected from corrosion by a tightly adherent coating of 2 applications of zinc chromate primer.

3.02 HANDRAILS

05520-7

A. General

1. Refer to Article 2.02 this Section for types of handrails.
2. Shop drawings and handrail manufacturer's printed instructions shall be closely followed during handrail installation. Posts shall be installed plumb and rails parallel.
3. Required anchorages shall be strictly followed.

B. Workmanship

1. All rail and post cuts shall be square and accurate for minimum joint gap, clean and straight, and free of burrs and nicks.
2. In exterior and high humidity interior fabricated fitting installations, provision shall be made to drain entrapped water from inside the railing system to prevent electrolysis and/or damage from freezing. Manufacturer's printed instructions shall be strictly followed.
3. Welds and damaged areas shall be finished and coated according to Article 2.02, this Section.
4. Where required, holes shall be drilled and countersunk the correct size for proper fit of all components.
5. In aluminum handrail systems where protection is applied for prevention of electrolysis from dissimilar materials, visibility of protective material shall be minimized.
6. Handrail system surfaces shall be protected from physical damage and discoloration during storage, assembly and installation. Manufacturer's coverings to protect anodized finishes shall be left intact until damage from construction operations no longer exists.

C. Rigidity

1. Posts shall be continuous from mounting surface to top rail.
2. Top and bottom rails shall be un-spliced lengths between post except as covered under expansion joints.
3. Railing manufacturer's instructions shall be strictly followed regarding torquing and tightening of fittings, and type and materials of fasteners.
4. Only stainless steel fasteners shall be used in aluminum installations, unless otherwise noted.

D. Expansion Joints

05520-8

1. To prevent excessive stresses and misalignment in standard joints and gaps shall be provided in top and bottom rails. Joints shall be located within 8 inches of posts and supports and the top and bottom rail joints shall be in vertical alignment. In fence-type handrail systems, top rail couplings shall be furnished with galvanized expansion compression spring as required in Part 2, this Section.
2. Where sleeve-type expansion joints are used, fasten only one side of sleeve to rail and allow other side of sleeve to slide on adjacent rail in standard aluminum handrail systems.
3. Gaps shall be provided according to the table below which is based on the coefficients of expansion of 0.000013 inch/°F for aluminum and 0.0000065 inch/°F for steel; a temperature difference of 120°F less the minimum listed temperature; and an expansion joints spacing of 24'-0" on centers for aluminum and 40'-0" on centers for steel. Where it is know that other temperature differentials and/or expansion joint spacings will be experienced, gap dimensions can be determined by: gap in inches = (coefficient of expansion) x temperature difference from maximum to minimum) x (distance in inches between expansion joints).

EXPANSION JOINTS GAP TABLE

Gap Dimension Required at Each Expansion Joint

<u>Temperature (°F) at Time of Installation</u>	<u>Aluminum Railing with Expansion Joints on 24' - 0" Centers</u>	<u>Steel Railing with Expansion Joints on 40' - 0" Centers</u>
-20 to 0	1/2"	7/16"
0 to 20	7/16"	3/8"
20 to 35	3/8"	5/16"
35 to 50	5/16"	1/4"
50 to 70	1/4"	1/4"
70 to 90	3/16"	3/16"
90 to 12	1/8"	1/8"

3.03 GRATINGS

- A. Grating frames shall be installed flush with the floor surfaces. Adequate blocking shall be provided to hold corners square during placing concrete and exposed aluminum surfaces shall be protected to prevent pitting from the concrete. Surfaces embedded in concrete shall be protected as covered under Article 3.01, this Section.

3.04 NUT AND BOLTS

05520-9

- A. Refer to Article 2.05, this Section, for material requirements.
- B. Bolts embedded in concrete shall be secured with templates at the time of pouring concrete. Bolts shall be suitably protected from damage throughout the construction period.
- C. Damaged galvanized surfaces on nuts and bolts shall be repaired according to Article 2.05, this Section.

3.05 CONCRETE ANCHORS

- A. Refer to Article 2.06, this Section, for anchor specifications.
- B. Concrete anchors shall be installed strictly in accordance with manufacturer's printed instructions which shall be available on the job site.
- C. Refer to Division 15 for supporting small pipe.

3.06 LADDERS

- A. Install ladders as herein specified and as detailed on the Drawings.

3.07 HATCHES

- A. Install hatches as herein specified and as detailed on the Drawings.

3.08 BOLLARDS

- A. Set in concrete as indicated. Fill cores solidly with air-entrained concrete having a 28-day minimum compressive strength at 3,000 psi.

END OF SECTION

SECTION 05540

CASTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, and equipment required to install castings as shown on the Drawings and specified herein. Included in this section are manhole covers, steps, valve boxes, and hatch covers.

1.02 RELATED WORK NOT INCLUDED

- A. Concrete work is included in Division 3.
- B. Surface preparation and furnishing of castings is included in Division 9, Section 09900.

1.03 SUBMITTALS

The CONTRACTOR shall submit to the ENGINEER, in accordance with Division 1, Section 01300, copies of construction details of castings proposed for use.

PART 2 MATERIALS

2.01 GENERAL

- A. All castings shall be gray iron, conforming to the requirements of the ASTM Standards, Designation A48 - latest revision, Class 35B.

2.02 MANHOLE CASTINGS

A. Frames and Covers

- 1. Sanitary sewer manhole castings shall consist of cast iron frames and 22-3/4 inch diameter covers, having a combined weight of not less than 350 pounds for out of traffic locations and 460 pounds for traffic locations. The frame shall be at least 7 inches high overall. Manhole covers must set neatly in the frame, with contact surfaces machined smooth for even bearing. The top of the cover shall be flush with the frame edge. The top of the cover shall have sufficient corrugations to prevent slipperiness and be marked in large letters "SANITARY SEWER." Covers shall have one pick hole only, about 1-1/2 inches wide and 3/4 inch deep with 3/8 inch square undercut at rear and 3/4 inch square undercut on sides. Covers on sanitary sewer manholes must not be perforated and shall be as manufactured by J.R. Hoe & Sons, Inc. or approved equal.

2. Storm sewer manhole castings shall consist of cast iron frames and 22-3/4 inch diameter grate type covers, having a combined weight of not less than 460 pounds. The frames shall be at least 7 inches high overall. Manhole covers must set neatly in the frame with contact surfaces machined smooth for even bearing. The top of the cover shall be flush with the frame edge. The castings shall be Neenah Foundry Company with type "D" grate, or approved equal.

B. Steps

1. Cast iron or polypropylene plastic encapsulated steel manhole steps shall be patterns shown on the detail Drawings, and have corrugated treads. In case of need for non-protruding steps, shop drawings of special inset cast iron steps shall be reviewed by and be acceptable to the ENGINEER.
2. If a step constructed of another material is going to be considered, shop drawings will need to be submitted far enough in advance to allow consideration.
3. It is intended that the cast iron step be Neenah Foundry Company's R-1980-E, or equal, and the polypropylene plastic encapsulated steel step be M.A. Industries PS-1, or equal.

2.03 VALVE BOXES

A. Slip Type for Iron Body Gate Valves

1. Valve boxes for 2 inch through 10 inch valves shall be the 2 piece slip type, without screw, of sufficient length to allow for 36 inches of cover over the top of the pipe, Tyler 6855 series, model #562-A, or approved equal. The inner section shall have a minimum inside diameter of 5-1/4 inches with a hood type base that will cover the packing gland on a 2 inch through 10 inch valve (minimum of 8 inches inside diameter). The base of the top section shall be flanged at least 1-1/4 inches. The caps shall be circular with a corrugated surface and have pick holes in the periphery and be marked "Water", "Gas", "Sewer", or "Air" according to use. For 12 inch through 16 inch valves, the valve boxes shall be Opelika Foundry Company No. 4907 for cast iron or approved equal.
2. Valve boxes for valves in the horizontal position shall be Opelika Foundry Company No. 4907 for cast iron or approved equal, with a base that is sized to allow covering of the bevel gear case and centering of the operating nut in the valve box.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The installation of castings is generally covered under specifications for pipe work and manholes. Castings shall be leveled, plumbed, secured, and installed in accordance with the Drawings.

END OF SECTION

SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Definitions: Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed, except as otherwise indicated. Types of work in this section include rough carpentry for:

1. Wood grounds, nailers, blocking and sleepers.

1.02 REFERENCES

- A. Lumber Standards: Comply with PS 20 and with applicable rules of the respective grading and inspecting agencies for species and products indicated.
- B. Plywood Products Standards: Comply with PS 1 (ANSI A199.1) or, for products not manufactured under PS 1 provisions, with applicable APA Performance Standard for type of panel indicated.

1.03 SUBMITTALS

- A. Wood Treatment Data: Submit treatment manufacturer's instructions for proper use of each type of treated material.
1. Pressure Treatment: For each type specified, include certification by treating plant stating chemicals and process used, net amount of preservative retained and conformance with applicable standards.
 2. For Water-borne Preservatives: Include statement that moisture content of treated materials was reduced to a maximum of 15% prior to shipment to project site.
 3. Fire-retardant Treatment: Include certification by treating plant that treatment material complies with governing ordinances and that treatment will not bleed through finished surfaces.

1.04 PRODUCT HANDLING

- A. Delivery and Storage
1. Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood, and provide air circulation within stacks.

1.05 JOB CONDITIONS

A. Coordination

1. Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking grounds and similar supports to allow proper attachment of other work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Lumber, General:

1. Factory-mark each piece of lumber with type, grade, mill and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.
2. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.
 - a. Provide dressed lumber, S4S, unless otherwise indicated.
 - b. Provide seasoned lumber with 19% maximum moisture content at time of dressing.
3. For light framing (less than 6" wide), provide the construction grade, any species.
4. For structural framing (6" and wider and from 2" to 4" thick), provide the following grade and species:
 - a. No. 1 grade
 - b. Any species and grade which meets or exceeds the following values:
 - (1) Fb (minimum extreme fiber stress in bending); 1,500 psi
 - (2) E (minimum modulus of elasticity); 1,500,00
5. Exposed Framing Lumber (2" through 4" thick): Where framing will not be concealed by other work, provide the following grade and species.
 - a. Douglas Fir, Appearance Framing (WCLB or WWPA); or
 - b. Southern Pine, Appearance Grade, Kiln Dried (SPIB)

6. Timber (5" and thicker): Provide No. 1 Grade Douglas Fir (WWPA) or No. 2 Dense SR Grade Southern Pine (SPIB), green (non-moisture controlled)
7. Boards (less than 2" thick)
 - a. Exposed Boards: Where boards will be exposed in the finished work, provide the following:
 - (1) Moisture content: 19% minimum, "S"-DRY
 - (2) Where painted finish is indicated, provide Southern Pine, No. 2 Boards (SPIB), or Douglas Fir Construction Boards (WCLB or WWPA)
 - b. Concealed Boards: Where boards will be concealed by other work, provide lumber of 19% maximum moisture content (S-DRY) and of Redwood Construction Common (RIS), Southern Pine No. 2 Boards (SPIB), or any species graded Construction Boards (WCLB or WWPA).
 - c. Board Sizes: Provide sizes indicated or, if not indicated (for sheathing, sub-flooring and similar uses), provide 1" x 8" boards.

B. Miscellaneous Lumber

1. Provide wood for support or attachment of other work including cant strips, buck, nails, blocking, furring, grounds, stripping and similar members. Provide lumber of sizes indicated, worked into shapes shown, and as follows:
 - a. Moisture Content: 19% maximum for lumber items not specified to receive wood preservative treatment.
2. Grade: Construction Grade light framing size lumber of any species or board size lumber as required. Provide construction grade boards (RIS or WCLB) or No. 2 boards (SPIB or WWPA).
3. Plywood Trademark: Identify each plywood panel with appropriate APA trademark.
4. Concealed Performance-Rated Plywood: Where plywood panels will be used for the following concealed types of applications, provide APA Performance-Rated Panels complying with requirements indicated for grade designation, span rating, exposure durability classification, edge detail (where applicable) and thickness.
 - a. Roof Sheathing: APA Rated Sheathing

- (1) Exposure Durability Classification: Exposure I
- (2) Span Rating: As required to suit rafter spacing indicated, but not less than 5/8" thick.

5. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant treatment plywood panels with grade designation, APA C-D PLUGGED INT with exterior glue, in thickness indicated, or, if not otherwise indicated, not less than 1/2".

C. Miscellaneous Materials:

1. Fasteners and Anchorages: Provide size, type, material and finish as indicated and as recommended by applicable standards, comply with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails.

Where rough carpentry work is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners and anchorages with a hot-dip zinc (ASTM A153).

2. Building Paper: Asphalt saturated felt, non-perforated, ASTM D226.

2.02 WOOD TREATMENT

- A. Preservative Treatment: Where lumber or plywood is indicated as "Trt-Wd" or "Treated", or is specified herein to be treated, comply with applicable requirements of AWWA Standards C2 (Lumber) and C9 (Plywood) and of AWPB standards listed below. Mark each treated item with the AWPB Quality Mark Requirements.
- B. Pressure-treat above-ground items with water-borne preservatives complying with AWPB LP-2. After treatment, kiln-dry to a maximum moisture content of 15%. Treat indicated items and the following:
 1. Wood cants, nailers, curbs, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers and waterproofing.
 2. Wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry or concrete.
 3. Wood framing members less than 18" above grade.

- C. Fire Retardant Treatment: Where "FR-S" lumber or plywood is specified or otherwise indicated, provide materials which comply with AWWA standards for pressure impregnation with fire-retardant chemicals, and which have a flame spread rating of not more than 25 when tested in accordance with UL Test 723 or ASTM E84, and show no increase in flame spread and significant progressive combustion upon continuation of test for additional 20 minutes.
 - 1. Kiln-dry treated items to maximum moisture content of 19%.
 - 2. Provide UL label of each piece of fire-retardant lumber or plywood.
- D. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.
- B. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.
- C. Secure attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.
- D. Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish material. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required.
- E. Wood Grounds, Nailers, Blocking and Sleepers
 - 1. Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
 - 2. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
 - 3. Provide permanent grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2 inch wide and of thickness

required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

F. Wood Framing, General

1. Provide framing members of sizes and on spacings shown and frame openings as shown, or if not shown, comply with recommendations of "Manual for House Framing" of National Forest Products Association. Do not splice structural members between supports.
2. Anchor and nail as shown, and to comply with "Recommended Nailing Schedule" of "Manual for House Framing" and other recommendations of the NFPA.

- G. Installation of Plywood: Comply with applicable recommendations contained in Form No. E304, "APA Design/Construction Guide - Residential and Commercial", for types of plywood products and applications indicated.

END OF SECTION

SECTION 07100

MASONRY WALL WATER REPELLENT COATING

PART 1 GENERAL

1.01 DESCRIPTION

- A. WORK of this section includes the installation of a liquid applied water repellent sealer on surfaces of brick, concrete block, stucco, stone, etc., as indicated on the DRAWINGS.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Unit Masonry is included in Division 4, Section 04200.
- B. Sealants are included in Division 7, Section 07900

1.03 DESCRIPTION OF SYSTEM

- A. The sealer shall be a complete system of compatible materials designed by the manufacturer to produce a water repellent system, applied by contractors regularly doing this type application and, in addition, shall be designed for application on the specific type surfaces indicated on the DRAWINGS.

1.04 QUALITY ASSURANCE

- A. Qualifications: The applicator shall be certified by the water repellent system manufacturer. The applicator shall submit with his quotation a copy of the applicator's certification issued by the water repellent system manufacturer.
- B. Installation: Test a small area of surface before starting general application to assure desired results. Low pressure airless spray tip (pressure not to exceed 10 pounds) is recommended as best application. Brush or roller may also be used. System manufacturer's recommendations shall be strictly followed.

1.05 WARRANTY REQUIREMENTS

- A. The materials involved in this application shall be by the manufacturer. The guarantee shall ensure the water repellent performance of the system for a period of 10 years from date of application. Provisions of the guarantee shall include responsibility for water penetration through structurally sound areas, otherwise no liability is to be required for defects in the substrate

1.06 PRODUCT HANDLING

- A. Deliver materials in the original manufacturer's sealed containers.
- B. Store materials to prevent damage to containers or product, and protect them from freezing temperatures.
- C. Coating materials shall be thoroughly stirred before and occasionally during use.

1.07 PROJECT CONDITIONS

- A. Surface, air and materials shall not be lower than 45°F during application.
- B. Weather shall be clear and there shall be no precipitation during application or expected for 12-24 hours following application.
- C. Areas not subject to natural ventilation shall have positive ventilation provided throughout the application.
- D. Surface shall be clean and dry prior to application.
- E. Personnel shall be warned against prolonged breathing of vapors and contact of materials with skin or eyes.
- F. Protect other surfaces during application. Use drop cloths or masking if required.
- G. Upon completion of the WORK, remove from site trash and debris caused by WORK under this Section.

PART 2 PRODUCTS

2.01 ACCEPTABLE MATERIALS

- A. The sealing of areas shall consist of one coat of HYDROZO ENVIROSEAL DOUBLE 7 for Brick or Block (as required) as manufactured by HYDROZO INC., Lincoln, Nebraska (1-800-422-1902), or equal. It shall contain approximately 12% solids. HYDROZO INC. reserves the right to approve conditions of surfaces to be coated, as well as conditions at the time of applications. The sealer shall pass ASTM C-67-80a with a repellency rating of 96%. After 2500 hours of weatherometer testing it shall have no loss in repellency. It shall have a Flash Point greater than 212°F. (ASTM D3278-latest revision).

2.02 PERFORMANCE CRITERIA

Solids by Weight	12% (approx.)
Penetration	Up to 3/8" dependent on substrate
Water Repellency Tests:	
ASTM C67 - latest revision	96% (min.)

Water Permeance Test of Masonry: ASTM E514 – latest revision	Percentage Reduction of Leakage
Brick Masonry	Greater than 94.8%
Block Wall	99.8%
Surface appearance after coating application	Unchanged to slightly darkening
Yellowing	None
Efflorescence Resistance	Excellent to highly resistant

PART 3 EXECUTION

3.01 GENERAL

- A. Strictly follow the water repellent manufacturer's written instructions.

3.02 INSPECTION

- A. Verify that WORK done under other sections meets requirements. Notify ENGINEER in writing of any conditions requiring additional preparation prior to application.

3.03 PREPARATION

- A. Repoint any loose or disintegrated mortar and allow 72 hours drying time before application.
- B. Alkali or efflorescence on the surface shall be treated with proper neutralizing compound prior to application.
- C. Caulking, glazing and painting shall be fully cured prior to application of sealer.

3.04 INSTALLATION

- A. Most applications should be made from the bottom to the top. Material should be applied to saturation.

- B. Coverage Rates

Brick wall regular	80-140 (approx.) sq. ft. per gal.
Concrete block	60-125 (approx.) sq. ft. per gal.
Stucco	70-120 (approx.) sq. ft. per gal.
Stone	Recommendations of Technical Service

- C. Coverage may vary greatly with porosity of the substrate. On extremely porous substrates, two coats may be necessary. (Application of 2nd coat can take place as soon as initial surface drying has become visible.)

3.05 CLEANING

- A. Window glass that gets coated/over-sprayed may be cleaned with ENVIROSEAL Multi-Purpose Cleaner.

END OF SECTION

SECTION 07720

ACCESS HATCHES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Access hatches shall be furnished and installed where shown on the PLANS for CONTRACT 1, one (1) shall be furnished and installed for access through the top of the converted flocculation basin housing the liquid alum tanks and two (2) shall be installed in the roof of the new high service pump building for access to the pumps, one (1) shall be installed for the access to the clearwell and one (1) shall be installed in the top slab of the high service meter vault. For CONTRACT 2, access hatches for five (5) valve vaults shall be installed in the top slab of each.

1.02 RELATED WORK

- A. Flashing and sheet metal is included in Section 07600 of this Division.

1.03 SUBMITTALS

- A. SHOP DRAWINGS shall be submitted in accordance with Division 1, Section 01300
- B. SHOP DRAWINGS shall include detailed installation instructions and dimensions.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Equipment referenced for design is as manufactured by Bilco. Subject to compliance with the complete requirements of these SPECIFICATIONS, manufacturers offering products that may be incorporated into the WORK are Bilco or equal.

2.02 EQUIPMENT

- A. Access door for the alum storage tanks basin shall be Type KD-3 (4'0" x 6'0") Double Leaf Aluminum. Frame shall be 1/4" extruded aluminum with built-in neoprene cushion and with strap anchors bolted to exterior. Door leaf shall be 1/4" aluminum diamond plate reinforced with aluminum stiffeners as required. Cast steel hinges shall be bolted to underside and pivot on torsion bars that counterbalance the door for easy operation. The door shall open to 90° and lock automatically in that position. A vinyl grip handle shall be provided to release the cover for closing. Doors shall be built to withstand a live load of 150 pounds per square foot, and equipped

with a snap lock and removable handle. Aluminum shall be mill finish, with bituminous coating to be applied to exterior of frame by manufacturer. Hardware shall be Type 316 SS.

- B. Roof hatches for the high service pump building shall be Type E-50 (3'0" x 3'0"). Cover shall be 11-gauge aluminum with a 3" beaded flange and formed reinforcing members welded to support a minimum live load of 40 lb/ft². Insulation shall be glass fiber 1" in thickness, fully covered and protected by a metal liner (18-gauge aluminum). Curb shall be 12" in height and of 11-gauge aluminum. It shall be formed with a 3 1/2" flange with holes provided for securing to the roof deck. Curb shall be equipped with the Bilclip™ flashing system, including stamped tabs and Pak-Rope. Insulation on the exterior of the curb shall be rigid fiberboard 1" in thickness. Hatch shall be completely assembled with heavy pintle hinges, positive snap latch with turn handles and padlock hasps inside and outside and a mechanically retained thermoplastic rubber gasket. Compression spring operators enclosed in telescopic tubes shall be provided for smooth, easy and controlled door operation throughout the entire arc of opening and closing. Operation shall not be affected by temperature. Cover shall be equipped with an automatic cover to its closed and latched position. All hardware shall be Type 316 SS and factory finish shall be mill finish with bituminous coating applied to the exterior of the frame.
- C. Access hatch for the clearwell high service flow meter vault and four (4) of the distribution system valve vaults shall be Type J-4 AL (3'0" x 3'0"). Access hatch for one (1) of the distribution system valve vaults shall be Type J-2 AL (2'6" x 2'6"). Door leaf shall be 1/4" steel (or aluminum) diamond pattern plate to withstand a live load of 300 lb/ft² with a maximum deflection of 1/150th of the span. Channel frame shall be 1/4" aluminum with an anchor flange around the perimeter and have a minimum cross-section area of 7-1/2 in² to allow for adequate water drainage. Door shall be equipped with heavy forged brass hinges having 3/8" minimum diameter stainless steel pins and pivot so that the cover does not protrude into the channel frame. Compression spring operators enclosed in telescopic tubes shall be provided for smooth, easy and controlled door operation throughout the entire arc of opening and closing. Operation shall not be affected by temperature. The door shall automatically lock in the vertical position by means of a heavy steel hold-open arm with release handle. A Type 316 stainless steel snap lock with a gasketed cover plug and removable turn handle shall be provided. A 1-1/2" drainage coupling shall be located in the front right corner of the channel frame. Hardware and all fasteners shall be Type 316 SS. Factory finish shall be mill finish with bituminous coating applied to exterior of the frame.

PART 3 EXECUTION

3.01 INSTALLATION

Installation shall be in accordance with manufacturer's instructions. The CONTRACTOR shall guarantee against defects in material or workmanship for a period of five (5) years.

END OF SECTION

SECTION 07900

JOINT SEALERS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The description and extend of each type of joint sealer is indicated on the DRAWINGS and specified herein. Specific applications include:
 - 1. Masonry wall joints
 - 2. Flashing and coping joints
 - 3. Interior wall/ceiling joints
 - 4. Gasketing of assemblies
 - 5. Door thresholds

1.02 RELATED WORK NOT INCLUDED

- A. Concrete work, including joints and sealants, is included in Division 3.
- B. Unit masonry is included in Division 4, Section 04200.
- C. Flashing is included in this Division, Section 07600.
- D. Glazing is included in Division 8, Section 08800.
- E. Doors and windows are included in Division 8.

1.03 QUALITY ASSURANCE

- A. General Performance: Except as otherwise indicated, joint sealers are required to establish and maintain airtight and waterproof continuous seals on a permanent basis, within recognized limitations of wear and aging as indicated for each application. Failures of installed sealers to comply with this requirement will be recognized as failures of materials and workmanship.

1.04 SUBMITTALS

- A. Product Data

Submit manufacturer's product specifications, handling/installation/ curing instructions, and performance tested data sheets for each elastomeric product required, in accordance with Division 1, Section 01300.

B. Certified Tests

1. With produce data, submit test reports for elastomeric sealants on aged performances as specified, including hardness, stain resistance, adhesion, cohesion or tensile strength, elongation, low-temperature flexibility, water absorption, and resistance (aging, weight loss, deterioration) to heat and exposure to ozone and ultraviolet.

PART 2 PRODUCTS

2.01 CAULKING COMPOUND AND ACCESSORIES

A. Caulking Compound

Caulking compound shall be Sonolastic NPI as manufactured by Sonneborn-Contech or equivalent by W.R. Grace Co., or equal. Color shall be light gray throughout unless noted on DRAWINGS.

B. Primer

For water immersion, prime with Sonneborn-Contech Primer No. 733 for concrete and masonry, and Primer No. 758 for glass and metals, or as required by manufacturer of equivalent sealants.

C. Joint Filler and Bond Breaker

Joints shall be filled to the required distance from the surface with polyethylene strip to prevent bonding, or closed cell polyethylene foam rod, Sonofoam Backer-Rod, or equal. Never use filler impregnated with asphalt, tar or any migratory saturant or oil base caulking compounds for joint fillers.

PART 3 EXECUTION

3.01 INSTALLATION OF CAULKING COMPOUNDS AND ACCESSORIES

- A. Caulking compound shall completely seal all joints around frames and sills of doors, windows and other openings in masonry and concrete walls, and all other joints or spaces noted on the DRAWINGS to be caulked. Set door thresholds in full bed of caulking compound. All caulking compound, primer and joint filler shall be installed in strict accordance with the manufacturer's printed instructions, which shall be available at the job site. Refer to Division 3 for special joint requirements in connection with pre cast and pre stressed structural concrete members.

- B. All joint surfaces must be dry, thoroughly clean and primed as recommended by the caulking manufacturer. Apply primer with a brush or clean cloth in sufficient amount to obtain 100 percent coverage. Best

results are obtained when primer is applied in a thin coat for most surfaces; however, porous surfaces require a somewhat heavier but not excessive coat. Allow primer to dry for the recommended period before applying sealant.

- C. The depth of sealant shall be 1/2 of the width of the joint, with a maximum depth of 1/2 inch and a minimum of 1/4 inch. Joint depths exceeding this design criteria should be filled to the proper depth using a joint filler or backup material such as a backer rod, which should be 1/8 inch larger in diameter than the width of the joint to allow for compression. Where the joint is too small to permit a backer rod, a polyethylene film strip must be used to prevent the sealant bonding to joint filler.
- D. Caulking can be applied with a bulk or air powered caulking gun. See manufacturer's recommendations for minimum temperature at which caulking can be applied.
- E. See manufacturer's instructions for application to masonry, metal, glass, and wood.
- F. Remove excess caulking and leave surface neat, smooth and clean. All caulked joints shall be watertight.

END OF SECTION

SECTION 08700

BUILDERS HARDWARE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Definition: "Builders' Hardware" includes items known commercially as builders hardware which are required for swing doors. Types of items in this Section may include (but are not necessarily limited to):
 - 1. Hinges
 - 2. Lock cylinders and keys
 - 3. Lock and latch sets
 - 4. Bolts
 - 5. Exit devices
 - 6. Closers
- B. The schedule included herein designates the type and quality of the hardware desired. Furnish all labor, materials, and equipment required to install and integrate finish hardware, weather-stripping and thresholds with the doors and frames.

1.02 QUALITY ASSURANCE

- A. Manufacturer: Obtain each kind of hardware (latch and lock sets, hinges, closers, etc.), from only one manufacturer, although several may be indicated as offering products complying with requirements.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical information for each item or hardware. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and finish.
- B. Hardware Schedule: Submit final hardware schedule in manner indicated below. Hardware schedules are intended for coordination of WORK.
- C. Final Hardware Schedule Content: Based on builder's hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door. Include the following information:

1. Type, style, function, size, and finish of each hardware item.
 2. Name and manufacturer of each item.
 3. Fasteners and other pertinent information.
 4. Location of hardware set cross-referenced to indications on DRAWINGS both on floor plans and in door and frame schedule.
 5. Explanation of all abbreviations, symbols, codes, etc., contained in schedule.
 6. Mounting locations for hardware.
 7. Door and frame sizes and materials.
 8. Keying information.
 9. Keying Schedule: The supplier shall coordinate specific keying requirements through the OWNER and the job-site construction office.
- D. Samples: Submit one sample of each type of exposed hardware unit, finished as required, and tagged with full description for coordination with schedule.
- E. Samples will be returned to the supplier. Units which are acceptable and remain undamaged through submittal, review and field comparison procedures may, after final check of operation, be used in the WORK, within limitations of keying coordination requirements.

1.04 PRODUCT HANDLING

- A. Packaging of hardware is the responsibility of the supplier. As material is received by the hardware supplier from the various manufacturers, sort and repackage in containers marked with the hardware set number. Two or more identical sets may be packed in the same container.
- B. Inventory hardware jointly with representatives of the hardware supplier and the hardware installer until each is satisfied that the count is correct.
- C. Provide secure lock-up for hardware delivered to the project, but not yet installed. Both before and after installation, control the handling and installation of hardware items which are not immediately replaceable so that the completion of the WORK will not be delayed by hardware losses.

1.05 JOB CONDITIONS

- A. Coordination: Coordinate hardware with other WORK. Tag each item or package separately, with identification related to the final hardware schedule, and include basic installation instructions in the package.

Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security, and similar requirements indicated, as necessary for proper installation and function. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.

- B. Templates: Furnish hardware templates to each fabricator of doors, frames, and other WORK to be factory-prepared for the installation of hardware. Upon request, check the SHOP DRAWINGS of such other WORK to confirm that adequate provisions are made for the proper installation of hardware.

PART 2 PRODUCTS

2.01 SCHEDULED HARDWARE

- A. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of builders' hardware is indicated in the Builders' Hardware Data Sheet and Hardware Schedule. Products are identified by using hardware designation numbers of the following:
1. Manufacturer's product designations: Manufacturer's product designation is used in the Hardware Schedule for purposes of establishing minimum requirements. Provide either the product designated or the comparable product of other manufacturers that comply with requirements, except for door locks.
 2. Manufacturer's numbers used in Hardware Schedule are for purposes of setting a standard of quality and are not intended to imply that products of named manufacturers are required to the exclusion of equivalent products of other manufacturers.
- B. BHMA numbers are taken from the following BHMA standards. Provide products complying with these standards and requirements specified elsewhere in this section.
1. Butts and Hinges: ANSI A156.1 (BHMA 101).
 2. Locks and Lock Trim: ANSI A156.2 (BHMA 601).
 3. Exit Devices: ANSI A156.3 (BHMA 701).
 4. Door Controls - Closers: ANSI A156.4 (BHMA 301).
 5. Auxiliary Locks: ANSI A157.5 (BHMA 501).
 6. Architectural Door Trim: ANSI A156.6 (BHMA 1001).
 7. Template Hinge Dimensions: ANSI A156.7.

8. Door Controls - Overhead Holders: ANSI A156.8 (BHMA 311).
9. Mortise Locks and Latches: ANSI A156.13 (BHMA 621).
10. Auxiliary Hardware: BHMA 1201.
11. Materials and Finishes: BHMA 1301.

2.02 MATERIALS AND FABRICATION

- A. General: Hand of door: The DRAWINGS show the direction of the swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of the door movement as shown.
- B. Manufacturer's Nameplate: Do not use manufacturer's products which have manufacturer's name or trade displayed in a visible location (omit removable nameplates), except in conjunction with required UL labels and as otherwise acceptable to the ENGINEER.
- C. Manufacturer's identification will be permitted on rim of lock cylinders only.
- D. Base Metals: Produce hardware units of the basic metal and forming method indicated, using the manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially recognized) quality than specified for the applicable hardware units.
- E. Fasteners: Manufacture hardware shall be attached with stainless steel screws to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.
- F. Provide concealed fasteners for hardware units which are exposed when the door is closed, except to the extent no standard units of the type specified are available with concealed fasteners. Do not use through bolts for installation where the bolt head or the nut on the opposite face is exposed in other WORK, except where it is not feasible to adequately reinforce the WORK.

2.03 HINGES

- A. Aluminum Doors
 1. Number of hinges: Provide number of hinges indicated but not less than three hinges for each door leaf for doors 90 inches or less in height and one additional hinge for each 30 inches of additional height per manufacturer's recommendations.
 2. Size: Furnish size 5" x 4-1/2" template butt hinges, unless otherwise noted in hardware set.

2.04 LOCK CYLINDERS AND KEYING

- A. General: Supplier will meet with OWNER at the job site construction office to finalize keying requirements and obtain final instructions in writing.
- B. Review the keying system with the OWNER and provide the type required (master, grandmaster, or great-grandmaster), either new or integrated with OWNER'S existing system.
- C. Keying system employed shall provide a high level of security. Each cylinder shall contain at least 7 key pins.
- D. All cylinders shall be furnished with temporary removable construction cores, which will be keyed alike and furnished with six keys and one control key.
- E. Permanent cores shall be keyed as directed and upon proper authorization shall be shipped directly to the hardware distributor.
- F. Hardware distributor shall:
 - 1. Deliver permanent cores to job.
 - 2. Remove temporary cores and install permanent cores.
 - 3. Deliver to building owner all change and master keys for permanent system.
 - 4. Assist OWNER in set-up of key cabinet system.
- G. All subsequent orders for cylinder and/or cut keys shall only be available from the factory upon receipt of the proper authorization from the building owner.
- H. Equip all locks with high security cylinders which comply with performance requirements for Grade 1 cylinders as listed in ANSI A156.5 and which have been tested for pick and drill resistance requirements of UL 437 and UL listed.
- I. Metals: Construct lock cylinder parts from brass/bronze, stainless steel or nickel silver.
- J. Comply with OWNER'S instructions for master-keying and, except as otherwise indicated, provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.
- K. Key Material: Provide keys of nickel silver only.
- L. Key Quantity: Furnish 2 change keys for each lock; 5 master keys for each master system; and 3 grandmaster keys for each grandmaster system.

1. Deliver keys to OWNER'S representative.

- M. Provide and install a key control system including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of the number of locks required for the project.

2.05 LOCKS, LATCHES AND BOLTS

- A. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set.
- B. Lock Throw: Provide 5/8" minimum throw of latch and dead-bolt used on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.
- C. Flush Bolt Heads: Minimum of 1/2" diameter rods of brass, bronze or stainless steel, with minimum 12" long rod.
- D. Cane Bolts: Provide 5/8" diameter rod, 18" long, steel with zinc plating, surface mount to inactive leaf of pair doors with stainless steel screws.
- E. Exit Device: No dogging.

2.06 CLOSERS

- A. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of closer, depending upon size of door, exposure to weather, and anticipated frequency of use.

2.07 HARDWARE FINISHES

- A. Provide matching finishes for hardware units at each door or opening to the greatest extent possible, and except as otherwise indicated. Reduce differences in color and texture as much as commercially possible where the base metal or metal-forming process is different for individual units of hardware exposed at the same door or opening. In general, match items to the manufacturer's standard finish for the latch and lock set (or push-pull units if no latch-lock sets) for color and texture.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified for the applicable units of hardware by referenced standards.
- C. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze and aluminum, except as otherwise indicated.

- D. The designations used in schedules and elsewhere to indicate hardware finishes are the industry-recognized standard commercial finishes, except as otherwise noted.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Mount hardware units at heights indicated in "Recommended Locations for Builders' Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by ENGINEER.
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing WORK specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrate.
- C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

3.02 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
- B. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the WORK during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- C. Instruct OWNER'S personnel in proper adjustment and maintenance of hardware and hardware finishes during the final adjustment of hardware.

END OF SECTION

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SECTION 08730

DOOR ACCESSORIES

PART 1 GENERAL

1.01 GENERAL SCOPE

- A. Unless noted on the DRAWINGS, weather stripping and thresholds shall apply to exterior doors only.
- B. Certain products manufactured by National Guard Products (NGP), Reese Enterprises and Zero Weather Stripping Co. have been specified because of characteristics which appear to be most suited to the application such as type and thickness of materials, physical configurations, methods of attachment and probability of obtaining satisfactory performance. Similar products proposed for substitution on an as-equal basis should be compared carefully with the specified products before submitting to the ENGINEER for review. Weather-stripping shall be attached with stainless steel fasteners.
- C. Weather-stripping and thresholds shall be installed strictly according to the SHOP DRAWINGS and manufacturer's recommendations using stainless steel fasteners.
- D. When required to fill out 1 9/16" rabbit for thinner combination doors or effect proper seal in exterior doors, press-on type sponge weather-stripping shall be used as directed by the ENGINEER.
- E. The bottom side of thresholds shall be completely filled with caulking when anchored to the floor to prevent water from passing under the threshold.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. For caulking compound and joint sealers, see Division 7, Section 07900.
- B. For extent of door accessories, see this Division, Section 08700.

1.03 QUALITY ASSURANCE

- A. Fire-rated and emergency exit openings: Regardless of typical types specified or detailed, provide only thresholds, stripping and seal units which do not interfere with rating or proper operation of doors at fire-rated openings and at emergency exit openings.
- B. Continuity of Stripping: Except as otherwise indicated, provide continuous stripping at each opening, without unnecessary interruptions at door corners and hardware. Where possible, provide units which will not become ineffective as seals because of misalignment at corners, minor

out-of-adjustments on doors and frames, temperature variations and normal wear and aging of materials.

- C. Manufacturer of Stripping and Seals: To greatest extent possible (where available), provide stripping and seals produced by only one manufacturer.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's standard details, specifications and installation instructions for each type of product required. Furnish templates to other fabricators when required for proper preparation of WORK to receive stripping and seals.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the WORK include, but not limited to, the following:

- 1. Stripping and Seals:

- National Guard Products, Inc.
 - Pemko Manufacturing Company
 - Reese Enterprises, Inc.
 - Zero Weatherstripping Company, Inc.

- 2. Thresholds:

- National Guard Products, Inc.
 - Pemko Manufacturing Company
 - Reese Enterprises, Inc.

2.02 WEATHERSTRIPPING AT JAMBS AND HEADS (WrStp)

- A. Doors

- 1. Heads and Jambs

- a. Seal recessed cap channel of doors with rigid vinyl filler strip with pile, Reese No. 169 or equal. Seal heads and jambs with compression weather-strip attached to stop, NGP No. 132NS, 3/8" by 1-1/4", "anodized natural aluminum and closed cell sponge neoprene flexible to 35° Fahrenheit, or equal.

- 2. Sill

- a. Seal sill on openings side of door with Raindrip, Reese No. 353 A, aluminum and vinyl. Seal sill on stop side of door with sweep, Reese No. 772, aluminum and polyurethane flexible to 80° Fahrenheit, or equal.

B. Frames

1. Heads and Jambs

- a. Supplemental weather-stripping in the space between door and frame may be required to effect proper seal without binding as directed by the ENGINEER.
- b. Weather-stripping shall be press-on closed cell sponge neoprene flexible to -35° Fahrenheit, rectangular in cross-section and in size of 3/8" by 3/16" and 1/2" by 1/4", as required for the installation. Where required, weather-stripping shall be installed at the intersections of the door frame jambs and stops with the long dimension applied to the stop at the lock and head jambs and applied to the jamb at the hinge side.
- c. Weather-stripping shall be NGP No. 361 and 362, or equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Weather-stripping and Seals: Comply with manufacturer's instructions and recommendations, to the extent that installation requirements are not otherwise indicated.
 1. Provide metal fasteners of the type which will not work loose as a result of normal door use, and which are compatible with the metal of the stripping and door (if metal). Provide only smooth exposed fastener heads which do not constitute a snagging hazard to clothing of building occupants.
 2. Set units plumb and level, accurately centered at optimum location for maintaining a permanent seal.
 3. Adjust doors, frames and hardware, if necessary, to achieve proper operation of seals and stripping.
- B. Thresholds
 1. Comply with threshold manufacturer's instructions.
 2. On concrete, masonry and similar substrates, install lead-shield anchors, accurately placed to receive machine screw anchors at

locations pre-drilled and evenly spaced in threshold units (spaced not more than 12 in o.c.).

3. Screw thresholds with stainless steel screws, or the proper type for permanent anchorage.
4. Set threshold units level and accurately aligned with frames and doors, and at proper elevation for door operation. Shim, if necessary, for full continuous support of threshold at each edge and intermediate legs, if any, using non-corrosive shims of metal or plastic. Set in full bed of caulking compound anchoring against dislocation from impact of traffic upon threshold.

END OF SECTION

SECTION 09900

COATING SYSTEMS FOR POTABLE WATER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Coating systems for potable water processing and storage facilities.

1.2 RELATED SECTIONS

- A. Section 02610 – General Piping (In particular, see requirements for ductile iron pipe lining.
- B. Section 09250 – Gypsum Drywall.
- C. Section 08120 – Hollow Metal Doors and Frames.
- D. Section 15075 - Mechanical Identification: Identification of mechanical equipment & piping.
- E. Section 13120 – Specification for Metal Building.
- F. Section 16195 – Electrical Identification: Identification of electrical equipment.

1.3 REFERENCES

- A. ASTM D 16 - Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
- B. ASTM D 4263 - Indicating Moisture in Concrete by the Plastic Sheet Method.
- C. ASTM F 1869 - Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- D. International Concrete Repair Institute (ICRI) Guideline No. 03732 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
- E. NACE RP0188 - Standard Recommended Practice, Discontinuity (Holiday) Testing of Protective Coatings.
- F. NAPF 500-03-04 Abrasive Blast Cleaning.
- G. NAPF 500-03-03 Power Tool Cleaning.

- H. SSPC-SP 1 - Solvent Cleaning.
- I. SPPC-SP 5/NACE 1 - White Metal Blast Cleaning.
- J. SSPC-SP 6/NACE 3 - Commercial Blast Cleaning.
- K. SSPC-SP 10/NACE 2 - Near-White Metal Blast Cleaning.
- L. SSPC-SP 13/NACE 6 - Surface Preparation of Concrete.

1.4 DEFINITIONS

- A. Definitions of Painting Terms: ASTM D 16, unless otherwise specified.
- B. Dry Film Thickness (DFT): Thickness of a coat of cured paint measured in mils (1/1000 inch).
- C. Exposed Surface: A surface is considered exposed if it is subject to contact with air and/or water after installation is complete. Surfaces hidden in walls, above ceilings, in pipe chases, etc., are considered exposed. Metal to like metal surfaces, steel embedded in concrete, or similar embedded work products are not considered exposed.

1.5 SUBMITTALS

- A. Comply with Section 01300 - Submittal Procedures.
- B. Product Data: Submit manufacturer's product data for each coating, including generic description, complete technical data, surface preparation, and application instructions.
- C. Color Samples: Submit manufacturer's color samples showing full range of standard colors.
- D. Manufacturer's Quality Assurance: Submit manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.
- E. Applicator's Quality Assurance: Submit list of a minimum of 5 completed projects of similar size and complexity to this Work. Include for each project:
 - 1. Project name and location.
 - 2. Name of owner.
 - 3. Name of contractor.
 - 4. Name of engineer.
 - 5. Name of coating manufacturer.

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6. Approximate area of coatings applied.
 7. Date of completion.
- F. Warranty: Submit manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
1. Specialize in manufacture of coatings with a proven successful experience.
 2. Able to demonstrate successful performance on comparable projects.
 3. Single Source Responsibility: Coatings and coating application accessories shall be products of a single manufacturer.
- B. Applicator's Qualifications:
1. Experienced in application of specified coatings on projects of similar size and complexity to this Work.
 2. Applicator's Personnel: Employ persons trained for application of specified coatings.
- C. Preapplication Meeting: Convene a preapplication meeting two [2] weeks before start of application of coating systems. Require attendance of parties directly affecting work of this section, including Contractor, Engineer, applicator, and manufacturer's representative. Review the following:
1. Environmental requirements.
 2. Protection of surfaces not scheduled to be coated.
 3. Surface preparation.
 4. Application.
 5. Repair.
 6. Field quality control.
 7. Cleaning.
 8. Protection of coating systems.

9. One-year inspection.
 10. Coordination with other work.
- D. Mock-Ups: Prepare 2 foot x 2 foot mock-up for each coating system specified using same materials, tools, equipment, and procedures intended for actual surface preparation and application. Obtain Engineer's approval of mock-ups. Retain mock-ups to establish intended standards by which coating systems will be judged.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:
1. Coating or material name.
 2. Manufacturer.
 3. Color name and number.
 4. Batch or lot number.
 5. Date of manufacture.
 6. Mixing and thinning instructions.
- B. Storage:
1. Store materials in a clean dry area and within temperature range in accordance with manufacturer's instructions.
 2. Keep containers sealed until ready for use.
 3. Do not use materials beyond manufacturer's shelf life limits.
- C. Handling: Protect materials during handling and application to prevent damage or contamination.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Weather:
1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
 2. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above dew point.
 3. Relative Humidity: Prepare surfaces and apply and cure coatings

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within relative humidity range in accordance with manufacturer's instructions.

4. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
 5. Wind: Do not spray coatings if wind velocity is above manufacturer's limit.
- B. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with AWWA D 102.
- C. Dust and Contaminants:
1. Schedule coating work to avoid excessive dust and airborne contaminants.
 2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Tnemec Company Incorporated, or approved equal.
- B. When submitting for consideration coatings proposed to be substituted as equivalent to the specified coatings, the CONTRACTOR shall submit to the ENGINEER notarized certificates on the letterhead of the firm manufacturing the proposed substitution certifying that the proposed substitution is the equivalent of the specified material in quality and performance, and that the proposed substitution is suitable for the intended use. The CONTRACTOR shall also submit to the ENGINEER on the letterhead of the firm manufacturing the proposed substitution a list of installations similar to the installation for which the products are being proposed, at which installations the proposed products have performed reliably in similar service; this list shall include the name, address, and telephone number of the OWNER of each installation, and the name of that OWNER'S employee who is responsible for maintenance and construction.
- C. Substitutions which decrease the film thickness, the number of coats applied, change the generic type of coating, or fail to meet the performance criteria of the specified materials will not be approved. Prime and finish coats of all surfaces shall be furnished by the same manufacturer.

2.2 COATING SYSTEMS FOR STEEL - STRUCTURAL, TANKS, PIPE, EQUIPMENT, AND MISCELLANEOUS

A. Exterior Exposed:

1. System Type: MCU/epoxy/urethane.
2. Surface Preparation: SSPC-SP 6.
3. Primer: Omnithane, DFT 2.5 to 3.5 mils.
4. Intermediate Coat: Series N69 Hi-Build Epoxoline II. DFT 2.0 to 3.0 mils.
5. Finish Coat: Series 1074 Endura-Shield. DFT 2.0 to 3.0 mils.
6. Total DFT: 6.5 to 9.5 mils.
7. Finish Color: As indicated on the drawings.

B. Interior Exposed – No Contact with Potable Water:

1. System Type: MCU/epoxy.
2. Surface Preparation: SSPC-SP 6.
3. Primer: Omnithane, DFT 2.5 to 3.5 mils.
4. Finish Coat: Series N69 Hi-Build Epoxoline II. DFT 4.0 to 6.0 mils.
[May require two coats if brush or roller applied].
5. Total DFT: 6.5 to 9.5 mils.
6. Finish Color: As indicated on the drawings.

C. H2S Gas Exposed:

1. System Type: MCU/Perma-Glaze.
2. Surface Preparation: SSPC-SP 5.
3. Primer: Series 435 Perma-Glaze. DFT 15.0 to 20.0 mils.
4. Finish Coat: Series 435 Perma-Glaze. DFT 15.0 to 20.0 mils.
5. Total DFT: 30.0 to 40.0 mils.
6. Finish Color: [5021 Gray] [5022 Beige].

D. Immersion – Contact with Potable Water:

1. System Type: MCU/epoxy.
2. Surface Preparation: SSPC-SP 10.
3. Primer: Omnithane, DFT 2.5 to 3.5 mils.
3. Intermediate Coat: Series N140-1255 Pota-Pox Plus DFT 4.0 to 6.0
4. Stripe Coat: Series N140-15BL Pota-Pox Plus applied by brush to all weld seams and sharp edges DFT 3.0-5.0
5. Finish Coat: Series N140-Tnemec White. DFT 4.0 to 6.0 mils.
6. Total DFT: 10.5 to 15.5 mils.
7. Finish Color: As indicated on the drawings.

**2.3 COATING SYSTEMS FOR GALVANIZED STEEL AND NONFERROUS METAL
- PIPE AND MISCELLANEOUS FABRICATIONS**

A. Exterior Exposed:

1. System Type: Epoxy/urethane.
2. Surface Preparation: SSPC-SP 1 - Solvent Cleaning and etch.
3. Primer: Series N69 Hi-Build Epoxoline II. DFT 2.0 to 3.0 mils.
4. Finish Coat: Series 1074. DFT 2.0 to 3.0 mils.
5. Total DFT: 4.0 to 6.0 mils.
6. Finish Color: As indicated on the drawings, or color schedule.

B. Interior Exposed – No Contact with Potable Water:

1. System Type: Epoxy.
2. Surface Preparation: SSPC-SP 1 - Solvent Cleaning and etch.
3. Primer: Series N69 Hi-Build Epoxoline II. DFT 2.0 to 3.0 mils.
4. Finish Coat: Series N69 Hi-Build Epoxoline II. DFT 2.0 to 3.0 mils.
5. Total DFT: 4.0 to 6.0 mils.
6. Finish Color: As indicated on the drawings, or color schedule.

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C. H2S Gas Exposed:

1. System Type: MCU/Perma-Glaze.
2. Surface Preparation: SSPC-SP 1 - Solvent Cleaning and severely etch.
3. Primer: Series 435 Perma-Glaze. DFT 15.0 to 20.0 mils.
4. Finish Coat: Series 435 Perma-Glaze. DFT 15.0 to 20.0 mils.
5. Total DFT: 30.0 to 40.0 mils.
6. Finish Color: [5021 Gray] [5022 Beige].

D. Immersion – Contact with Potable Water:

1. System Type: Epoxy.
2. Surface Preparation: SSPC-SP 1 followed by abrasive blast.
3. Primer Coat: Series N140-15BL Pota-Pox Plus DFT 4.0-6.0
4. Finish Coat: Series N140-1255 Pota-Pox Plus DFT 4.0 to 6.0
5. Total DFT: 7.0 to 11.0 mils.

2.4 COATING SYSTEMS FOR DUCTILE OR CAST IRON - PIPE, PUMPS, AND VALVES

A. Exterior Exposed:

1. System Type: MCU/epoxy/urethane.
2. Surface Preparation: NAPF 500-03-03 Power Tool Cleaning.
3. Primer: Omnithane, DFT 2.5 to 3.5 mils.
4. Intermediate Coat: Series N69 Hi-Build Epoxoline II. DFT 2.0 to 3.0 mils.
5. Finish Coat: Series 1074 Endura-Shield. DFT 2.0 to 3.0 mils.
6. Total DFT: 6.5 to 9.5 mils.
7. Finish Color: As indicated on the drawings, or color schedule.

B. Below Ground (Buried):

1. System Type: Coal tar epoxy.
2. Surface Preparation: NAPF 500-03-04 Abrasive Blast Cleaning.
3. Finish Coat: Series 46H-413 Hi-Build Tneme-Tar. DFT 14.0 to 20.0 mils.
4. Total DFT: 14.0 to 20.0 mils.
5. Finish Color: As indicated on the drawings, or color schedule.

C. Interior Exposed:

1. System Type: MCU/Epoxy.
2. Surface Preparation: Surface Preparation: NAPF 500-03-03 Power Tool Cleaning.
3. Primer: Omnithane, DFT 2.5 to 3.5 mils.
4. Finish Coat: Series N69 Hi-Build Epoxoline II. DFT 4.0 to 6.0 mils. *[May require two coats if brush or roller applied].*
5. Total DFT: 6.5 to 9.5 mils.
6. Finish Color: As indicated on the drawings, or color schedule.

D. H2S Gas Exposed:

1. System Type: MCU/Perma-Glaze.
2. Surface Preparation: Surface Preparation: NAPF 500-03-04 Abrasive Blast Cleaning.
3. Primer: Series 435 Perma-Glaze. DFT 15.0 to 20.0 mils.
4. Finish Coat: Series 435 Perma-Glaze. DFT 15.0 to 20.0 mils.
5. Total DFT: 30.0 to 40.0 mils.
6. Finish Color: [5021 Gray] [5022 Beige].

E. Immersion – Contact with Potable Water:

1. System Type: MCU/Epoxy.
2. Surface Preparation: NAPF 500-03-04 Abrasive Blast Cleaning.
3. Primer: Omnithane, DFT 2.5 to 3.5 mils.
4. Intermediate Coat: Series N140 Pota-Pox Plus DFT 4.0-6.0

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5. Finish Coat: Series N140 Pota-Pox Plus. DFT 4.0 to 6.0 mils.
6. Total DFT: 10.5 to 15.5 mils.

2.5 COATING SYSTEMS FOR PVC

A. Exterior Exposed:

1. System Type: Epoxy/urethane.
2. Surface Preparation: Scarify.
3. Primer: Series N69 Hi-Build Epoxoline II. DFT 2.0 to 3.0 mils.
4. Finish Coat: Series 1074 Endura-Shield. DFT 2.0 to 3.0 mils.
5. Total DFT: 4.0 to 6.0 mils.
6. Finish Color: As indicated on the drawings, or color schedule.

B. Interior Exposed:

1. System Type: Epoxy.
2. Surface Preparation: Scarify.
3. Primer: Series N69 Hi-Build Epoxoline II. DFT 2.0 to 3.0 mils.
4. Finish Coat: Series N69 Hi-Build Epoxoline II. DFT 2.0 to 3.0 mils.
5. Total DFT: 4.0 to 6.0 mils.
6. Finish Color: As indicated on the drawings.

2.6 COATING SYSTEMS FOR INSULATED PIPE

A. Interior/Exterior Exposed:

1. System Type: Acrylic.
2. Surface Preparation: Clean and dry.
3. Primer: Series 28 Tufcryn. DFT 1.5 to 2.0 mils.
4. Finish Coat: Series 28 Tufcryn. DFT 1.5 to 2.0 mils.
5. Total DFT: 2.0 to 3.0 mils.
6. Finish Color: As indicated on the drawings, or color schedule.

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2.7 COATING SYSTEMS FOR PRECAST CONCRETE, CAST-IN-PLACE CONCRETE, AND DENSE CONCRETE MASONRY UNITS

A. Exterior Exposed:

1. System Type: Acrylate.
2. Surface Preparation: SSPC-SP 13/NACE 6. Clean and dry.
3. Primer: Series 156 Enviro-Crete. Spreading Rate 125 sf/gal.
4. Finish Coat: Series 156 Enviro-Crete. Spreading Rate 200 sf/gal.
6. Finish Color: As indicated on the drawings.

B. Below Grade (Soil Side):

1. System Type: Coal tar epoxy.
2. Surface Preparation: SSPC-SP 13/NACE 6. Clean and dry.
3. Primer: None.
4. Finish Coat: 46H-413 Hi-Build Tneme-Tar. DFT 14.0 to 20.0 mils.
5. Total DFT: 14.0 to 20.0 mils.
6. Finish Color: Black.

C. H2S Gas Exposed and Severe Immersion:

1. System Type: Perma-Shield H2S/Perma-Glaze.
2. Surface Preparation: SSPC-SP 13/NACE 6 and ICRI Guideline 03732, CSP-5
3. Surfacer: Series 218 MortarClad and/or Series 219 MortarCast.
4. First Coat: Series 434 Perma-Shield H2S. Nominal DFT 125 mils.
5. Finish Coat: Series 435 Perma-Glaze. DFT 15.0 to 20.0 mils.
6. Total DFT: Over 140 mils.
7. Finish Color: [5021 Gray] [5022 Beige].

D. Immersion – Contact with Potable Water:

1. System Type: Epoxy.
 2. Surface Preparation: SSPC-SP 13/NACE 6 and ICRI Guideline 03732, CSP-3.
 3. Primer: Series N140 Pota-Pox Plus DFT 3.0 to 5.0 mils.
 4. Intermediate Coat: Series N140 Pota-Pox Plus. DFT 4.0 to 6.0 mils.
 5. Finish Series N140 Pota-Pox Plus. DFT 4.0 to 6.0 mils.
 6. Total DFT: 11.0 to 17.0 mils.
 7. Finish Color: As indicated on the drawings, or color schedule.
- E. Interior Exposed:
1. System Type: Epoxy [Spay apply, or addition coats may be required].
 2. Surface Preparation: SSPC-SP 13/NACE 6 and ICRI Guideline 03732, CSP-3.
 3. Primer: Series 113 H.B. Tneme-Tufcoat. DFT 4.0 to 6.0 mils. Roll or backroll.
 4. Finish Coat: Series 113 H.B. Tneme-Tufcoat. DFT 4.0 to 6.0 mils.
 5. Total DFT: 8.0 to 12.0 mils.
 6. Finish Color: As indicated on the drawings, or color schedule.

2.8 COATING SYSTEMS FOR CONCRETE FLOORS

- A. Mild Exposure:
1. System Type: Silicate Blend.
 2. Surface Preparation: Clean & Dry. No curing compounds.
 3. Primer: Series 629 CT Densifyer 201. 300-350 sq. ft./gal.
 4. Finish Coat: 629 CT Densifyer 201. 350-400 sq. ft./gal.
 6. Total DFT: N/A.
 7. Finish Color: As selected by Architect from manufacturer's standard colors.

B. Heavy Traffic and Chemical Exposure :

1. System Type: Aggregate-filled epoxy/urethane.
2. Surface Preparation: SSPC-SP 13/NACE 6 and ICRI Guideline 03732, CSP-5.
3. First Coats: Series 237 Power-Tread, double broadcast. DFT 1/8 inch.
4. Intermediate Coat: Series 280 Tneme-Glaze. DFT 6.0 to 8.0 mils.
5. Finish Coat: Series 290 CRU. DFT 2.0 to 3.0 mils.
6. Total DFT: Greater than 1/8 inch.
7. Finish Color: As indicated on the drawings. [Limited Color Selection]
8. Finish Texture: As required by the Engineer.

C. H2S Gas Exposed:

1. System Type: Perma-Shield H2S/Perma-Glaze.
2. Surface Preparation: SSPC-SP 13/NACE 6 and ICRI Guideline 03732, CSP-5
3. Surfacer: Series 218 MortarClad and/or Series 219 MortarCast.
4. First Coat: Series 434 Perma-Shield H2S. Nominal DFT 125 mils.
5. Finish Coat: Series 435 Perma-Glaze. DFT 15.0 to 20.0 mils.
6. Total DFT: Over 140 mils.
7. Finish Color: [5021 Gray] [5022 Beige].

D. Decorative:

1. System Type: Ceramic-filled epoxy.
2. Surface Preparation: SSPC-SP 13/NACE 6 and ICRI Guideline 03732, CSP-5.
3. First Coats: Series 222 Deco-Tread, double broadcast. DFT 1/8 inch.
4. Finish Coat: Series 284 Deco-Clear. DFT 8.0 to 10.0 mils.

5. Total DFT: Greater than 1/8 inch.
 6. Finish Color: As indicated on the drawings.
 7. Finish Texture: As required by the Engineer.
- E. High-Build Epoxy/Urethane Floor Coating
1. Surface Preparation: Shot Blast or Mech. Abrade (ICRI CSP 3-5).
 2. Primer for concrete: Series 281 Tneme-glaze. DFT 6.0 to 8.0 mils.
 3. Base Coat: Series 224 Deco-Fleck (broadcast flake to refusal or as directed by Engineer). Liquid DFT 8.0 to 10.0 Mils.
 4. Grout Coat: Series 224 Deco-Fleck. DFT 8.0 to 10.0 Mils.
 5. Intermediate Coat: Series 224 Deco-Fleck. DFT 8.0 to 10.0 Mils.
 6. Finish Coat: Series 295 Clear CRU. DFT 2.0 to 3.0 Mils
 7. Total DFT: 24.0 to 31.0 Mils.
 8. Finish Color & Pattern: As selected by Architect from manufacturer's standard colors.

2.9 COATING SYSTEMS FOR SECONDARY CONTAINMENT

- A. Chemical Storage Containment Area
1. System Type: High-solids epoxy.
 2. Surface Preparation: SSPC-SP 13/NACE 6 and ICRI Guideline 03732, CSP-5.
 3. Primer: Series 201 Epoxoprime. DFT 6.0 to 8.0 mils.
 4. Intermediate Coat: Series 275 Stranlock. DFT 25.0 to 40.0 mils.
 5. Finish Coat: Series 282 Tneme-Glaze. DFT 8.0 to 12.0 mils.
 6. Total DFT: 39.0 to 60 mils.
 7. Finish Color: As indicated on the drawings. [Limited Color Selection]
- B. Floors, Severe Chemical, Abrasion, and Traffic Exposure:
1. System Type: Aggregate-filled epoxy novalac.
 2. Surface Preparation: SSPC-SP 13/NACE 6 and ICRI Guideline

03732, CSP-5.

3. First Coats: Series 239 Chemtread, double broadcast. DFT 1/8 inch.
4. Finish Coat: Series 282 Tneme-Glaze. DFT 6.0 to 8.0 mils.
5. Total DFT: Greater than 1/8 inch (125 mils).
6. Finish Color: As indicated on the drawings. [Limited Color Selection]

2.10 COATING SYSTEMS FOR POROUS CONCRETE MASONRY UNITS

A. Exterior Exposed:

1. System Type: Siloxane/Silane Water Repellent/ Methylmethacrylate Acrylic Stain.
2. Surface Preparation: SSPC-SP 13/NACE 6. Clean and dry.
3. First Coat: Series 662 Prime-A-Pell Plus. Spreading rate 65 to 85 sq. ft/gal.
4. Second Coat: Series 662 Prime-A-Pell Plus. Apply second coat wet-on-wet to saturation. Block receiving accent stain do not require a second coat.
5. Accent Stain: Series 607 Conformal Stain. Spreading rate 75 to 100 sq. ft/gal per coat. Apply two coats.
6. Total DFT: N/A.
7. Finish Color: As selected by Architect from manufacturer's standard colors.

B. Interior Exposed:

1. System Type: Cementious Acrylic/epoxy.
2. Surface Preparation: SSPC-SP 13/NACE 6. Clean and dry.
3. Primer: Series 130 Masonry Filler. Spreading rate 80 to 100 sq. ft/gal.
4. Intermediate Coat: 113 H.B. Tneme-Tufcoat. DFT 2.0 to 3.0 mils.
5. Finish Coat: Series 113 H.B. Tneme-Tufcoat. DFT 2.0 to 3.0 mils.
6. Total DFT: 4.0 to 6.0 mils plus filler.

7. Finish Color: As selected by Architect from manufacturer's standard colors.

C. H2S Gas Exposed:

1. System Type: Perma-Shield H2S/Perma-Glaze.
2. Surface Preparation: SSPC-SP 13/NACE 6. Clean and dry.
3. Primer: Series 130 Masonry Filler. Spreading rate 80 to 100 sq. ft/gal.
4. First Coat: Series 435 Perma-Glaze. DFT 15.0 to 20.0 mils.
5. Finish Coat: Series 435 Perma-Glaze. DFT 15.0 to 20.0 mils.
6. Total DFT: 30.0 to 40.0 mils plus filler.
7. Finish Color: [5021 Gray] [5022 Beige].

2.11 COATING SYSTEMS FOR PLASTER, GYPSUM BOARD, AND WOOD

A. Interior Exposed:

1. System Type: Epoxy/acrylic-epoxy.
2. Surface Preparation: Clean and dry.
3. Primer: Series 151-1051 Elasto-Grip FC. DFT 1.0 to 1.5 mils.
4. Intermediate Coat: Series 113 H.B. Tneme-Tufcoat. DFT 2.0 to 3.0 mils.
5. Finish Coat: Series 113 H.B. Tneme-Tufcoat. DFT 2.0 to 3.0 mils.
6. Total DFT: 5.0 to 7.5 mils.
7. Finish Color: As selected by Architect from manufacturer's standard colors.

2.12 ACCESSORIES

A. Coating Application Accessories:

1. Accessories required for application of specified coatings in accordance with manufacturer's instructions, including thinners.
2. Products of coating manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which coating systems are to be applied. Notify Engineer of areas or conditions not acceptable. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.

3.2 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

- A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.
- B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.3 SURFACE PREPARATION OF STEEL

- A. Prepare steel surfaces in accordance with manufacturer's instructions.
- B. Fabrication Defects:
 - 1. Correct steel and fabrication defects revealed by surface preparation.
 - 2. Remove weld spatter and slag.
 - 3. Round sharp edges and corners of welds to a smooth contour.
 - 4. Smooth weld undercuts and recesses.
 - 5. Grind down porous welds to pinhole-free metal.
 - 6. Remove weld flux from surface.
- C. Ensure surfaces are dry.
- D. Immersion or Below Grade Surfaces: Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 10/NACE 2. Create a blast profile of 1.5 to 2.5 mils.
- E. Exterior Exposed or Interior Exposed Surfaces: Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 6/NACE 3. Create a blast profile of 1.5 to 2.5 mils.
- F. H₂S Gas Exposed: Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance

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with SSPC-SP 10/NACE 1. Create a blast profile of at least 3.0 mils.

- G. Abrasive Blast-Cleaned Surfaces: Coat abrasive blast-cleaned surfaces with primer before visible rust forms on surface. Do not leave blast-cleaned surfaces uncoated for more than 8 hours.
- H. Shop Primer: Prepare shop primer to receive field coat in accordance with manufacturer's instructions. Removal all unknown shop primers and re-prime in accordance with this specification.

3.4 SURFACE PREPARATION OF GALVANIZED STEEL AND NONFERROUS METAL

- A. Prepare galvanized steel and nonferrous metal surfaces in accordance with this specification and the coating manufacturers instructions.
- B. Ensure surfaces are dry.
- C. Immersion Service: Clean surfaces by abrasive blasting.
- D. Remove Rust From Galvanized Steel:
 - 1. Remove white rust from galvanized steel by hand or power brushing.
 - 2. Do not damage or remove galvanizing.
- E. Increase mechanical adhesion under moderate to severe conditions, such as exterior exposure or chemical environments, by abrasive blast and/or chemical cleaning.

3.5 SURFACE PREPARATION OF DUCTILE OR CAST IRON

- A. Prepare ductile or cast iron surfaces in accordance with NAPF 500-03-04 Abrasive Blast Cleaning or NAPF 500-03-03 Power Tool Cleaning and the coating manufacturer's instructions.
- B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

3.6 SURFACE PREPARATION OF PVC

- A. Prepare PVC surfaces in accordance with manufacturer's instructions.
- B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.
- C. Scarify PVC surfaces.

3.7 SURFACE PREPARATION OF INSULATED PIPE

- A. Prepare insulated pipe surfaces in accordance with manufacturer's instructions.
- B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

3.8 SURFACE PREPARATION OF CONCRETE

- A. Interior, Wet Substrate:
 - 1. Prepare concrete surfaces in accordance with manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 03732.
 - 2. Allow concrete to cure for a minimum of 28 days.
 - 3. Test concrete for moisture in accordance with ASTM D 4263 and, if necessary, F 1869.
 - 4. Abrasive blast surface to remove laitance and solid contaminants and to provide clean, sound substrate with uniform anchor profile.
 - 5. Verify that the pH of the cleaned concrete surfaces to be coated is within the range of to 8 to 11. Application of coating materials outside this range will not be permitted without written approval from the Engineer.
 - 6. Fill holes, pits, voids, and cracks with manufacturer approved surfacer.
 - 7. Ensure surfaces are clean, dry, and free of oil, grease, chalk, form release agents, and other contaminants.
- B. Exterior and Interior Dry:
 - 1. Prepare concrete surfaces in accordance with manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 03732.
 - 2. Allow concrete to cure for a minimum of 14 days.
 - 3. Test concrete for moisture in accordance with ASTM D 4263 and, if necessary, F 1869.
 - 4. Level concrete protrusions and mortar spatter.
 - 5. Verify that the pH of the cleaned concrete surfaces to be coated is within the range of to 8 to 11. Application of coating materials outside this range will not be permitted without written approval from the Engineer.
 - 6. Fill hairline cracks less than 1/64 inch (0.4 mm) in accordance with manufacturer's instructions.

7. Prepare cracks wider than 1/64 inch (0.4 mm), moving cracks, gaps, and expansion joints in accordance with manufacturer's instructions.
8. Ensure surfaces are clean, dry, and free of oil, grease, chalk, form release agents, and other contaminants.

3.9 SURFACE PREPARATION OF CONCRETE FLOORS

- A. Prepare concrete surfaces in accordance with manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 03732.
- B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.
- C. Allow concrete to cure for a minimum of 28 days before coating.
- D. Test concrete for moisture in accordance with ASTM D 4263 and, if necessary, F 1869.
- E. Verify that the pH of the cleaned concrete surfaces to be coated is within the range of 8 to 11. Application of coating materials outside this range will not be permitted without written approval from the Engineer.

3.10 SURFACE PREPARATION OF SECONDARY CONTAINMENT

- A. Prepare secondary containment surfaces in accordance with manufacturer's instructions.
- B. Prepare concrete surfaces in accordance with manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 03732.
- C. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.
- D. Allow concrete to cure for a minimum of 28 days before coating.
- C. Test concrete for moisture in accordance with ASTM D 4263 and, if necessary, F 1869.
- D. Verify that the pH of the cleaned concrete surfaces to be coated is within the range of 8 to 11. Application of coating materials outside this range will not be permitted without written approval from the Engineer.

3.11 SURFACE PREPARATION OF POROUS CONCRETE MASONRY UNITS

- A. Prepare porous concrete masonry unit surfaces in accordance with manufacturer's instructions and SSPC-SP 13/NACE 6.

- B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.
- C. Allow mortar to cure for a minimum of 28 days before coating.
- D. Level protrusions and mortar spatter.

3.12 SURFACE PREPARATION OF PLASTER

- A. Prepare plaster surfaces in accordance with manufacturer's instructions.
- B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.
- C. Allow plaster to cure and dry out for a minimum of 28 days before coating.
- D. Do not coat over plaster containing free water, lime, or other soluble alkaline salts.
- E. Remove plaster nibs and other protrusions.
- F. Patch voids and cracks with approved materials and after dry, sand flush with surface.

3.13 SURFACE PREPARATION OF GYPSUM BOARD

- A. Prepare gypsum board surfaces in accordance with manufacturer's instructions.
- B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.
- C. Sand joint compound smooth and feather edge.
- D. Avoid heavy sanding of adjacent gypsum board surfaces, which will raise nap of paper covering.
- E. Do not apply putty, patching pencils, caulking, or masking tape to drywall surfaces to be painted.
- F. Lightly scuff-sand tape joints after priming to remove raised paper nap. Do not sand through primer.

3.14 SURFACE PREPARATION OF WOOD

- A. Prepare wood surfaces in accordance with manufacturer's instructions.
- B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, surface deposits of sap or pitch, and other contaminants.
- C. Seal knots and pitch pockets.

- D. Sand rough spots with the grain.
- E. Fill cracks and holes with approved materials after primer is dry. Sand flush with surface when filler is hard.
- F. Lightly sand between coats.

3.15 APPLICATION

- A. Apply coatings in accordance with manufacturer's instructions.
- B. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.
- C. Keep containers closed when not in use to avoid contamination.
- D. Do not use mixed coatings beyond pot life limits.
- E. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.
- F. Uniformly apply coatings at spreading rate required to achieve specified DFT.
- G. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.
- H. Stripe paint with brush critical locations on steel such as welds, corners, and edges using specified primer. Apply and additional strip coat of the intermediate coating material in immersion areas.
- I. Roll or backroll the first coat of epoxy or block filler applied to concrete or interior block substrates to work the material into the substrate.

3.16 REPAIR

- A. Materials and Surfaces Not Scheduled To Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.
- B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.
- C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.17 FIELD QUALITY CONTROL

- A. Required Inspections and Documentation:
 - 1. Verify coatings and other materials are as specified.
 - 2. Verify surface preparation and application are as specified.
 - 3. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gauges.
 - 4. Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.
 - a. Check for holidays on interior steel immersion surfaces using holiday detector.
 - 5. Report:
 - a. Submit written reports describing inspections made and actions taken to correct nonconforming work.
 - b. Report nonconforming work not corrected.
 - c. Submit copies of report to Engineer and Contractor.
- B. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

3.18 CLEANING

- A. Remove temporary coverings and protection of surrounding areas and surfaces.

3.19 PROTECTION OF COATING SYSTEMS

- A. Protect surfaces of coating systems from damage during construction.

3.20 ONE-YEAR INSPECTION

- A. Owner will set date for one-year inspection of coating systems.
- B. Inspection shall be attended by Owner, Contractor, Engineer, and manufacturer's representative.
- C. Repair deficiencies in coating systems as determined by Engineer in accordance with manufacturers instructions.

3.21 SCHEDULES

- A. Coating System Schedule:
Refer to the drawings for coating system schedules.

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B. Color Schedule:

To facilitate identification of piping in plants and pumping stations the following color scheme shall be utilized:

Raw Sludge Line	Brown with black bands
Sludge recirculation suction line	Brown with yellow bands
Sludge draw off line	Brown with orange bands
Sludge recirculation discharge line	Brown
Sludge gas line	Orange (or red)
Natural gas line	Orange (or red) with black bands
Nonpotable water line	Blue with black bands
Potable water line	Blue
Chlorine line	Yellow
Sulfur dioxide	Yellow with red bands
Sewage (wastewater) line	Gray
Compressed air line	Green
Water lines for heating	Blue with 6-in. red band on 30-in. centers
Fuel oil/diesel	Red
Plumbing drains and vents	Black
Polymer	Purple

In situations where two colors do not have sufficient contrast to easily differentiate between them, a six-inch (6") band of contrasting color shall be on one of the pipes at approximately 30 inch (30") intervals. The name of the liquid or gas shall also be on the pipe. Provide arrows indicating the direction of flow.

END OF SECTION

SECTION 10100

BUILDING MECHANICAL AND LIGHTING

PART I GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Dehumidifier
 - 2. Heaters
 - 3. Ventilation
 - 4. Air Conditioner
 - 5. Lighting

1.02 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's technical product data, including installation instructions.
- B. Submit in accordance with Section 01300.

1.03 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. UL Compliance: Comply with applicable UL standards pertaining to gauges.
 - 2. ANSI and ISA Compliance: Comply with applicable portions of ANSI and Instrument Society of America (ISA) standards pertaining to construction and installation of level sensing equipment.

PART 2 PRODUCTS

2.01 Dehumidifier

A packaged dehumidifier with a sealed refrigeration type compressor rated at 5.2 full load amps and shall be mounted within the building in such a manner that the

condensate shall discharge to the floor drain through ¾" hose provided for that purpose. The dehumidifier shall operate on a 120 volt, single phase A.C. power source and be provided with a safety protected power cord of UL approved three (3) wire construction with three (3) spade plug. The dehumidifier shall be capable of removing forty-five (45) pints of water in twenty-four (24) hours when the room temperature is 80 degrees F and at 60 percent relative humidity (AHAM Standard DH-1). The dehumidifier shall be actuated by a dial-controlled adjustable humidistat which will automatically cycle the unit at pre-selected moisture levels. The humidifier shall have a washable slide-out filter. The dehumidifier shall be Dayton, Model 1DGX5, or approved equal.

2.02 Heaters

Each room shall be furnished with a forced air, electric wall-mounted unit heater. Heaters shall have a flow-through design. Heaters shall have automatic reset thermal protection disconnects if the normal operating temperatures are exceeded. Motors shall be heavy-duty totally enclosed 60 Hz. Heating element shall be aluminum-finned, copper-clad steel sheath. Housing shall be 20 grade factory-painted steel, with reinforced mounting holes. Heaters shall be mounted using wall brackets specifically designed for hanging them. Heaters shall be installed with a unit-mounted thermostat. Units shall be UL and C-UL listed.

Heater Schedule (or approved equal):

1. Pump Room – Dayton, Model 2YU62, 5kW, 17,000 BtuH, 240V, single phase, 21 amps.
2. Chlorine Room - Dayton, Model 2YU58, 3.0 kW, 10,200 BtuH, 240V, single phase, 12.5 amps.
3. Thermostats – Per manufacturer

2.03. Ventilation

Each room of the building shall be furnished with one (1) shutter-mount exhaust fan, located as shown on Plans. The fan capacity of each shall be able to make ten complete air changes per hour per room. The blower wheel shall be statically balanced to assure quiet performance and maximum air delivery. The unit shall be constructed of corrosion-resistant materials, including a fiberglass shutter and frame, fiberglass-reinforced polypropylene propellers, epoxy-coated wire guards and stainless steel hardware. Motors shall be totally enclosed and bearings shall be sealed ball.

Fans shall be thermostatically controlled with a speed control. Additionally, the Chlorine Room exhaust fan shall be equipped with a weatherproof switch mounted on the outside of the building next to the door.

A, Fan Schedule (or approved equal):

1. Pump Room – Dayton, Model 1BLH8, 10" propeller, 379 CFM @ 0.125", 1/20 hp, 1550 rpm, 1.9 FLA. 5kW, 17,000 BtuH, 240V,

single phase, 21 amps. Wall mounted thermostat with speed controller.

2. Chlorine Room – Dayton, Model 1BLH8, 10" propeller, 379 CFM @ 0.125", 1/20 hp, 1550 rpm, 1.9 FLA. 5kW, 17,000 BtuH, 240V, single phase, 21 amps. Wall mounted speed controller, with weatherproof switch located on the exterior of the building near the handle side of the door.

B. Combination Louver/Damper Schedule, Both Rooms (or approved equal):

1. Greenheck Model EAC-401, 18" x 18". Frame manufactured from heavy gauge extruded aluminum, 4" x 0.125" nominal wall thickness. Blades shall be drainable, heavy gauge extruded 6063-T5 aluminum, 0.081 in. nominal wall thickness, positioned at 45° angles on approximately 4 in. centers. Blade seals shall be dual-durometer extruded vinyl. Jamb seals shall be compressible stainless steel. Operating range shall be between -20° F to +180°F. Side linkage shall be out of the airstream (concealed in frame). Bearings shall be synthetic sleeve type. Axles shall be ½ in. dia. zinc plated steel. Construction shall be mechanically fastened. Louver/damper shall be equipped with an insect screen in a removable flattened expanded aluminum frame, inside mount (rear). Unit shall receive a 2-Coat 70% Kynar 500/Hylar 5000 finish.

2.04 Air Conditioner

The pump room shall be equipped with a through-the-wall air conditioner unit rated for 8000 BTU, 115 Volts, 8 amps, 850 Watts. The air conditioner shall operate on a 120 volt, single phase A.C. power source and be provided with a safety protected power cord of UL approved three (3) wire NEMA type 5-15P three (3) spade plug. The air condition shall have a three-speed cooling and fan setting. It shall be Energy Star certified. The unit shall be mounted through the wall with a sleeve kit supplied by the manufacturer. The air conditioner shall be a Frigidaire Model FRA086HT1 or approved equal.

2.05 Lighting

Two (2) tube, 120W, rapid-start, 50" long, ceiling mount fluorescent light fixtures shall be installed in each room of the building. Housing shall be manufactured of fiberglass-reinforced polyester with cold-rolled steel enclosed wireway, and shall be completely closed and gasketed to prevent dust, dirt and moisture from entering the fixture. Diffuser shall be a high-impact acrylic with a stippled interior surface. Lights shall be equipped with dust-resistant T8 electronic ballasts. Lighting fixtures shall be Lithonia DMW-2-96T8- -120-GEB101S, or approved equal.

The light switch shall be of the night glow type and be located inside to the right of the Pump Room door opening, and the left of the Chlorine Room door

opening.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which level sensing equipment is to be installed. Do not proceed with Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION OF PRESSURE INSTRUMENTATION

- A. Install level sensing instrumentation and ancillaries in a readily accessible location for observation and maintenance. Install per the manufacturer's recommendations.

END OF SECTION

SECTION 11261

SODIUM HYPOCHLORINATION SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. WORK includes furnishing, installing, and placing into operation sodium hypochlorination equipment for feeding chlorine solution. The installation shall include all equipment, piping, electrical and controls to make a complete chlorine feed system.
- B. The CONTRACTOR shall furnish all labor, materials, and equipment to make a complete installation.

1.02 RELATED WORK

- A. Special and general requirements for equipment are included in Divisions 0 and 1.
- B. Piping is specified in Division 2 and 15.
- C. Special construction is included in Division 13.
- D. Valves are included in Division 15.
- E. Painting is specified in Division 9, Section 0900.
- F. Electrical is specified in Division 16.

1.03 SUBMITTALS

- A. SHOP DRAWINGS, and operation and maintenance manuals shall be furnished in accordance with Division 1, Section 01300.
- B. SHOP DRAWINGS shall include detailed installation DRAWINGS and dimensions as well as performance data.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Design and layout of equipment shown on the plans and described in the SPECIFICATIONS are based upon LMI Milton Roy as represented by Straeffer Pump & Supply, Inc. Subject to compliance with the complete requirements of the SPECIFICATIONS, manufacturers offering products which may be incorporated into the WORK includes LMI Milton Roy or equal.

2.02 EQUIPMENT

A. Electronic Metering Pumps

One metering pump shall be positive displacement Liquifram, Series A14 and one metering pump shall be positive displacement Liquifram, Series A15. Output volume shall be adjustable while pumps are in operation from zero to maximum capacity of 14 GPD, Series A14 and from zero to maximum capacity of 24 GPD, Series A15.

1. Control

Adjustment shall be by readily accessible dial knobs, one for changing stroke length and the other for changing stroke frequency. Both knobs are to be located opposite the liquid handling end. On-off switch shall be integral with frequency control, "off" position to be below lowest frequency setting.

2. Design

Metering pumps shall be capable, without a hydraulically backed diaphragm, of injecting chlorine solution against pressures up to 250 psig, Series A14 and up to 110 psig, Series A15.

3. Drive

The pump drive shall be totally enclosed with no exposed moving parts. Solid state electronic pulser shall be fully encapsulated with no exposed printed circuit etch and be supplied with quick connect terminals of at least 3/16" wide. Electronics shall be housed in chemical resistant enclosure at the rear of the pump for maximum protection against chemical spillage. Electrical power consumption shall not exceed 22 watts per hour under full speed and maximum pressure conditions. Pump weight shall not exceed 14 lbs.

4. Automatic Pressure Relief

To eliminate need for pressure relief valve, metering pump shall automatically stop pulsating when discharge pressure exceeds pump pressure rating by not more than 35%.

3. Material

Chlorine solution metering pump housing shall be of chemically resistant glass fiber reinforced thermoplastic. All exposed fasteners shall be stainless steel. Chlorine solution metering pump valves shall be ball type, with ceramic balls seating on combination valve seat and seal ring. Valve seat and seal ring shall be renewable by replacing only the combination seat-seal ring. Pump head shall be of acrylic (transparent) material capable of resisting the chlorine solution. Fittings and connections at pump head shall be PVC.

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4. Check Valves and Tubing

A total of 16 ft. of polyethylene tubing shall be provided per pump complete with compression connections. A foot valve with integral one piece strainer shall be provided for the suction line, and a injection check/back pressure valve with 1/2" NPT male connection for the injection point. The injection check valve shall incorporate a dilating orifice which prohibits scale formation and accumulation of crystalline deposits.

B. Four Function Valve

Each metering pump shall be furnished with one (1) Four Function Valve as manufactured by LMI Milton Roy or approved equal.

C. Wall Mounting Bracket Assembly

Each metering pump shall be furnished with one (1) Wall Mounting Bracket Assembly Model 34643 as manufactured by LMI Milton Roy or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION AND FIELD SERVICE

- A. The CONTRACTOR shall take care in installing the equipment to ensure proper location and positioning. All equipment and accessories shall be installed in accordance with the manufacturer's written instructions and illustrations.
- B. A qualified manufacturer's representative shall inspect the installation at initial start-up.

END OF SECTION

SECTION 11290

ABOVE GROUND BOOSTER PUMPING STATION

1.01 Location

This contract includes installation of an above ground water booster station, at the intersection of KY 28 and KY 315 and one located the current Town Hill Location. The exact location is noted on the PLANS.

1.02 WORK Included

The CONTRACTOR shall furnish all materials and provide all labor for construction and installation of **two (2)** above ground water booster station with all the necessary piping, controls and appurtenances as shown on the PLANS and as specified herein. The station shall be complete with all necessary equipment installed in a concrete masonry block building. The booster station pumps and related equipment shall be as represented by Straeffer Sales and Service, Inc., or approved equal.

1.03 Operating Conditions

KY 28 Pump Station.

The pump station shall contain **two (2)** vertical centrifugal pumps each to deliver **(340) gallons per minute at (470) feet total dynamic head with a minimum efficiency of seventy five percent (75%).** Each pump to be driven by a **60 horsepower, 3 phase, 460 volt TEFC motor.** Pumps shall be Grundfos model **CR 64-5-2** or approved equal.

Town Hill Pump Station.

The pump station shall contain **two (2)** vertical centrifugal pumps each to deliver **(600) gallons per minute at (300) feet total dynamic head with a minimum efficiency of seventy five percent (75%).** Each pump to be driven by a **75 horsepower, 3 phase, 460 volt TEFC motor.** Pumps shall be Grundfos model **CR 150-3-1** or approved equal.

1.03a Trailer Mounted Diesel Generator

Provide one (1) Trailer Mounted Generator that shall be a minimum 65 KW with a 4 position switch with the capability to produce multiple voltages: 1 phase 120/240, 3 phase 120/208, 120/240, 230/460, 277/480. Generator similar to Generac Magnum Model-MMG75D or approved equal.

Including the transfer switch gear, generator plug and extension wire required to make the generator operational with the Town Hill Pump Station and KY 28 Pump Station. The electrical transfer switch gear should be the same as previous models used (ABB model 1001-3tb8b).

1.04 Piping

All internal transmission piping and fitting shall be of Schedule 40 black, seamless steel pipe and will be manufactured in accordance with the dimensional tolerances and materials specifications of the AWWA for steel pipe and steel butt-weld fittings. Piping within the part of the unit shall be sized as shown on the Plan sheets.

1.05 Gate Valves

1. Gate valves 3" and larger in size, unless otherwise specified shall be full opening with an iron body, bronze mounted, solid wedge gate valves with flanged ends and conforming to the AWWA Standard Specification for Gate Valve for Water and Sewage Systems, Designation C509-latest revision, insofar as applicable and in addition to the following requirements:
 - a. Valve shall be outside screw and yoke type with rising stem (unless otherwise shown on the PLANS).
 - b. Flanges shall be faced and drilled to ANSI B16.1 125 pound template, unless otherwise shown on the PLANS.
 - c. Bronze gate rings shall be fitted into grooves of dovetail or similar shape in the gates. For grooves or other shapes, the rings shall be firmly attached to the gates with bronze rivets.
 - d. Handwheels shall turn counterclockwise to open the valves. Handwheels shall be of ample size and shall have an arrow and the word "OPEN" cast thereon to indicate the direction of opening.
 - e. Stuffing box follower bolts shall be of steel and the nuts shall be of bronze.
 - f. The design of the valves shall permit packing the valves without undue leakage while they are wide open and in service.
 - g. O-ring stuffing boxes may be used.
 - h. Gate valves with spur gears shall be housed to accommodate the offset of the operating nut.

1.06 Compression Couplings

Each pump suction and discharge pump run shall include a compression type coupling of uni-flange. The coupling when installed shall provide a permanent, leak-proof, flexible installation.

1.07 Pressure Gauges

All pressure gauges within the booster pumping station shall have four and one-half inch (4-1/2") minimum diameter faces. The case shall be black, cast aluminum, flanged back type with close type ring and clear glass face. The gauge connections shall be at the bottom of the gauge and will be one-fourth inch (1/4") N.P.T. The gauge internal construction shall include phosphor bronze bourdon tube with a brass movement, bronze bushed independently mounted. Pressure gauge range and scale graduations shall be in feet of water and pounds per square inch (psi). Each gauge shall be protected by a combination pulsation dampener and shut off valve. Gauge may be remote and connected to pressure source by polyethylene tubing.

1.08 Hydraulic Check Valves

Each pump discharge pipe run shall include a hydraulic check valve. The valves shall be as shown on the plan sheets. Valves shall be equal to a Bermad Model 760 with 250 pound flanges.

1.09 Strainer

Strainers shall be as sized on the PLANS. Strainers shall be Mueller 758, or approved equal, and be equipped with a boiler draw for blow-off.

1.10 Vertical In-Line Multi-Stage Centrifugal Pumps

A. The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point.

B. All pump bearings shall be lubricated by the pumped liquid.

C. Large In-line Vertical Multi-Stage Pumps shall have the following features:

1. Each pump shall be designed for in-line installation requiring no more than 2.5 square feet of floor space (including motor).
2. The pump impellers shall be secured directly to the smooth pump shaft by means of a split cone and nut design.
3. The suction/discharge base shall have ANSI Class 125 or Class 250 flange connections in a slip ring (rotating flange) design as indicated in the drawings or pump schedule.
4. Pump Construction.

a. Suction/discharge base, pump head Ductile Iron (ASTM 65-45-12)

- | | |
|---|------------------------------|
| b. Shaft couplings, flange rings | Ductile Iron (ASTM 65-45-12) |
| c. Shaft | 431 Stainless Steel |
| d. Motor Stool | Cast Iron (ASTM Class 30) |
| e. Impellers, diffuser chambers, outer sleeve | 304 Stainless Steel |
| f. Impeller wear rings | 304 Stainless Steel |
| g. Intermediate Bearing Journals | Tungsten Carbide |
| h. Intermediate Chamber Bearings | Leadless Tin Bronze |
| i. Chamber Bushings | Graphite Filled PTFE |
| j. O-rings | EPDM |
5. The shaft seal shall be a single balanced metal bellows cartridge with the following construction:
- | | |
|--|----------------------|
| a. Bellows | 904L Stainless Steel |
| b. Shaft Sleeve, Gland Plate, Drive Collar | 316 Stainless Steel |
| c. Stationary Ring | Carbon |
| d. Rotating Ring | Tungsten Carbide |
| e. O-rings | EPDM |
6. Shaft seal replacement shall be possible without removal of any pump components other than the coupling guard, motor couplings, motor and seal cover. Pumps with motors equal to or larger than 100 hp (one hundred horsepower) shall have adequate space within the motor stool so that shaft seal replacement is possible without motor removal.
7. The maximum working temperature shall be 250 degrees F. The maximum working pressure shall be 232 psig or 362 psig as determined by the installation requirements.

1.11 Motors

- A. Motors are to be provided with the following basic features:
1. Motors shall be premium efficiency, inverter rated for operation with a variable frequency drive.
 2. Motors shall be designed for continuous duty operation, NEMA design B with a 1.15 S.F.
 3. Totally Enclosed Fan Cooled Motors are to be furnished with class "F" insulation. Open Drip Proof Motors are to be furnished with class "B" insulation.
 4. Motor nameplate shall be mounted on enclosure with stainless steel fastening pins. Nameplate shall have, as a minimum, all information as described in NEMA Standard MG 1-20.40.1.
 5. Open Drip Proof (ODP) motors shall have drip covers.

6. Motors over 50 lbs shall having lifting provisions.
7. Motors shall have a NEMA C-Flange for vertical mounting.
8. Drive end bearings shall be adequately sized so that the minimum L10 bearing life is 17,500 hours at the minimum allowable continuous flow rate for the pump.

1.033 Warranty

- A. The warranty period shall be a non-prorated period of 24 months from date of start-up.

1.034 Execution

A. Manufacturer's Pump Test

All pumps shall be tested at the factory prior to shipment to ensure the performance criteria as stated in these SPECIFICATIONS can be met. Evidence of such testing shall be made available at the request of the ENGINEER.

B. Installation

1. Installation shall be in strict accordance with the MANUFACTURER'S instructions and recommendations in the locations shown on the Drawings.
2. Upon completion of the installation, the CONTRACTOR shall submit a certificate stating that the installation of the equipment is satisfactory, that the equipment is ready for operation.

C. Start-up

1. After the pumps have been completely installed and wired, the contractor shall do the following:
 - a. Megger stator and power cables.
 - b. Check for proper rotation.
 - c. Check power supply voltage.
 - d. Measure motor operating load and no load current.
 - e. Check level control operation and sequence.
2. The CONTRACTOR shall furnish the services of the MANUFACTURER'S field service technician, who has

complete knowledge of proper operation and maintenance of the equipment, for a period of at least one (1) full day to inspect the installed equipment, perform field test runs to verify the flow meets the specified flow and head conditions in the field, and to provide instruction to the plant personnel. All pump operating settings, alarms, controls and shutdown devices shall be calibrated and tested during the field tests.

3. Pumps operating on a variable frequency drive (VFD) shall be tested at full operating speed, normal operating speed and minimum operating speed for the specified range of flow. During each test, the pump shall be run at each head condition for sufficient time to accurately determine discharge, head, power input, and efficiency.
4. If a pump performance does not meet the specified requirements, corrective measures shall be taken and field tests will be repeated at no additional cost to the OWNER.
5. At least four (4) hours shall be allocated solely to instruction of plant personnel in operation and maintenance of the equipment. The instruction period shall be scheduled at least 10 days in advance with the OWNER and shall take place prior to start up and acceptance by OWNER. The final copies of operation and maintenance manuals specified must be delivered to the ENGINEER prior to scheduling the instruction period with the OWNER.
6. The VFD and electric control system shall be test operated for proper functioning prior to the pump mechanical test. The control system shall be checked out using simulated operating signals as per pump MANUFACTURER'S recommendations.
7. The CONTRACTOR shall check direction of rotation of all motors and reverse connections if necessary.
8. The CONTRACTOR shall meet all the testing requirements of Division 16.

1.12 Control

Control of pump operation shall be provided by a telemetry system with backup provided by a twenty-four (24) hour timer. Timer to be provided by the pump control panel supplier. While in time-clock operation, the pump alternation is to be under the control of the pump control panel via a mechanical pump alternator with manual Lead 1/Alternate/Lead 2 selector switch.

Suction control of the pumping operation shall be provided by bellows type, snap action pressure switches. The switch action shall be actuated by a single brass bellows. Each switch assembly shall be complete with internal switches to cover the start or stop cycle. Each internal switch assembly shall be complete with internal switches to cover the start or stop cycle. Each internal switch shall be independently adjustable so as to provide from 2.0/6.0 PSI to full scale control differential. Switches are to be provided to control the following functions.

- A. Low suction cut-out, 0 to 150 PSI control range, Pump 1.
- B. Low suction cut-out, 0 to 150 PSI control range, Pump 2.

A selector switch shall be provided to bypass the alternator and still allow automatic operation of either pump. A sensor switch shall be provided for timer-off-telemetry.

Two (2) four and one-half inch (4 ½") diameter pressure gauges as previously described shall be mounted adjacent to the suction control pressure switches for each pump.

Two (2) four and one-half inch (4 ½") diameter pressure gauges as previously described shall be mounted for sensing inlet pressure prior to the strainers and for discharge pressure.

Pressure switches and gauges shall be mounted in tandem, on a plate, as near to their respective pressure source as is practical. Switches and gauges will not be allowed within the electrical control panel. Hydraulic sensing lines shall be plumbed to the switches and gauges so the switch functions can be checked. All switch and gauge assemblies shall be complete with shut-off valve and pulsation dampener.

1.12.01 Adjustable/Variable Frequency Drives for Pumping Applications

1.0: GENERAL

1. SUMMARY

- A. This section provides specification requirements for solid-state, pulse-width modulated (PWM) Adjustable Frequency Drives, herein referred to as AC Drives, for use with NEMA® design [NEMA A] [NEMA B] [NEMA D] [NEMA E] AC motors, or standard IEC motors.
- B. The AC Drive supplier shall furnish, field test, adjust and certify all installed AC Drives for satisfactory operation.
- C. Any exceptions/deviations to this specification shall be indicated in writing and submitted no less than one week prior to bid date.

2. REFERENCES

- A. ANSI®/NFPA® 70 - National Electrical Code® (NEC®).
- B. UL 508 - UL Standard for Safety Industrial Control Equipment.
- C. UL 508C - UL Standard for Safety Power Conversion Equipment.
- D. NEMA ICS7 : Industrial Control and Systems Variable Speed Drives
- E. CSA C22.2 No. 14-M91 : Industrial Control Equipment
- F. IEC 1800 : Adjustable speed Electrical power drive systems
- G. SEMI-F47: Voltage Ride Thru

3. WARRANTY

- A. An 18-month warranty shall be provided on materials and workmanship from the date of shipment.

4. QUALITY ASSURANCE

- A. The manufacturer of the AC Drive shall be a certified ISO 14001 facility.
- B. The AC Drive and all associated optional equipment shall be UL Listed according to UL 508 C - Power Conversion Equipment. As verification, a UL label shall be attached on the nameplate.
- C. The AC Drive shall be designed, constructed and tested in accordance with applicable UL, CSA, IEC, NEMA, and NEC standards.
- D. Every power converter shall have serial number with traceability records maintained by the manufacture.

PRODUCTS

2.1 Acceptable Manufacturers:

A. Danfoss VLT® AQUA Series VFD (Variable Frequency Drive)

2.2 General:

- A. Furnish complete VFD as specified herein or in the equipment schedule for loads designated to be variable speed. VFD's shall be user-selectable for either constant or variable torque loads.
- B. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC induction motors. The VFD shall be a six-pulse input design, and the input voltage rectifier shall employ a full wave diode bridge; VFD's utilizing controlled SCR rectifiers shall not be acceptable. The output waveform shall closely approximate a sine wave. The VFD shall be of a PWM output design utilizing current IGBT inverter technology and voltage vector control of the output PWM waveform.
- B. Option for Single Phase input: The VFD shall convert incoming fixed frequency single-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC induction motors. The VFD shall be UL-listed for phase converting. The VFD shall be a six-pulse input design, and the input voltage rectifier shall employ a full wave diode bridge; VFD's utilizing controlled SCR rectifiers shall not be acceptable. The output waveform shall closely approximate a sine wave. The VFD shall be of a PWM output design utilizing current IGBT inverter technology and voltage vector control of the output PWM waveform
- C. The VFD shall include a full-wave diode bridge rectifier and maintain a displacement power factor of near unity regardless of speed and load.
- D. The manufacturer of the VFD shall demonstrate a continuous period of manufacturing and development of VFD's for a minimum of 40 years. VFD's that are brand-labeled are not acceptable.
- E. The VFD shall produce an output waveform capable of handling maximum motor cable distances of up to 1,000 ft. (unshielded) without tripping or derating.
- F. The VFD shall utilize VVC^{PLUS}, an output voltage-vector switching algorithm, or equivalent, in both variable and constant torque modes. VVC^{PLUS} provides rated RMS fundamental voltage from the VFD. This allows the motor to operate at a lower temperature rise, extending its thermal life. VFD's that cannot produce rated RMS fundamental output voltage or require the input voltage to be increased above motor nameplate value to achieve rated RMS fundamental output voltage are not acceptable. VFD's that utilize Sine-Coded PWM or Look-up tables shall not be acceptable.
- G. The VFD selected must be able to source the motor's full load nameplate amperage (fundamental RMS) on a continuous basis, and be capable of running the motor at its nameplate RPM, voltage, current, and slip without having to utilize the service factor of the motor.
- H. The VFD shall offer a programmable motor parameter that allows the total number of poles of a motor to be programmed to optimize motor performance.
- I. VFD shall automatically boost power factor at lower speeds.
- J. The VFD will be capable of running either variable or constant torque loads. In variable torque applications, the VFD shall provide a CT-start feature and

be able to provide full torque at any speed up to the base speed of the motor. In either CT or VT mode, the VFD shall be able to provide its full rated output current continuously and 110% of rated current for 60 seconds.

- K. An Automatic Energy Optimization (AEO) selection feature shall be provided in the VFD to minimize energy consumption in variable torque applications. This feature shall optimize motor magnetization voltage and shall dynamically adjust output voltage in response to load, independent of speed. Output voltage adjustment based on frequency alone is not acceptable for single motor VT configurations.
- L. For multi-motor variable torque configurations, user-selectable load profile curves including VT-High, VT-Medium, and VT-Low shall be provided to ensure easy commissioning and improved energy efficiency. VFD's requiring the operator to assign load torque data-points to create a V/Hz profile, are not acceptable.
- M. An initial ramp function shall be available to provide a user-selectable ramp, up to 60 seconds, for applications requiring a faster or slower ramp than the normal ramp.
- N. A Dual Ramp Down feature shall include a Check Valve Ramp Down and a final Ramp feature. The Check Valve Ramp Down shall be programmable to gently seat a check valve and reduce the potential of damage from excess pressure while shutting-down the system. Both time and end speed shall be programmable. On the Final Ramp, the VFD shall be programmable to quickly stop the motor after seating of a check valve or for a more rapid stopping than the normal ramp down setting.
- O. VFD shall offer up to 4 separate PID controllers. One controller shall operate the drive in closed loop, while the other 3 provide control signals to other equipment. VFD's with PI controllers only are not acceptable.
- P. An Autotuning PI controller output feature shall provide automated PI controller settings. Once the user accepts the settings, the VFD will save the settings to memory.
- Q. An empty pipe fill mode shall be available to fill an empty pipe in a short period of time, and then revert to the PID controller for stable operation. Pipe fill mode shall have a programmable time to reduce water hammer in the system or fill the pipe at a unit per time rate.
- R. VFD shall offer a motor spinning test that will run the motor at 5 Hz until the OK button is pressed. This feature will allow the user to determine if the motor is running in the correct direction.
- S. An embedded cascade pump controller shall be included to provide lead pump alternation and provide control for up to 3 total pumps. The VFD Pump and 2 other pumps can be controlled either by a starter or softstarter.
- T. Switching of the input power to the VFD shall be possible without interlocks or damage to the VFD at a minimum interval of 2 minutes.
- U. Switching of power on the output side between the VFD and the motor shall be possible with no limitation or damage to the VFD and shall require no additional interlocks.
- V. An Automatic Motor Adaptation (AMA) function shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to spin the motor shaft or de-couple the motor from the load to

accomplish this optimization. Additionally, the parameters for motor resistance and motor reactance shall be user-programmable.

- W. The VFD shall have temperature controlled cooling fans for quiet operation, minimized internal losses, and greatly increased fan life.
- X. VFD shall provide full torque to the motor, given input voltage fluctuations of up to +10% to -10% of the rated input voltage (525 to 690VAC, 380 to 480VAC, or 200 to 240VAC). Line frequency variation of $\pm 2\%$ shall be acceptable.

2.3 Harmonics

- A. The VFD shall provide internal DC link reactors to minimize power line harmonics and to provide near unity power factor. DC Link reactor shall be installed so that power fluctuations to the DC Capacitors shall be reduced to increase Capacitor life. VFD's without a DC link reactor shall provide a 5% impedance line side reactor and provide spare capacitors.

(Further Harmonic Mitigation if required)

- B. *The VFD shall be provided with line-side harmonic reduction, as required, to insure that the current distortion limits, as defined in table 10.3 of IEEE 519-1992, are met. PCC₁, defined as the low voltage side of the distribution transformer, is used for purposes of calculation and referred, by the turns ratio of the transformer, to the PCC defined by the IEEE Recommended Practices as the Consumer-Utility interface. The tables of limits set forth therein are with reference to the PCC (primary side of the main transformer).*
- C. *Harmonic solutions shall be designed to withstand up to 2% line imbalances with the maximum Current Distortion not to exceed 11% at 100% load.*
- D. *Harmonic solutions shall be capable of withstanding up to 2% ambient voltage distortion with the maximum Current Distortion not to exceed 12% at 100% load.*
- E. *To ascertain the harmonic contribution of the VFD's at the PCC and to show compliance with IEEE 519-1992, harmonic analysis shall be performed and submitted with the bid package, provided that the VFD vendor is in receipt of the below listed information 10 working days prior to the bid date.*
 - a. *kVA rating of the low voltage distribution transformer(s)*
 - b. *X/R Ratio of utility low voltage distribution transformer(s)*
 - c. *Primary voltage*
 - d. *Secondary voltage*
 - e. *Secondary %IZ (impedance)*
 - f. *Length, size, & number of conductors between transformer LV side and distribution panel*
 - g. *System Single Line Diagram and electrical equipment list showing transformer and VFD detail*
 - h. *Total linear load kW to be connected to the distribution transformer*
 - i. *Anticipated maximum demand load (15 minute or 30 minute) on the distribution transformer (IEEE 519)*

2.4 Protective Features:

- A. VFD shall have input surge protection utilizing MOV's, spark gaps, and Zener diodes to withstand surges of 2.3 times line voltage for 1.3 msec.
- B. VFD shall include circuitry to detect phase imbalance and phase loss on the input side of the VFD.

- C. VFD shall auto-derate the output voltage and frequency to the motor if an input phase is lost. This result will maintain operation without decreasing the life expectancy of the VFD. The use of this feature shall be user selectable and export a warning during the event.
- D. Printed Circuit boards shall be conformal coated to reduce the corrosion effect from environmental gases and other conditions. The conformal coating must meet IEC 61721-3-3, Class 3C2 as standard and the VFD shall have an optional 61721-3-3, Class 3C3 coating available.
- E. Automatic "No-Flow Detection" shall be available to detect a no-flow situation in pump systems where all valves can be closed. This shall be functional in closed loop control or when controlled by an external signal.
- F. Dry-pump detection shall be available to detect if the pump has run dry. If this condition occurs, the drive will be safely stopped. A timer shall be included to prevent nuisance tripping.
- G. End-of-Pump curve detection shall stop motor when the pump is operating outside of its programmed pump curve.
- H. VFD shall provide a flow compensation program to reduce energy by adjusting the Set point to match changes in flow (friction loss). Flow compensation shall also operate in Cascade control mode.
- I. VFD shall include current sensors on all three-output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.
- J. VFD shall auto-derate the output voltage and frequency to the motor in the presence of sustained ambient temperatures higher than the normal operating range, so as not to trip on an inverter temperature fault. The use of this feature shall be user-selectable and a warning will be exported during the event. Function shall reduce switching frequency before reducing motor speed.
- K. VFD shall auto-derate the output frequency by limiting the output current before allowing the VFD to trip on overload. The speed of the load can be reduced, but not stopped.
- L. The VFD shall have the option of an integral RFI filter. VFD enclosures shall be made of metal to minimize RFI and provide immunity.
- M. The VFD shall have a motor preheat function with the ability to be programmed to induce a small amount of current to the motor whenever it is at rest. This will prevent condensation inside the motor and help to extend its life without the need for space heaters or other external equipment.
- N. The VFD shall be provided with an optional enclosure that is IP-66/Nema 4X rated. A VFD that is mounted in a separate enclosure will not be acceptable. The enclosure shall be suitable for installations that require protection against windblown dust and rain or splashing water. All cast aluminum parts shall be powder-coated with a durable epoxy that is capable of withstanding harsh environments. All circuit boards shall be conformally coated to meet the requirements of the IEC61721-3-3, Class 3C2 specification.

2.5 Interface Features:

- A. VFD shall provide an alphanumeric backlit display keypad (LCP) which may be remotely mounted using a standard 9-pin cable. VFD may be operated

with keypad disconnected or removed entirely. Keypad may be disconnected during normal operation without the need to stop the motor or disconnect power to the VFD.

- B. VFD Keypad shall feature an INFO key that, when pressed, shall display the contents of the programming manual for the parameter that is currently viewed on the display. The description shall explain the feature and how the settings can be made by the operator.
- C. VFD shall display all faults in plain text; VFD's which can display only fault codes are not acceptable.
- D. The keypad shall feature a 6-line graphical display and be capable of digitally displaying up to five separate operational parameters or status values simultaneously (including process values with the appropriate engineering unit) in addition to Hand/Off/Auto, Local/Remote, and operating status.
- E. Two lines of the display shall allow "free text programming" so that a site description or the actual name of the equipment being controlled by the VFD can be entered into the display.
- F. Keypad shall provide an integral H-O-A (Hand-Off-Auto) and Local-Remote selection capability, and manual control of speed locally without the need for adding selector switches, potentiometers, or other devices.
- G. All VFD's shall be of the same series, and shall utilize a common control card and LCP (keypad/display unit) throughout the rating range. The control cards and keypads shall be interchangeable through the entire range of drives used on the project.
- H. VFD keypad shall be capable of storing drive parameter values in non-volatile RAM uploaded to it from the VFD, and shall be capable of downloading stored values to the VFD to facilitate programming of multiple drives in similar applications, or as a means of backing up the programmed parameters.
- I. VFD Display shall have the ability to display 5 different parameters pertaining to the VFD or the load including: current, speed, DC bus voltage, output voltage, input signal in mA, or other values from a list of 92 different user-selectable parameters.
- J. VFD display shall indicate which digital inputs are active and the status of each relay.
- K. It shall be possible to toggle between three status read-out screens by pressing the [Status] key. Various operating variables, even with different formatting, can be shown in each status screen.
- L. VFD display shall indicate the value of any voltage or current signal, including the engineering units of measurement, connected to the analog input terminals.
- M. VFD display shall indicate the value of the current at the analog output terminals, including the engineering units of measurement.
- N. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.
- O. Two-level password protection shall be provided to prevent unauthorized changes to the programming of the VFD. The parameters can be locked via a digital input and/or the unit can be programmed not to allow an unauthorized user to change the parameter settings.

- P. A quick setup menu with factory preset typical parameters shall be provided on the VFD to facilitate commissioning. Use of macros shall not be required.
- Q. A digital elapsed time meter and kilowatt hour meter shall be provided in the display.
- R. VFD shall offer as standard an internal clock. The internal clock can be used for: Timed Actions, Energy Meter, Trend Analysis, date/time stamps on alarms, Logged data, Preventive maintenance, or other uses. It shall be possible to program the clock for Daylight Saving Time / summertime, weekly working days or non-working days including 20 exceptions (holidays, etc.). It shall be possible to program a Warning in case the clock has not been reset after a power loss.
- S. A battery back-up option shall be provided to maintain internal clock operation during power interruptions. Battery life shall be no less than 10 years of normal operation.
- T. VFD shall provide full galvanic isolation with suitable potential separation from the power sources (control, signal, and power circuitry within the drive) to ensure compliance with PELV requirements and to protect PLC's and other connected equipment from power surges and spikes.
- U. All inputs and outputs shall be optically isolated. Isolation boards between the VFD and external control devices shall not be required.
- V. There shall be six fully programmable digital inputs for interfacing with the systems external control and safety interlock circuitry. Two of these inputs shall be programmable as inputs or outputs.
- W. The VFD shall have two analog signal inputs. Inputs shall be programmable for either 0 -10V or 0/4-20 mA.
- X. One programmable analog output shall be provided for indication of the drive status. This output shall be programmable for output speed, voltage, frequency, motor current and output power. The analog output signal shall be 0/4-20 mA.
- Y. The VFD shall provide two user programmable relays with 75 selectable functions. Two form 'C' 230VAC/2A rated dry contact relay outputs shall be provided.
- Z. Floating point control interface shall be provided to increase/decrease frequency in response to external switch closures.
- AA. The VFD shall accept a N.C. motor temperature over-temperature switch input, as well as possess the capability to accept a motor thermistor input.
- BB. The VFD shall store in memory the last 10 faults with time stamp and recorded data.
- CC. Run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until isolation valves, seal water pumps or other types of auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.
- DD. The VFD shall be equipped with a standard RS-485 serial communications port and front-of-drive accessible USB port. Danfoss FC or ModBus RTU communications shall be integrally mounted.

- EE. A Windows® compatible software program to display all monitoring, fault, alarm, and status signals shall be available. This software program shall allow parameter changes, storage of all VFD operating and setup parameters, and remote operation of the VFD.

2.6 Adjustments:

- A. The VFD shall have an adjustable output switching frequency.
- B. Four complete programming parameter setups shall be provided, which can be locally selected through the keypad or remotely selected via digital input(s), allowing the VFD to be programmed for up to four alternate control scenarios without requiring parameter changes.
- C. In each programming set up, independent acceleration and deceleration ramps shall be provided. Acceleration and deceleration time shall be adjustable over the range from 0 to 3,600 seconds to base speed.
- D. The VFD shall have four programmable "Bypass frequencies" with adjustable bandwidths to prevent the driven equipment from running at a mechanically resonant frequency. The feature shall offer a Semi-Automatic program to simplify the set-up.
- E. VFD shall include an automatic acceleration and deceleration ramp-time function to prevent nuisance tripping and simplify start-up.
- F. In each programming setup, independent current limit settings, programmable between 50% and 110% of the drives output current rating, shall be provided.
- G. PID parameter settings shall be adjustable while the VFD is operating, to aid in tuning the control loop at start up. The VFD will also be capable of simultaneously displaying set-point reference and feedback values with appropriate engineering units, as well as output frequency, output current, and run status while programming the PID function.
- H. The VFD will include a "loss of follower" function to detect the loss of process feedback or reference signals with a live-zero value and a user-selectable choice of responses (go to set speed, min speed, max speed, stop, stop, and trip).
- I. A Sleep Mode function shall be provided to reduce wear and heating of the pump and other equipment in periods where system demand is minimal. This function will operate in both open and closed loop modes:
 - 1. In closed loop process control, when the output speed drops to a user-programmed minimum value ("sleep frequency") for a specified time ("sleep mode timer"), the drive will enter a sleep mode and either go into standby, or boost mode before entering standby. The drive shall automatically restart the motor once the output of the PID processor exceeds a programmable value "wake up frequency".
 - a. Boost mode shall prevent short-cycling of the motor by temporarily adjusting the set-point by a user-programmable percentage. Upon reaching this value, the unit will go into standby.
 - 2. In open loop, the drive shall be capable of entering sleep mode if the input reference drops below a user-programmable value. When the input reference increases above a user-programmable reference, the drive will automatically start.

- K. An integral motor alternation function shall be provided to enable the output of the drive to alternate between two motors. The alternation interval shall be user-programmable in hours. This function shall operate external relays as required to control the motor alternation sequence. A dwell time shall be integral to the function and can prevent damage to the motor contactors.
- L. The VFD will include a user-selectable Reset function, which enables the selection of between zero and twenty restart attempts after any self-clearing fault condition (under-voltage, over-voltage, current limit, inverter overload, and motor overload), or the selection of an infinite number of restart attempts. The time between restart attempts shall be adjustable from 0 through 600 seconds.
- M. An automatic "on-delay" function may be selected from 0 to 120 seconds.
- N. The VFD will include a user-selectable Auto-Restart function that enables the VFD to power up in a running condition after a power loss, to prevent the need to manually reset and restart the VFD.
- O. VFD shall catch a rotating motor operating either in forward or reverse at up to full speed.

2.8 Service Conditions:

- A. The ambient operating temperature of the VFD shall be -10°C to 50°C (14 to 122°F), with a 24-hour average not to exceed 45°C. Storage temperatures shall be -13° F (-25° C) to 149/158° F (65/70° C).
- B. 0 to 95% relative humidity, non-condensing.
- C. Elevation to 3,300 feet (1000 meters) without derating.
- D. VFD's shall be rated for line voltage of 525 to 690VAC, 380 to 480VAC, or 200 to 240VAC; with +10% to -10% variations. Line frequency variation of $\pm 2\%$ shall be acceptable.
- E. No side clearance shall be required for cooling of the units.

3.0 EXECUTION

3.1 Submittals:

- A. Submit manufacturer's performance data including dimensional drawings, power circuit diagrams, installation and maintenance manuals, warranty description, VFD's FLA rating, certification agency file numbers, catalog information and catalog cut-sheets for all major components.
- B. All drawings shall be in an 8.5 X 11" reproducible format, and incorporate the manufacturer's title block on the drawing.
- C. This specification lists the minimum VFD performance requirements for this project. Each supplier shall list any exceptions to the specification. If no departures from the specification are identified, the supplier shall be bound by the specification.
- D. Three copies of all submittals shall be provided.
- E. Submit a computer generated Harmonic Distortion Analysis for the jobsite location.

3.2 Quality Assurance:

- A. The manufacturer shall be both ISO-9001 and ISO-14001 certified.
- B. All products shall be CE marked; UL labeled, and meet the requirements of UL-508C and maintain ULc.
- C. To ensure quality and minimize infant-mortality failures on the jobsite, each VFD shall be completely tested by the manufacturer. The VFD shall operate a dynamometer at full load and speed under elevated temperature conditions.
- D. All optional features shall be functionally tested at the factory for proper operation.
- E. Factory test documentation shall be available upon request.

3.3 Examination:

- A. Contractor to verify that job site conditions for installation meet factory recommended and code-required conditions for VFD installation prior to start-up, including clearance spacing, temperature, contamination, dust, and moisture of the environment. Separate EMT conduit installation of the motor wiring, power wiring, and control wiring, and installation per the manufacturer's recommendations shall be verified.
- B. The VFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.

3.4 Start-up and Warranty

- 1. A factory-authorized service technician shall perform start-up on each drive. ("Start up" shall not include installation or termination of either power or control wiring.) The service technician shall perform start-up on up to 8 drives per day. Start-up costs provided with the bid shall include time and travel for the estimated number of visits required, but shall not be less than at least one half-day with travel. Additional labor or return trips to the site shall be billed at Danfoss' published straight-time rates. Upon completion, a start up service report shall be provided.
- 2. A 6-year on-site warranty shall be provided such that the owner is not responsible for any warranty costs including travel, labor, parts, or other costs for a full 6 years from the date of manufacture of the Drive. The cost of the warranty shall be included in the bid.

1.13 Electrical Apparatus - Switch Gear

The electrical apparatus shall consist of all equipment associated with motor control and motor starting, including the equipment used to protect the electrical facilities. All circuit breakers, motor starters, time delay relays and control relays, shall be incorporated into one (1) NEMA 12 control panel. The electrical service shall be 240 volt, 3 phase, 60 cycle 4 wire.

There shall be provided, thermal-magnetic trip circuit breakers as required in each pump station.

- A. One (1) main breaker
- B. Two (2) branch breakers, one each per pump

C. Eight (8) auxiliary circuit breakers, as follows:

1. Controls
2. Lights
3. Heater
4. HVAC
5. Sump Pump
6. Exhaust Fans
7. Convenience Outlets
8. Telemetry
9. Spare

Pump starting equipment shall be three (3) phase, full voltage magnetic starters connecting the pump motor directly across the line complete with overload relay with correctly sized heater elements on each line.

All electrical WORK shall be done in accordance with applicable electric codes.

Elapsed run timers shall be provided for each pump mounted in the panel face, to indicate in hours, the amount of time each pump has been in operation. A phase/voltage sensing relay shall be provided.

1.14 Electrical Apparatus - Devices

Five (5) time-delay relays shall be provided to perform the following function:

- A. Low suction timer
- B. 24-hour backup timer
- C. Valve fail, Pump 1
- D. Valve fail, Pump 2

The time delay relays shall be solid state plug in type. Interchangeability of the timers shall not disturb control wiring. Timers shall be provided with a red neon light to indicate timing cycle. The timers shall be adjustable.

Hands-off automatic switches shall be oil tight, three (3) position maintained and be located on the main control panel door and control the following circuits:

- A. Pump 1
- B. Pump 2
- C. Exhaust Fans
- D. Telemetry/Timer
- E. Alternator Bypass

Indicating lights to indicate equipment shall be oil tight, with a full voltage pilot light. Indicating lights shall be provided in colors and functions as follows:

- A. Red - Low Suction Pressure, Pumps 1 and 2
- B. Green - Pump 1 in Operation
- C. Green - Pump 2 in Operation
- D. Telemetry Operation
- E. Timer Operation
- F. Valve Fail, Pump 1
- G. Valve Fail, Pump 2

Name plates shall be furnished on all panels front mounted switches and lights. Name tags shall also indicate proper nomenclature of control panel internal parts.

1.15 Wiring

It shall be the responsibility of the installing electrician to furnish and install the correct size service wires from the service pole outside the building to the connection terminals inside the power or control panel designated for that purpose. No splice will be allowed in the service wires. It shall also be the responsibility of the installing electrician to furnish and install the electric service pole and, if required, any exterior disconnects or other switching mechanisms.

Rigid conduit, sized to adequately accept the inbound service connectors, shall be installed from the main power or control panel through the equipment capsule side sheet and terminate in a threaded coupling exterior to the equipment capsule.

All wiring within the building and outside of the control panel or panels shall be run in conduit except for the watertight flexible conduit and fittings properly used to connect pump drivers, fan motors, solenoid valves, limit switches, etc., where flexible connections are best utilized. Such accessories as the dehumidifier, when furnished by the original manufacturer with a UL approved rubber cord and plug, may be plugged into polarized receptacles designated for that purpose. All internal

equipment conduit and wire will meet or exceed the conduit, wiring schedule, and electrical codes set forth as follows:

Service Entrance: Rigid, heavy wall, hot dipped galvanized steel conduit with threaded watertight connections adequately sized to handle the type, number, and size of the incoming service conductors; in compliance with Article 346 of the National Electrical Code.

Equipment Conduit: Rigid, heavy wall, Schedule 40 PVC with solvent-weld moisture-proof connections adequately sized to handle the type, number, and size of equipment conductors to be carried; in compliance with Article 347 of the National Electrical Code and NEMA TC-2, Federal WC-1094A, and UL-651 underwriters Laboratory Specifications.

Flexible Connections: Where flexible conduit connections are necessary, the conduit used shall be liquid-tight flexible metal conduit having an outer non-metallic, sunlight resistant jacket over an inner flexible metal cord, sized to handle the type, number, and size of equipment conductors to be carried; in compliance with Article 351 of the National Electrical Code.

Motor Circuit Conductors: Sized for load. All branch circuit conductors supplying a single motor of one (1) horsepower or more full load current rating, type THHN, as set forth in Article 310 and 430-B of the National Electrical Code, Schedule 310-13 for flame retardant, heat resistant thermoplastic, copper conductors in nylon or equivalent outer covering.

Control and Accessory Wiring: Sized for load, type MTW/AWM (Machine Tool Wire/Appliance Wiring Material) as set forth in Article 310 and 670 of the National Electrical Code, Schedule 310-13 and NFPA Standard 79 for flame-retardant, moisture, heat and oil resistant thermoplastic, copper conductors in compliance with NMTBA and as listed by Underwriter's Laboratories (AWM), except where accessories are furnished with a manufacturer supplied UL approved rubber cord and plug. Four (4) duplex, grounding type, three (3) wire, polarized convenience receptacles shall be furnished about the periphery of the equipment capsule. One (1) duplex receptacle shall be adjacent to the main control panel. The equipment ground wire from each equipment ground post of the polarized receptacles shall be affixed at the main control panel terminal board solely designated for that purpose and separated from the neutral buss.

1.16 Ancillary Equipment

A. Dehumidifier

A packaged dehumidifier with a sealed refrigeration type compressor rated at 1/5 horsepower, 4.7 full load amps and 430 watts shall be wall mounted within the building in such a manner that the condensate shall discharge to the floor drain through tubing provided for that purpose. The dehumidifier shall operate on a 120 volt, single phase A.C. power source and be provided with a safety protected power cord of UL approved three (3) wire construction with three (3) spade plug. The dehumidifier shall be capable of

removing twenty-five (25) pints of water in twenty-four (24) hours when the room temperature is 80 degrees F and at 60 percent relative humidity (AHAM Standard DH-1). The dehumidifier shall be actuated by a dial-controlled adjustable humidistat which will automatically cycle the unit at pre-selected moisture levels. The humidistat shall also have "off" and "continuous run" positions. The dehumidifier shall be listed by Underwriter's Laboratories.

B. Heater

The building will be provided with an electric heater. The heater will have a rating of 3000 watts, 10,239 BTU-HR output when operating on a 230 volt, single phase A.C. power source. The heater shall be wall-mounted.

C. HVAC

The building will be provided with an electric through wall Heat & Air Conditioner unit. This unit shall be able to condition the pump station to the requirements as specified by the electrical (VFD) equipment. The minimum requirements shall be a cooling capacity of 8,000 BTU and a heating capacity of 3,000 watts with an energy efficiency ratio of 10.

D. Exhaust Fan

There shall be included in each room of the building, one (1) exhaust fan, located as shown on Plans. The fan capacity of each shall be 600 cfm and be able to make one complete air change per minute per room. The blower wheel shall be statically balanced to assure quiet performance and maximum air delivery. The fan motor will be complete with a conduit box. The exhaust fan shall operate on an independent 120 volt, single phase A.C. power source with single pole, 15 amp circuit breaker protection. Control of the exhaust fan shall be by a temperature switch with a manual switch located on the exterior of the building next to the door. The exhaust fan in the chlorine room shall take suction near the floor and exhaust to the outside atmosphere. Exhaust fan louvers shall facilitate airtight closure.

E. Fresh Air Intake

There shall be included in each room of the building fresh air intake. Air inlet in the pump room shall be near the ceiling and facilitate airtight closure whereas the air inlet in the chlorine room shall be near the floor.

F. Lighting

Fixtures shall be two (2) tubes, 40 watt per tube, rapid start, "OSHA" approved, enclosed and gasketed fluorescent lights. There shall be four (4)

fixtures installed within the pump room and two (2) fixtures in the chlorine room of the building. One fixture shall be located directly over the main control panel and be of forty-eight inch (48") minimum length, the other fixtures shall be centrally located within the building. The light switch shall be of the night glow type and be located inside to the left of the door opening. This switch also turns on the exhaust blower. Open or incandescent fixtures without OSHA approval will not be accepted.

1.17 Manufacturer's Pump Test

All pumps shall be tested at the factory prior to shipment to ensure the performance criteria as stated in these SPECIFICATIONS can be met. Evidence of such testing shall be made available at the request of the ENGINEER.

1.18 Factory Start-Up Service

After the booster pump station equipment has been completely installed, including the electrical service, and has been put under pressure by the installer, then a factory service representative will be scheduled to visit the job site and put the booster station into trouble free, automatic operation. The service representative will be a regular employee of the booster pump station manufacturer.

The service representative will spend time as required at the job site. In addition to his start-up duties, he shall explain and demonstrate the operation of the booster pump station to a representative of the OWNER. Two (2) bound copies of the booster pump station Maintenance and Operation Manual shall be supplied.

1.19 Telemetry Interface

The station manufacturer shall provide:

- A. Mounting Brackets for RTU
- B. One (1) Pole Breaker for Power
- C. One Inch (1") Coupling for Antenna
- D. Dry Contacts for Pump Starts

END OF SECTION

SECTION 11295

ABOVE GROUND HYDRO-PNEUMATIC BOOSTER STATION AND TANK

1.01 LOCATION

This contract includes installation of an above ground hydro-pneumatic water booster station, located as noted on the PLANS.

1.02 SCOPE OF WORK

The contractor shall furnish and install one (1) factory built, factory delivered, above ground booster pump station, with all the necessary internal piping, pump, motors, valves and controls and other necessary appurtenances as specified herein. The station shall be complete when delivered and will not require internal contractor construction except to install the power service through the service conduit provided for that purpose.

The above ground water booster pump station shall be manufactured by Engineered Fluid, Inc. (EFI), Centralia, Illinois, or approved equal.

1.03 QUALITY ASSURANCE

The equipment and materials covered by these specifications are intended to be standard equipment of proven reliability and as manufactured by reputable manufacturers having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods and shall operate satisfactorily when installed and operated per manufacturer's recommendations.

It is intended that the manufacturer of the selected equipment shall be a business regularly engaged in the manufacture, assembly, construction, start-up and maintenance of water distribution equipment of the type required for this project. The manufacturer shall have at least ten (10) years of successful experience in providing stations of the type, design, function and quality as required for this project.

The completed station shall be E.T.L. Listed by Intertek Testing Services (ITS) under Category 225 - Packaged Pumping Systems. Each station shall bear an E.T.L. listing label. The listing label shall include the station manufacturer's name, address, and telephone number. The station manufacturer shall have quarterly inspections performed by ITS at the manufacturer's facilities to ensure that the products being listed comply with the report and procedural guide for that product.

1.04 SUBMITTAL

Equipment submittals shall be bound and in a minimum of six (6) copies. The submittals shall contain a minimum of two (2) full size drawings, size 24" x 36";

one (1) each covering the booster pump station and the electrical control schematic. The booster pump station drawing shall be specific to this project, in at least three (3) different views and be to scale. The submittal booklets will be complete with data sheets covering all individual components that make up the booster pump station and the UL file number under which the manufacturer is listed, service department personnel statement as detailed in the specifications and be complete with the manufacturer's formal warranty policy.

Two (2) submittal reviews of this item will be accomplished at no cost to the submitting contractor. However, all subsequent reviews will be charged to the submitting contractor at the design engineer's standard hourly billing rate.

1.05 EQUIPMENT BASE

The plate steel employed throughout the equipment base shall meet or exceed the requirements for ASTM A-36. The structural shapes (channels and angles) shall be of the thickness/weight for this item and shall meet or exceed the requirements for ASTM A-36. The design of all members shall be in accordance with the recommended practice for design as specified in the MANUAL OF STEEL CONSTRUCTION, published by the American Institute of Steel Construction, Inc.

The equipment base shall be one completed unit when delivered. Field welding to complete the structure or attach the internal piping system will not be accepted. The steel plate and structural shapes used must be adequate to meet the purpose for which they are intended plus the additional stresses from the lifting and setting of the equipment. The equipment base design shall accommodate both lifting from above the unit by a hoist or crane and lifting from below by a fork lift.

1.06 EQUIPMENT ENCLOSURE

The equipment enclosure shall be a hand layup, molded fiberglass cover containing but not limited to the following raw material:

- A. Resins - Resins shall be thermosetting, medium reactivity, rigid fire resistant polyester containing maximum monomer content of 42% and a maximum of 11% Thixotropic additive.
- B. Glass Fiber - Glass Fiber reinforcement shall be K filament type E Borosilicate glass having high performance chrome-complex or silane finish compatible with polyester resins.
- C. Gelcoat - Exterior surface coating shall be ultraviolet light stabilized, weather resistant, polyester base containing fade resistant color pigments, and such inert extenders as are appropriate to maintain total pigment volume concentration less than 20%.
- D. Interior Coating - Interior laminate coating when required shall be a pigmented heat resistant high gloss polyester base surfacing sealer.
- E. Other Materials - Organic peroxide catalysts and promoters appropriate to the resin-type shall be used as necessary to provide thorough cure.

The equipment enclosure when installed shall be hinged at one end. A minimum of three (3) butt type hinges will be used and each hinge will have a removable hinge pin. The hinges will be affixed to the cover by bolting and be complete with a full span aluminum backing bar. Bolts and nuts of the hinging system will not directly bear on the fiberglass cover, but bear only on each hinge and the backing bar. The hinges will allow the cover to open fully to expose all interior equipment.

Two (2) pneu-spring inert gas over oil spring-loaded opening assist automatic cylinders shall be supplied to counterbalance the weight of the fiberglass cover to ease the opening and closing function. The cylinders shall be complete with internal orifice-type valve that dampens the extension motion, but permits undampened compression.

The equipment enclosure shall be secured from unauthorized entry by a simplex, weather resistant padlock system. Where more than one (1) cover is used or more than one (1) booster station is supplied, the padlocks will be keyed alike. Two (2) keys will be provided for each padlock, with each set of keys on a key ring complete with the manufacturer's identification and service telephone number. The equipment enclosure cover shall have affixed in a prominent location the logo of the manufacture.

The equipment enclosure shall be insulated with a isocyanurate (flame retardant urethane) foam insulating material. The insulation shall be applied to the interior of the cover by spray and other approved methods. The insulation shall have a minimum density (compressibility) of 2.25 lbs/cu. ft. nominal and shall be applied to the thickness required to provide a minimum R value of 21.

The equipment enclosure cover shall be complete with a minimum of one (1) galvanized lifting handle. The handle will be affixed to the long side of the cover. The handle will be so located as to allow the equipment enclosure cover to be easily tilted to expose completely the mechanical/electrical equipment contained therein. The handle will be bolted through the cover and through an aluminum backing bar. Handles screwed directly to the cover will not be acceptable.

DELIVERY - BOOSTER STATION PROTECTION - Each completed above ground booster pump station shall be completely encased (with the exception of the underneath portion of the base) in a shrink wrap, polyethylene plastic enclosure to protect the transported unit from adverse elements encountered during shipment. The plastic enclosure shall be of Griff-Shrink 5-ply VCI clear reinforced shrink film as manufactured by Reef Industries, or approved equal.

1.07 CORROSION PROTECTION - BASE ONLY

All surfaces of the entire structure shall be grit blasted equal to commercial blast cleaning (SSPC-SP6).

Following grit blasting, all weldments will be pretreated by hand using Tnemec Series 69 Hi-Build Epoxoline II coating, or approved equal, to provide additional corrosion protection. Following the pretreatment full coating application shall take place.

The full protective coating shall take place immediately after surface preparation. The protective coating shall consist of a two-component, high solids, epoxy system formulated for high build application for protecting and finishing of steel and having excellent chemical and corrosion resistant properties. The epoxy system shall be self-priming and require no intermediate coatings. The protective coating shall provide in two (2) applications a total dry mil thickness of 8.0 mils.

1.08 OPERATING CONDITIONS

The pump station shall be capable of delivering the fluid medium at the following capacity and head when operating at 30 psi minimum suction pressure.

PUMP #1 & #2 - Grundfos CR 3-7

**Design: 14.5 GPM @ 170 feet TDH;
Efficiency at design GPM shall be 75%.**

The pump driver shall be a standard, A.C. induction motor, TEFC construction, of the vertical extended shaft, normal thrust type and shall be, 3500 rpm nominal and suitable for 3 phase electrical service.

VFD controls for speed control and phase conversion.

PORTABLE BACKUP GENERATOR refer to plan sheet notes.

1.09 BOOSTER PUMPS – CENTRIFUGAL IN-LINE, MULTI-STAGE - VERTICAL

Pumps

- A. The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point.
- B. All pump bearings shall be lubricated by the pumped liquid.
- C. Small Vertical In-Line Multi-Stage Pumps (Nominal flow from 3 to 125 gallons per minute) shall have the following features:
 - 1. Each pump shall be designed for in-line installation requiring no more than 1.5 square feet of floor space (including motor).
 - 2. The pump impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement.
 - 3. The suction/discharge base shall have ANSI Class 250 flange or internal pipe thread (NPT) connections as indicated in the drawings or pump schedule.
 - 4. Pump Construction.

- | | | |
|----|---|----------------------------|
| a. | Suction/discharge base, pump head, motor stool: | Cast iron (Class 30) |
| b. | Impellers, diffuser chambers, outer sleeve: | 304 Stainless Steel |
| c. | Shaft | 316 or 431 Stainless Steel |
| d. | Impeller wear rings: | 304 Stainless Steel |
| e. | Shaft journals and chamber bearings: | Silicon Carbide |
| f. | O-rings: | EPDM |

Shaft couplings for motor flange sizes 184TC and smaller shall be made of cast iron or sintered steel. Shaft couplings for motor flange sizes larger than 184TC shall be made of ductile iron (ASTM 60-40-18).

Optional materials for the suction/discharge base and pump head shall be cast 316 stainless steel (ASTM CF-8M) resulting in all wetted parts of stainless steel.

5. The shaft seal shall be a balanced o-ring cartridge type with the following features:

- | | | |
|----|----------------------------|---------------------|
| a. | Collar, Drivers, Spring: | 316 Stainless Steel |
| b. | Shaft Sleeve, Gland Plate: | 316 Stainless Steel |
| c. | Stationary Ring: | Silicon Carbide |
| d. | Rotating Ring: | Silicon Carbide |
| e. | O-rings: | EPDM |

The Silicon Carbide shall be imbedded with graphite.

6. Shaft seal replacement shall be possible without removal of any pump components other than the coupling guard, shaft coupling and motor. Pumps with motors equal to or larger than 15 hp (fifteen horsepower) shall have adequate space within the motor stool so that shaft seal replacement is possible without motor removal.
7. The maximum working temperature shall be 250 degrees F. The maximum working pressure are as follows:

Connection Type	Maximum Working Pressure
1" or 1 1/4" Internal Thread (NPT)	232 psig
2" Internal Thread (NPT)	145 psig
ANSI Flange (Class 250)	362 psig

Motors

- A. Motors are to be provided with the following basic features:
1. Motors shall be designed for continuous duty operation, NEMA design B with a 1.15 S.F.
 2. Totally Enclosed Fan Cooled Motors are to be furnished with class "F" insulation. Open Drip Proof Motors are to be furnished with class "B" insulation.
 3. Motor nameplate shall be mounted on enclosure with stainless steel fastening pins. Nameplate shall have, as a minimum, all information as described in NEMA Standard MG 1-20.40.1.
 4. Open Drip Proof (ODP) motors shall have drip covers.
 5. Motors over 50 lbs shall having lifting provisions.
 6. Motors shall have a NEMA C-Flange for vertical mounting.
 7. Drive end bearings shall be adequately sized so that the minimum L10 bearing life is 17,500 hours at the minimum allowable continuous flow rate for the pump.

1.10 PIPING

Piping shall be steel and conform to material specification ASTM A-53(CW) for nominal pipe size four (4) inch and smaller and ASTM A-53(ERW) Grade B for nominal pipe size five (5) inches and larger. Steel butt-welding fittings shall conform to material specification ASTM A-234 Grade WPB and to the dimensions and tolerances of ANSI Standards B16.9 and B16.28 respectively.

Forged steel flanges shall conform to material specification ASTM A-105 Class 60 and/or ASTM A-181 for carbon steel forgings and to the dimensions and tolerances of ANSI Standards B16.5 as amended in 1992 for Class 150 and Class 300 flanges.

The piping sizes shall be as shown on the drawing.
Size 10 inch and below - Schedule 40
Size 12 inch thru 20 inch - Standard weight (.375" wall)
Size 24 inch and above - Standard weight (.500" wall)

All pipe welds shall be performed by certified welders employed by the pump station manufacturer. As part of the equipment submittal, the pump station manufacturer shall provide copies of the welding certificates of the employees who are to perform the pipe welds.

All piping surfaces shall be prepared by sandblasting, or other abrasive blasting, prior to any welds taking place. Piping of 5" diameter and smaller may be cut by saw. Piping of 6" diameter and larger shall be bevel cut, and Oxyfuel or Plasma-

arc cutting techniques shall be used to assure and facilitate bevel pipe cuts. No saw cuts or other form of abrasive cut-offs are allowed on 6" and larger diameter pipe.

In all cases, short circuit transfer, spray transfer or pulse-arc transfer modes of the gas metal arc welding process shall be applied semi-automatically. When utilizing the short circuit mode, shielding gas consisting of 50% carbon dioxide and 50% argon gas shall be used. When utilizing the spray or pulse-arc transfer modes, a shielding gas consisting of 5% carbon dioxide and 95% argon shall be used. In all cases, welding wire with a minimum tensile strength of 70,000 psi shall be employed. All flange welds and butt welds of equal size pipe shall be a single continuous nonstop weld around the complete circumference of the pipe. Whenever possible, vertical up weld passes will be applied to all pipe welds. No vertical down weld passes will be allowed. Completed welding assemblies shall create no internal obstruction, restriction or create any unintended sources of water deflection.

Piping of six (6) inch diameter and larger shall require a minimum of two (2) weld passes to complete each weld. The first pass, or root pass, shall be applied at the bottom of the bevel cut using the short circuit transfer welding mode, and the second pass, or cap pass, shall be applied over the root pass using the spray or pulse arc transfer welding modes to insure that at a minimum the total weld thickness shall be equal to thinnest of the two pieces being welded together.

1.11 POLYAMIDE EPOXY COATING - STEEL PIPING

Steel piping of size 1-1/2" and smaller shall have applied to it a polyamide epoxy coating on the interior pipe surface that conforms to AWWA D-102 Inside Systems No. 1 and No. 2 for steel water pipelines. The coating product shall be certified by National Sanitation Foundation (NSF) International in accordance with ANSI/NSF Standard 61. The polyamide epoxy coating shall provide a minimum total dry mil thickness of 7-9 mils. The polyamide epoxy coating shall be Tnemec Series 20 Pota-Pox, or approved equal.

Prior to shipment of the station, the station manufacturer shall provide in writing to the Engineer certification that the polyamide epoxy coating has been applied to all internal surfaces of the steel piping using the proper method. Said certification shall show under the station manufacturer's letterhead:

- Date of application;
- Material manufacturer and product designation including a product data sheet for the coating;
- Applier of the fusion bonded coating, name, address and phone number;

Notarized signature of an officer of the station manufacturing company stating the polyamide epoxy coating was applied to AWWA D-102 or the latest revision.

1.12 PIPE SUPPORTS

Pipe supports by minimum sizing for:

- 8" and smaller piping shall be 2" x 3" x 3/16" wall rectangular tubing;
- 10" and larger piping shall be 3" x 4" x 1/4" wall rectangular tubing;

Pipe supports are to be fully welded at both end points to the pipe and steel floor where required.

Simple pipe stands made of pipe welded only at the floor and upholding a bracket with or without a threaded jack bolt or a U-bolt are not acceptable, as no lateral or transverse support is provided.

1.13 HYDRO-PNEUMATIC STORAGE

The station shall be complete with one (1) diaphragm type hydro-pneumatic ASME coded storage tank. **The storage tank volume will be a minimum of 16 gallons with a maximum working pressure of 250 psi.**

The hydro-pneumatic storage tank shall feature deep drawn steel upper and lower domes with side shell construction specifically designed for diaphragm type storage tanks. Storage tank welding shall be carefully done to eliminate rough spots and sharp edges. The storage tank base shall be designed so as to permit free airflow to prevent moisture from accumulating beneath the storage tank.

The hydro-pneumatic storage tank internals shall include two (2) separate pieces. The first piece shall be a heavy-duty butyl diaphragm that effectively separates the air chamber from the water chamber. The shape of the diaphragm shall conform exactly to the shell configuration and shall be of seamless construction meeting FDA requirements for potable water.

The second piece shall be a polypropylene liner that conforms exactly to the lower dome and acts as the water receptacle. Water shall never touch steel.

The polypropylene liner shall be 100% non-corrosive and will not be bonded to the steel shell wall or lower dome. A mechanical clamping ring shall permanently affix the diaphragm and the liner to the shell groove. The polypropylene liner shall be tested and accepted by the National Sanitation Foundation.

THE HYDRO-PNEUMATIC STORAGE VESSEL SHALL BE AS MANUFACTURED BY WESSELS COMPANY, OR APPROVED EQUAL.

1.14 SERVICE CONNECTIONS ON INTERNAL PIPING

All plumbed devices within the station eventually requiring service, such as meters, control valves, pumps and like equipment, shall be easily removed from the piping by the presence of appropriately placed and sufficient quantity of adaptors and couplings as shown on the drawings; no less than the quantity of couplings and adaptors shown shall be allowed.

1.15 RESTRAINING POINTS

The main inlet and outlet piping to the station shall each be provided with two (2) or four (4) restraining points as welded on "eyes" or similar device welded to the station framing to facilitate the attachment of joint restraint tie rods or other device to be used in retarding any pipe movement at the connections.

1.16 COMPRESSION COUPLINGS

The booster station piping shall include a compression type, flexible coupling to prevent binding and facilitate removal of associated equipment where shown on the plans for this item. In lieu of a compression coupling, a Uni-Flange or a flanged coupling adapter (FCA) may be used.

All compression couplings, Uni-Flanges, flanged coupling adapters (FCA), and flexible connectors/expansion joints shall include a minimum of two (2) control joint rods with appropriate restraining points.

1.17 COMBINATION PRESSURE GAUGES

Combination pressure gauges shall have a built-in pressure snubber and have 4-1/2" minimum diameter faces and turret style case, black fiberglass-reinforced thermoplastic with a clear acrylic window with Buna-N gasket. The movement shall be rotary; the bourdon tube shall be copper alloy C-type. The gauge shall have a 1/4" MNPT lower mount process connection and contain a 0.6mm copper alloy restrictor. Combination pressure gauge range and scale graduations shall be in psi and feet of water as follows:

SUCTION PRESSURE - 0 to 100 psi, 1 psi figure intervals, with graduating marks every .1 psi (0-35 feet).

DISCHARGE PRESSURE - 0 to 250 psi, 20 psi figure intervals, with graduating marks every 2 psi (0-460 feet).

All gauges will be panel mounted off the pipeline and be flexible connected to their respective sensing point. The gauge trim tubing shall be complete with both isolating and vent valves and the tubing shall be so arranged as to easily vent air and facilitate gauge removal. Gauges mounted directly to the pipeline or at the sensing point will not be accepted.

GAUGES SHALL BE WIKA MODEL 212.34, OR APPROVED EQUAL.

1.18 BALL VALVES

Ball valves shall meet or exceed ASTM Spec B124 No. C37700. The ball valves will be 2-piece forged brass body, blow out proof stem, TFE seats, TFE packing with adjustable stem packing gland. The valves will be NPT threaded pattern complete with lever operators. Maximum working pressure shall be 600 psi.

BALL VALVES SHALL BE HAMMOND VALVE MODEL 8901, OR APPROVED EQUAL.

1.19 SPRING CHECK VALVES

The spring check valves shall be inline lift type, ASTM B-584 Alloy C84400 bronze bodies, stainless steel stem and spring, Teflon seat ring with Buna-N discs. The valve is rated for 250 psi non-shock WOG working pressure. The check valve shall be designed to prevent water hammer by returning the valve plug to the seat before reversal of flow occurs. The valves may be installed in both horizontal and vertical lines with upward flow.

THE SPRING CHECK VALVES SHALL BE NIBCO MODEL T-480, OR APPROVED EQUAL.

1.20 STRAINERS

Each pump inlet shall include a "Y" type strainer of the size as shown on the plans for this item. The strainer body shall be high grade cast iron equal to ASTM specification A126 Class B with threaded end connections. Strainer basket to be of 304 stainless steel material with perforated sided and solid bottom. For water service, 1/4" thru 2" sizes to have 20 mesh perforations, 2 1/2" and 3" to have .045 perforations.

STRAINERS SHALL BE METRAFLEX MODEL TSC, OR APPROVED EQUAL.

1.21 PRESSURE TESTING

When the station plumbing is completed, the pressure piping within the station, including valves, pumps, control valves, fittings, and connections as make up the entire system shall be hydrostatically tested at a pressure of 250 psi or a pressure equal to the lowest test pressure rating of the equipment within the tested system, whichever is lesser pressure. The test pressure shall be applied for a minimum of 20 minutes, during which time all joints, connections and seams shall be checked for leaking. Any deficiencies found shall be repaired and the system shall be retested.

The results of this testing shall be transmitted in writing to the Engineer prior to shipment of the station and shall note test pressure, time at full pressure and be signed by the Quality Control Manager or test technician.

1.22 ELECTRICAL APPARATUS - DESIGN, ASSEMBLY & TEST

The electrical apparatus and control panel design, assembly, and installation, and the integration of component parts will be the responsibility of the manufacturer of record for this booster pumping equipment. That manufacturer shall maintain at his regular place of business a complete electrical design, assembly and test facility to assure continuity of electrical design with equipment application. Control panels designed, assembled or tested at other than the regular production facilities or by other than the regular production employees of the manufacturer of record for this booster pumping equipment will not be approved.

1.23 CONFORMANCE TO BASIC ELECTRICAL STANDARDS

The manufacture of electrical control panels shall be done in strict accordance with the requirements of UL Standard 508A so as to afford a measure of security to the eventual owner. No exceptions to the requirements of these codes and standards will be allowed; failure to meet these requirements will be cause to remove the equipment and correct the violation.

1.24 U.L. LISTING

All service entrance, power distribution, control and starting equipment panels shall be constructed and installed in strict accordance with Underwriters Laboratories (UL) Standard 508A "Industrial Control Equipment." The UL label shall also include an SE "Service Entrance" rating stating that the main distribution panel is suitable for use as service entrance equipment. The panels shall be shop inspected by UL, or constructed in a UL recognized facility. All panels shall bear a serialized UL label indicating acceptance under Standard 508A and under Enclosed Industrial Control Panel or Service Equipment Panel. In addition, a photocopy of the UL labels for this specific project shall be transmitted to both the project engineer and the contractor for installation within their permanent project files, prior to shipment of the equipment covered under these specifications.

Each electrical equipment item in the station shall be properly grounded per Section 250 of the National Electrical Code. Items to be grounded include, but are not limited to, pump motor frames, control panel, transformer, convenience receptacles, heater, exhaust fans and pressure switches.

All ground wires from installed equipment shall be in conduit and shall lead back to the control panel to a plated aluminum ground buss specific for grounding purposes and so labeled. The ground buss shall be complete with a lug large enough to accept the installing electrician's bare copper earth ground wire. The bus shall serve as a bond between the earth ground and the equipment ground wires.

1.26 PANEL MOUNTING HARDWARE

Metal framing channel shall be used exclusively for mounting of all electrical panels and electrical components except for those specifically designated otherwise.

1.27 ELECTRICAL APPARATUS - CONTROL PANEL

All circuit breakers, motor starters, time delay relays and control relays shall be incorporated into one (1) NEMA 4/12 control panel.

There shall be provided, thermal-magnetic trip circuit breakers as follows:

- One (1) Main Breaker, 100 amps;
- One (1) Branch Breaker, one each per pump, 15 amps;
- One (1) Voltage Monitor Breaker, 15 amps;

Four (4) Auxiliary Circuit Breakers, as follows:

1. Controls
2. Heater
3. Exhaust Fan
4. Convenience Outlet

1.28 ELECTRICAL APPARATUS - PUMP STARTING EQUIPMENT

Pump starting equipment shall be single (1) phase, full voltage non-reversing magnetic starters connecting the pump motor directly across the line. The relay shall be complete with a manually reset overload relay. The relay shall be complete with a correctly sized heater element on each line. Starters and overloads shall be UL listed.

1.29 ELECTRICAL APPARATUS - RUNNING TIME METER

A running time meter shall be supplied for each pump to show the number of hours of operation. The meter shall be enclosed in a dust and moisture proof molded plastic case, suitable for flush mounting on the main control panel. The meter dial shall register in hours and tenths of hours up to 99999.9 hours before repeating. The meter shall be suitable for operation from a 115 volt, 60 cycle supply.

1.30 ELECTRICAL APPARATUS - SURGE ARRESTER

A secondary surge arrester shall be provided. Housing shall be Noryl and be ultrasonically sealed. Valve blocks shall be metal oxide with an insulating ceramic collar. Gap design shall be annular. The lead wire shall be permanently crimped to the upper electrode forming part of the gap structure. Arresters shall be UL and CSA listed Lightning Protective Devices.

1.31 ELECTRICAL APPARATUS - SUCTION PRESSURE CONTROL

Suction control of the pumping operation shall be provided by a bellows type, adjustable differential pressure switch. The switch shall be complete with a single pole, double throw contact block with 5 amp non-inductive rated contacts at 230 volts AC. The set points of the on/off cycle shall be independently adjustable through the full range of the switch rating.

1. Low Suction Cut-out, 2-150 psi.
- 1A. Adjustable Differential, 2-25 psi.

A pressure gauge shall be sub-panel mounted adjacent to the low suction pressure switch. The gauge and switch shall be so plumbed with the suction header sensing line that a common blow-off valve can relieve pressure in both simultaneously for purposes of checking and calibrating the low suction lock-out.

1.32 ELECTRICAL APPARATUS - LOCAL PRESSURE CONTROL

Control of the pumps shall be provided by bellows type, adjustable differential pressure switches. Each switch assembly will be complete with a single pole,

double throw contact block with 5 amp non-inductive rated contacts at 230 volts AC. The set points of the on/off cycle shall be independently adjustable through the full range of the switch rating.

1. Start Lead Pump, 4-100 psi control range.
- 1A. Adjustable Differential, 2-25 psi.

A pressure gauge shall be sub-panel mounted adjacent to the discharge pressure switches. The gauge and switches shall be so plumbed with the discharge header sensing line that a common blow-off valve can relieve pressure in all simultaneously for purposes of checking and calibrating the start-stop functions of the pumps.

1.33 ELECTRICAL APPARATUS - DEVICES

Two (2) solid state time delay relays shall be provided to perform the following functions:

1. Low Suction Timer (minimum on)
2. Low Suction Timer (minimum off)

The solid state time delay relay shall have an adjustable time range of 10 seconds to 10 minutes. The relays shall be constructed to use a DIN rail mount socket so that the relays can be replaced without disturbing the wiring. The relay shall be complete with LED indicators for output and power.

Hand-Off-Automatic switches shall be oil tight, 3-position maintained and be located on the main control panel door, and control the following circuits:

1. Pump #1
2. Exhaust Fan (2-position) Run-Auto

Indicating lights shall be oil tight, with a full voltage pilot light and be provided:

1. Red - Low Suction Pressure
2. Green - Pump #1 in Operation

Nameplates shall be furnished on all panel front mounted switches and lights.

The control panel door shall be complete on the interior with a stick-on transparency containing an "as-built" reproduction of the electrical control panel schematic. The wiring diagram shall be a corrected "as-built" copy and contain individual wire numbers, circuit breaker numbers, switch designations and control function explanations.

One (1) duplex receptacle shall be adjacent to the main control panel. The equipment ground wire from each equipment ground post of the polarized receptacle shall be affixed at the main control panel terminal board solely designated for that purpose and separate from the neutral buss.

1.34 ELECTRICAL APPARATUS - CONDUIT AND WIRING

The service entrance conduits shall be liquid-tight flexible totally nonmetallic, corrosion resistant, nonconductive, U.L. listed conduit with a sunlight resistant jacket over an inner flexible core, sized to adequately accept the inbound service conductors, and/or telemetry/telephone/radio cables, and shall be installed from the main power or control panel through the equipment enclosure and terminate in a threaded coupling welded through the equipment enclosure. The service entrance conduit connection shall be plugged for shipment.

All wiring within the equipment enclosure and outside of the control panel or panels shall be run in conduit except for the watertight flexible conduit and fittings properly used to connect pump drivers, fan motors, solenoid valves, limit switches, etc., where flexible connections are best utilized. All internal equipment conduit and wire will meet or exceed the conduit, wiring schedule and electrical codes set forth as follows:

EQUIPMENT ENCLOSURE CONDUIT - Rigid, heavy wall, Schedule 40 PVC with solvent weld moisture-proof connections, in minimum size 3/4" or larger, sized to handle the type, number and size of equipment conductors to be carried - in compliance with Article 347 of the National Electrical Code and NEMA TC-2, Federal WC-1094A and UL-651 Underwriters Laboratory Specifications.

FLEXIBLE CONNECTIONS - Where flexible conduit connections are necessary the conduit used shall be liquid-tight flexible totally nonmetallic, corrosion resistant, nonconductive, U.L. listed conduit with a sunlight resistant jacket over an inner flexible core, sized to handle the type, number and size of equipment conductors to be carried - in compliance with Article 351 of the National Electrical Code.

MOTOR CIRCUIT CONDUCTORS - Sized for load. All branch circuit conductors supplying a single motor of one (1) horsepower or more shall have an ampacity of not less than 125 percent of the motor full load current rating, dual rated type THHN/THWN, as set forth in Article 310 and 430-B of the National Electrical Code, Schedule 310-13 for flame retardant, heat resistant thermoplastic, copper conductors in a nylon or equivalent outer covering.

CONTROL AND ACCESSORY WIRING - Sized for load, type MTW/AWM (Machine tool wire/appliance wiring material) as set forth in Article 310 and 670 of the National Electrical Code, Schedule 310-13 and NFPA Standard 79 for flame retardant, moisture, heat and oil resistant thermoplastic, copper conductors in compliance with NTMA and as listed by Underwriters Laboratories (AWM), except where accessories are furnished with a manufacturer supplied UL approved rubber cord and plug.

CONVENIENCE GROUP - HEATER

1. One (1) each.
2. Rating - _10,240 BTU/HR – 3,000 watts, 240 volt.
3. Steel finned metal sheath heating elements with low sheath temperatures.
4. Control - thermostat.

5. UL listed.
6. Vane axial fan - down flow discharge.
7. Hard wired in conduit per UL 400-1.

CONVENIENCE GROUP - EXHAUST FAN

1. One (1) each installed as shown.
2. Capacity each 230_cfm at .2 inch static pressure.
3. Squirrel cage blower.
4. Hard wired in conduit to conduit box on motor per UL 400-1.
5. 120 volt A.C. operation from wall mount thermostat and HAND/AUTO switch on main control panel.

FACTORY START-UP SERVICE

1. Start-up service technician shall be a regular employee of booster station manufacturer.
2. As part of the submittal covering this equipment, list the factory service manager, his employee number, his telephone number with extension and his number of years with the company. List also each start-up service technician, his employee number and years of service with the company.
3. Verify that one (1) or more of the service technicians listed above will perform the required start-up service on the equipment covered in the submittal.
4. One (1) full day at job site for start-up and training.
5. Start-up service to include two (2) bound O&M manuals.
6. Start-up service report attested to by start-up technician and representative of owner or engineer.
7. Service report distributed to:
 - A. Manufacturer's File
 - B. Engineer's File
 - C. Contractor's File
 - D. Owner's File

1.35 MANUFACTURER'S WARRANTY

The warranty is the sole responsibility of the station manufacturer and that manufacturer's warranty shall be provided in written form for inclusion with both the submittal covering the specified equipment and the O&M manuals provided with that equipment.

Said manufacturer's warranty shall at a minimum cover:

1. A period of one (1) year commencing upon successful start-up of the equipment, after authorized manufacturer's start-up, not to exceed eighteen (18) months from the date of shipment.
2. The warranty period shall be inviolate regardless of any component manufacturer's warranty for equipment and components within the station.
3. The manufacturer's warranty shall cover all equipment, components and

systems provided in or with the station by the manufacturer of the station, exclusive of those components supplied by and/or installed by others independent of the manufacturer of record for this station.

4. The warranty shall provide for the station manufacturer to bear the full cost of labor and materials for replacement and/or repair of faulty or defective components so there shall be no cost incurred by the Owner for this work during the warranty period.
5. The manufacturer's warranty policy is amended only by the items considered consumables, i.e., light bulbs, pump seals, pump packing, lubricants and other maintenance items consumed by usage.
6. No assumption of contingent liabilities for any component failure during manufacturer's warranty is made.

It is the intent of this manufacturer's warranty to gain for the owner a single source responsible party for all components specified herein. "Second party" or "pass through" warranties will not be accepted.

END OF SECTION

SECTION 11500

REMOTE METER READING SYSTEM

5/8 X 3/4 Orion Radio Read Meter

The remote meter reading system shall consist of all hardware's necessary to equip new meters such as to provide a complete functioning system complimentary to the existing Orion Radio Read System.

- A. Transmitter / registers for all meters which are to be straight reading, permanently sealed, magnetic drive and which measures in U.S. Gallons. This unit is to be factory wired to the end cap assembly for maximum reliability with the end cap to be bottom mounted thru a drilled hole in the meter pit lid. This unit is to communicate with the interrogation device.

The transmitter shall use two (2) 3.6 V 2.4 Ahr Lithium batteries as a power source and said batteries shall be guaranteed for a minimum of seven (7) years from initiation of operation.

This unit shall be capable of providing optional leak detection when no tow hour window of no usage within a 24 hour period is detected. It shall also be capable of tamper detection such as a cut wire.

- B. Meters shall be Badger Recordall Bronze Disc meters (5/8" X 3/4") Model 25 which complies with the latest ANSIA./AWWA Standards.

END OF SECTION

SECTION 11900

SCADA SYSTEM WITH RADIO TELEMETRY

PART 1 GENERAL

1.01 Location

The work to be accomplished under this section shall consist of new SCADA hardware and software equipment for automatic operation of new pumps located at (2 Ea.) new duplex Booster Pump Stations (BPS) as indicated on the plans. The SCADA system shall monitor and control pilot equipment to maintain sufficient water in associated remotely located tanks as indicated. Future additions to the operational strategy should be planned for utilizing the existing SCADA Master and new SCADA Workstations at the Districts Water Office.

1.02 Scope of Work

- A: (1 Ea. New) RTU-400 Town Hill BPS
- B: (1 Ea. New) RTU-3400 KY28 BPS with local supply storage tank
- C: (1 Ea. New) RTU-3500 KY315 Water Storage Tank with local valve control
- D: (2 Ea. New) SCADA Computers with HMI Software Upgrade
- E: (1 Lot) Communications Equipment Maintenance
- F: Cane Creek Tank-Level transducer isolator and grounding

The CONTRACTOR shall be responsible for furnishing materials and installing various equipment necessary for a complete and expanded SCADA/Radio Telemetry monitoring and process control system. The Supervisory Control and Data Acquisition (SCADA) system shall function properly to create and maintain all appropriate data and control as selected by the water operator, and in accordance with these specifications. The system shall be based on the utilization for Programmable Logic Controllers (PLC) which are sold or distributed on a national basis through multiple distributors in various Cities throughout the State of Kentucky. Proprietary hardware/software products sold/provided via an exclusive territorial basis by only one entity/representative per area are specifically and unconditionally not acceptable.

Complete and detailed integration of equipment supplied under this contract with any existing equipment and/or all new equipment furnished herein as well as by other specific suppliers is required. The complete system shall be constructed with UL listed materials wherever applicable. The new SCADA hardware/software and associated modifications specified herein shall be the product of a manufacturer and Systems Integrator who can demonstrate at least ten (10) years of satisfactory experience in construction, furnishing, and maintenance of the product.

To assure system compatibility, the SCADA system supplier shall be of identical equipment type and brand of the owner's existing SCADA equipment as supplied by

HTI Inc, Horse Branch, Kentucky (270)-274-4632. Suppliers desiring to submit as alternate must provide to the engineer 2 weeks prior to bid date, prior experience demonstrating qualifications to perform the project task along with a listing of equipment types and guarantees of required compatibility with the existing system. All control hardware components, communications equipment, software, programming and control methods shall be completely compatible with the existing system.

The Systems Integrator shall supply specific SCADA equipment, software and services as noted specifically in this contract specification section and related portions of the plan documents. Equipment or services listed in subsequent sections of this contract detailing piping, earth work, concrete, building construction, pumps, pump controls, electrical or the like shall not be under the Scope of Work for the Systems Integrator/SCADA Supplier.

The SCADA system supplier will furnish the following services to the CONTRACTOR prior to acceptance by the OWNER, and to the OWNER after acceptance. All costs involved in these services shall be included. These services include:

- A. Coordinate shop drawings for other items, or equipment, as required to insure proper interface into the System.
- B. Furnish Instrumentation and SCADA System wiring diagrams reflecting all equipment approved for use on the project. The wiring diagrams will be used by the CONTRACTOR for installation of the equipment and wiring. All wires shall be tagged and labeled at both ends for quick identification.
- C. During construction, the SCADA SUPPLIER shall assist the CONTRACTOR, as necessary, to calibrate, test, and coordinate the installation of the System. If interrelated devices furnished by others do not perform properly when tested, the SUPPLIER shall use suitable test equipment to introduce simulated signals to and or measure signals from those devices as may be required to locate the source of trouble or malfunction. A written report regarding the results of such tests shall be furnished to the ENGINEER and CONTRACTOR. The report shall identify the measures needed to correct the installation.
- D. Services of a trained instrumentation and SCADA technician for:
 - One day, during construction, for consultation and assistance to the CONTRACTOR in planning and implementing the installation.
 - Three days, one trip, for start-up of the Systems new components. Startup services shall include checking, calibrating, and adjusting all equipment integrated into the System. The OWNER shall accompany the supplier during start-up services if desired.
 - One day, one trip, following start-up to instruct the OWNER's personnel in the proper operation, adjustment, and maintenance of the System. Instructions may be video taped by the owner for future reference. The program shall include at least six (6) clock hours of instruction for owner personnel, and shall cover at least the following topics:

1. Preventive and scheduled maintenance for all equipment.
2. Programming and resetting set points and alarm conditions.
3. Emergency maintenance and restoration procedures.
4. PLC troubleshooting
5. Radio troubleshooting and replacement.

E. Operation and Maintenance Manuals will be furnished as specified in Division 1 shall be furnished to the ENGINEER for equipment supplied under this Section.

PART 2 PRODUCTS

2.01 General

A. Operational Description

➤ (1Ea) New KY 28 Booster Station (RTU-3400)/ (1Ea) New KY 315 Tank (RTU-3500)

- I. The operation for the telemetry control system will include a new Remote Terminal Unit (RTU-3400) at the new KY 28 Booster Station, a new unit (RTU-3500) at the associated new KY 315 Water Storage Tank RTU-3400 will communicate with / interrogate RTU-3500 to obtain water level data, power status, and intrusion alarm. RTU-3400 will include a "Panel View" type Operator Interface Terminal (OIT) device which the operators will use for local adjustment of the set-point parameters, for determinations of Pump Station/tank levels controls, and for determination of alarm set points and status. "Soft" programmed Selector Switches, English text data, and all operational and alarm conditions will be displayed via the local OIT to allow for the continuous automatic control of the booster station pumps.
- II. The Booster Pump Station (BPS) RTU will interrogate the remote Water Tank RTU for water level status and initiate a tank fill pump run call based on an operator entered start fill set point. The BPS RTU shall continuously monitor the local standpipe tank water level and remove the local pump call in the event its level is below an operator programmable level set point. Upon the local tank level returning to a normal operational level, the pump call shall be re-established to continue the fill cycle of the KY 315 Tank to the operator programmed stop fill set point.

RTU-3400 shall monitor the KY 315 Tank level. If the tank drops below a given low level setpoint or exceeds a high level setpoint, an alarm will be energized via the local OIT and SCADA HMI.

The SCADA system provider shall include (2) new pressure transmitters to monitor booster station suction/Local Tank Level) and discharge pressure. The pressure reading shall be available via the local OIT and SCADA HMI.

- III. While the system is under the control of the telemetry system, pump alternation schemes shall be initiated by the RTU. Lead 1, Alternate and Lead 2 selection shall be available via the RTU panel selector switch. A RTU Enable/Disable local hand switch shall be included.
- IV. The BPS RTU shall be configured for a "discharge pressure control mode". If the operator selects pressure control mode operation or pressure control mode is initiated due to a loss of radio communications with its associated tank RTU, the pumps shall automatically call to run based on operator variable control setpoints. When the RTU is in pressure control mode and calling for a pump run, a 4-20mA PID process demand signal shall be sent to the pump control panel VFDs to maintain a desired discharge based on the operator entered variable setpoint.
- V. The general system operational control and monitoring as described herein for the Booster Station local OIT shall also be available at the 2 Each Water Office SCADA workstations. Required SCADA PC/MTU programming and configuration shall be included to accommodate the new sites with similar graphical control functions as presently available for existing pump stations. SCADA software tag/screen count requirements shall be included in the supplier's scope of work. Accommodations shall be provided for programmed I/O channels to the owner's auto-dialer system for system critical alarms.

➤ **(1Ea) New Town Hill Pump Station (RTU-400) / (1Ea) Existing Town Hill Tank (RTU-500)**

- I. The operation for the telemetry control system will include a new Remote Terminal Unit (RTU-400) at the new Town Hill Booster Station, an existing unit (RTU-500) at the associated Town Hill Water Storage. RTU-400 will communicate with / interrogate RTU-500 to obtain water level data, power status, and intrusion alarm. RTU-400 will include a "Panel View" type Operator Interface Terminal (OIT) device which the operators will use for local adjustment of the set-point parameters, for determinations of Pump Station/tank levels controls, and for determination of alarm set points and status. "Soft" programmed Selector Switches, English text data, and all operational and alarm conditions will be displayed via the local OIT to allow for the continuous automatic control of the booster station pumps.
- II. The Booster Pump Station (BPS) RTU will interrogate the remote Water Tank RTU for water level status and initiate a tank fill pump run call based on an operator entered start fill set point. RTU-400 shall monitor the Town Hill Tank level. If the tank drops below a given low level setpoint or exceeds a high level setpoint, an alarm will be energized via the local OIT and SCADA HMI.

The SCADA system provider shall include (2) new pressure transmitters to monitor booster station suction and discharge pressure. The pressure reading shall be available via the local OIT and SCADA HMI.

- III. While the system is under the control of the telemetry system, pump alternation schemes shall be initiated by the RTU. Lead 1, Alternate and Lead 2 selection shall be available via the RTU panel selector switch. A RTU Enable/Disable local hand switch shall be included.
- IV. The BPS RTU shall be configured for a "discharge pressure control mode". If the operator selects pressure control mode operation or pressure control mode is initiated due to a loss of radio communications with its associated tank RTU, the pumps shall automatically call to run based on operator variable control setpoints. When the RTU is in pressure control mode and calling for a pump run, a 4-20mA PID process demand signal shall be sent to the pump control panel VFDs to maintain a desired discharge based on the operator entered variable setpoint.
- V. The general system operational control and monitoring as described herein for the Booster Station local OIT shall also be available at the 2 Each Water Office SCADA workstations. Required SCADA PC/MTU programming and configuration shall be included to accommodate the new sites with similar graphical control functions as presently available for existing pump stations. SCADA software tag/screen count requirements shall be included in the supplier's scope of work. Accommodations shall be provided for programmed I/O channels to the owner's auto-dialer system for system critical alarms.

B. Booster Pump Station RTU Control Modes

The RTU shall provide 3 modes of system control.

1. Tank Level Mode Control:

- During normal operation the associated pumps shall be called to run for a remote tank fill cycle based on tank level control setpoints noted herein.
- In the event of a radio communications failure from the BPS to its associated tank, the operator may select one of two backup modes of operation to be initiated. (Pressure Mode or Pump Panel Time Clock Mode). The selected backup mode shall automatically initiate in the event of a loss of radio communications.

2. Pressure mode control:

- When a loss of radio communications has been detected, the booster pump call shall be initiated by the RTU based on station discharge pressure. The pressure control set points shall be operator adjustable. Pump alternation shall be controlled by the RTU in this scenario.

3. Time clock mode control:

- o When a loss of radio communications has been detected, the RTU shall initiate a contact closure for use by the pump manufactures control panel for time clock operation. The pump control call to run and alternation shall then be the responsibility of the pump manufactures time clock controls under this scenario.

2.02 CONTROL SYSTEM OVERVIEW OF SCADA SITES

A. Booster Pump Station RTU

Data to be displayed/controlled via local RTU/Operator interface Terminal and available to the network for monitoring and control at the Water Office SCADA workstations.

- a. Local Tank level (1/10 feet resolution)
- b. Local Tank level high/low alarm (operator variable)
- c. Remote Tank level (1/10 feet resolution)
- d. Remote Tank level high/low alarm (operator variable)
- e. Local and associated remote RTU power failure alarm
- f. Tank calling for a fill
- g. Tank Level/Pressure Mode Operation Select
- h. Operator initiated and automatic tank fill sequence
- i. Operator control set points for associated tank levels (operator variable)
- j. Booster pump alternation control selection status
- k. Booster pump 1 running
- l. Booster pump 1 accumulated run time
- m. Booster pump 1 failed
- n. Booster pump 2 running
- o. Booster pump 2 accumulated run time
- p. Booster pump 2 failed
- q. Booster pump station low suction pressure alarm
- r. Booster pump station high/low discharge pressure alarm
- s. Booster pump station unauthorized entry alarm
- t. Booster pump station suction pressure
- u. Booster pump station discharge pressure
- v. RTU RF communications failure alarm (all associated sites)
- w. RTU RF communications counters (operator resettable for all associated sites)
- x. Common trouble visual alarm
- y. Selected backup mode indication
- z. RTU Enable/Disabled indication
- aa. Low suction pressure cutout (Digital input from pump manufacture)
- bb. Phase loss (Digital input from pump manufacture)
- cc. Pump Fail/Valve Fail (Digital input from pump manufacture if applicable)

C. Water Tank RTU (KY315)

A local digital indicator shall be included in the RTU to display tank level (1/10th feet resolution). The indicator shall be installed in an interior swing panel and not exposed to exterior elements.

- An integral PLC LCD display unit may be used in lieu of a separate display unit.
- The tank RTU shall include a 3 position Open/Auto/Close hand switch for manual and automatic of the local control valve. Interposing relays shall be included for associated PLC discrete outputs.

2.03 PROGRAMMABLE CONTROLLER

PLC Hardware: Listed hardware is to establish basic major components only. Any required related ancillary devices shall be provided by the integrator at no additional cost to the owner.

A.(1Ea) New RTU-400, (1Ea) New RTU-3400

Manufacture Allen-Bradley Micrologix 1400 (No substitutions allowed)
(1) ea 1766-L32XXX
(1) ea 1766-MM1
(As Required) 1762-IF4 analog module
(As Required) 1762 series digital input and output modules
(As required) Communications cables

B.(1Ea) New RTU-3500

Manufacture Allen-Bradley Micrologix 1100 (No substitutions allowed)
(1) ea 1763-L16XXX
(1) ea 1763-MM1
(As Required) 1762-IF4 analog module
(As Required) 1762 series digital input and output modules
(As required) Communications cables

C. PLC General Specifications

The supplier shall provide a copy of all final working programs on CD ROM. Ladder logic programming shall include detailed descriptions of I/O and internal bit/word functions.

1. Main Frame Hardware

The CPU shall be a self-contained unit, and will be capable of displaying Ladder Rung program execution through its communication port. The CPU will also control all I/O scanning and communications servicing.

The CPU within the system shall perform internal diagnostic checking and give visual indication to the user by illuminating an indicator when a fault is detected.

The controller shall be designed to operate in a free air flow environment. (Convection cooling only, no fans or other air moving devices shall be required).

The main front panel of the packaged PLC shall include the following indicators:

- a. Power
- b. Run
- c. Fault
- d. Force

Processor run/program mode shall be selected by a command from a programming device or integral mode switch.

RUN - No ladder edits possible, program always executing;
PROGRAM - Programming allowed, program execution disabled.

Non-volatile memory shall store the operating system, user program, and all user data information to protect against loss in the case of power loss or system shut-down.

2. Firmware:

The processor must support on site flash upgradeable firmware.

3. Power.

120 VAC, single phase, in power systems that operate on 50/60 Hz. The controller must also be available with an operating voltage of 12 or 24Vdc.

The onboard power supply must be capable of supplying all necessary power to all subsystems. (CPU, Memory, I/O, etc.) External power supplies must not be needed to provide power to controller circuitry.

At the time of power-up, the power supply shall inhibit operation of the processor and I/O modules until the DC voltages are within specifications.

4. Networking and Communications

The packaged controller shall support direct connection to a programming computer equipped with standard RS-232 serial ports Supporting DF1 and Modbus protocols. Native Ethernet I/P @ 10/100 MBPS shall also be supported.

The packaged controller shall support direct connection to a modem for remote programming functionality.

The packaged controller shall support DF-1 full duplex point-to-point, DF-1 radio modem and Master or Slave ½ duplex communications on a network

capable of at least of 250 nodes. The ½ duplex network shall support program upload/download, monitoring, and peer to peer communications. The unit shall include store and forward and Masterless peer-to-peer support.

5. Interfacing and Peripherals.

The programming means shall be an IBM or compatible desktop/portable, or industrial quality programming terminal. Programming tools must be available that run on Windows 7 32/64 bit environments.

6. Programming Techniques.

The programming format shall be traditional relay ladder diagram. It shall be possible to program a maximum instruction matrix containing as many as 128 instructions.

7. Quality Requirements.

The packaged controller shall be able to withstand conducted susceptibility tests as outlined in:

Electrostatic Discharge	IEC801-2 @ 15KV
Radiated Susceptibility	IEC801-3 @ 10V/m, 27 MHz - 1000 MHz.
Fast Transient	IEC801-4 @ 2 KV Power Supply, 1KV I/O.
Isolation	1500 Vac, 250 Vdc continuous

The packaged controller and its associated peripherals shall be listed or recognized by the following registrations: UL listed, CSA and CE certified.

2.04 PUMP STATION RTU OPERATOR INTERFACE

Allen-Bradley PanelView Plus 7 Standard Terminal, Touch Screen, 5.7 inches, TFT Color, Single Ethernet, 24V DC, Windows CE OS License, Standard Model

2.05 RADIO COMMUNICATIONS

Wireless communications shall be accomplished using licensed VHF radio modems. The integrator shall supply proper FCC licensing for the owner all sites and cover all associated fees. The supplier shall provide a computer generated radio path study to determine recommend antenna heights. The RF path study must be provided with bid. Radio path study results shall indicate requirements for communications towers where required. The towers shall be provided as recommend by the control system integrator and installed by the contractor. If a specific tower height is not noted, a tower with a minimum height of 40 ft shall be provided. The tower is to be provided by the Systems Integrator and installed by the CONTRACTOR. If the radio path study results indicate the need for additional height at this location, the SCADA supplier shall include this in the bid to the contractor. The supplier shall be responsible for informing the contractor of proper locations and installation techniques of towers.

Antenna heights to be located at appropriate heights as noted in the computer path study for a fade margin of 20 dB at a RX threshold of -110 dBm. An average foliage height of 85 ft shall be used in the RF path calculations.

A. Radio/Modem

ESTEEM 195M series (No substitutions allowed)

B. Antenna

Omni Directional: Celwave, Astron or approved equal

Yagi: Celwave, Astron or approved equal

(System gain an type as determined by path study and FCC requirements)

C. Coaxial Cable

Times Microwave: LMR-400DB with type "N" end connectors

- Coax cable shall be secured at proper intervals using Stainless Steel Tie Wraps or other means designed for securing coaxial cable. All hardware used to secure the coax shall be Stainless Steel. At all points where the Tie Wraps or clamps contact the coax cable, a protective rubber cover shall be installed to prevent damage to the coax.

D. Antenna Towers

A: RTU-400 Town Hill BPS (30 Foot Tower Minimum)

B: RTU-3400 KY28 BPS (50 Foot Tower Minimum)

C: RTU-3500 KY315 Water Storage Tank (70 Foot Tower Minimum)

Towers to be free standing "tilt up" type and constructed of high quality aluminum. Properly sized base section shall be provided with tower.

Tower to be sized by integrator for adequate regional wind loading for antenna type used. Tower heights to be determined by integrators pre-bid radio path study. Towers to be as manufactured by Universal Tower Inc.

Any required permitting and fees shall be administrated by the owner.

2.06 PRESSURE SENSORS

A. Tank Level Measurement

1. Non-submerged locations, .5 % accuracy, 4-20 MA, 9-30 VDC, Stainless Steel NEMA 4X, Manufacture: Pressure Systems Inc., Keller-America or approved equal.
2. Submerged/Wet locations, Submersible , Sealed sensor, .5 % accuracy, 4-20 MA, 9-30 VDC, Stainless Steel , Manufacture: Pressure Systems Inc., Keller-America or approved equal

B. Pump Station inlet/outlet pressure

1. .5 % accuracy, 4-20 MA, 9-30 VDC, Stainless Steel NEMA 4X
2. Manufacture: Pressure Systems Inc., Keller-America or approved equal

2.07 RTU ENCLOSURES

A. Outdoor or corrosive environment exposure:

24x24x10" minimum
NEMA 4, Stainless Steel, Factory Painted White,
Pad lockable handle required for outdoor units
Manufacture: Hoffman Concept SS, EXM or approved equal

B. Indoor:

24x24x10" minimum
NEMA 12, Painted Steel
Manufacture: Hoffman Concept or approved equal

Enclosures shall be supplied with adequate heating capacity for condensation protection and component temperature rating exposure. A thermostat shall be included desired temperature control. Outdoor enclosures shall include ventilation if required to accommodate component temperature specification limits. Enclosures mounted outdoors shall include an interior swing panel for mounting of push buttons, switches, displays, etc. No buttons, displays, switches, etc., shall be exposed directly to outdoor weather conditions.

2.08 SURGE PROTECTION

A. RTU Panel AC 120 VAC Supply:

MOV protection
Current capacity: 15Amp
Surge Current: 20 kA
PHYSICAL SPECIFICATIONS
Operating Temperature Range -40°C to 60°C
Storage Temperature Range -40°C to 90°C
Relative Humidity 0 to 95% non-condensing
Manufacture: MGC, Citel or approved equal

B. RTU Analog signals:

Analog I/O devices located outside of the RTU shall be surge protected in the RTU panel
Nominal Operating Voltage 24VDC
Max. Surge Current 5kA
Operating Temperature Range -10°C to 60°C
Storage Temperature Range -10°C to 90°C
Relative Humidity 0 to 95% non-condensing
Manufacture: MGC, Citel or approved equal

C. RTU Coax Surge Protection:

Bulkhead mount, NF-NF end connectors
Manufacture: Polyphaser, Citel or approved equal

2.09 POWER SUPPLIES

A. 12 VDC:

11900-11

7 Amp minimum continuous output rating @ 12 VDC
Adjustable output 12-15 VDC
DIN rail mountable
Manufacture: Allen-Bradley, Sola, Mean-Well or approved equal

B.24 VDC:

4 Amp minimum continuous output rating @ 24 VDC
Adjustable output 24-30 VDC
DIN rail mountable
Manufacture: Allen-Bradley, Sola, Mean-Well or approved equal

2.10 UNINTERRUPTIBLE POWER SUPPLY

All RTU's shall be equipped with a battery backup system with voltage regulation. The backup time shall be 30 minutes minimum.

2.11 CIRCUIT BREAKER

The RTU shall be fitted with a UL listed DIN rail mounted circuit breaker. The circuit breaker shall disconnect the RTU panel from all outside AC voltage sources. Manufactured by Allen-Bradley, Eaton or approved equal

2.12 RTU PANEL WIRING

RTU panel wiring shall conform to high quality assembly standards. All components shall be UL listed where available. Panel wiring shall conform to standard color coding practices for easy identification. Color coding scheme shall be clearly stated on system drawings. All internal back plate wiring shall be in slotted wiring duct. Duct shall be neatly installed in vertical and horizontal runs. Duct installed at angles other than vertical or horizontal shall not be accepted. Exposed wiring shall only be acceptable where wiring transitions to the intended device or termination point. All exposed wiring crossing door panels or similar transitions shall be wrapped in plastic wire wrap or flexible duct.

Proper grounding practice for personnel and equipment protection shall apply. All field wiring shall terminate at DIN rail mounted terminal strips. Direct field termination to RTU devices shall not be allowed. Terminal strips shall be feed through type rated @ 600 V/ 20 Amp. All terminals and wiring shall be clearly marked using machine printed permanent making labels. Wires shall be clearly identified at termination points and clearly identified on system drawings.

Individually fused components shall be required for the following:

- A. PLC AC supply power
- B. DC power supplies AC supply power
- D. Radio/Modem Power supply DC output
- E. DC Loop power to analog devices

2.13 SCADA Computer and HMI Software

- A. There are two each existing computers with SCADA/HMI and related software installed at the Breathitt Co. Water Office. Both computers are to be replaced and the SCADA/HMI software upgraded to the latest HMI and related software as noted herein. The new computers and software shall be fully configured, programmed and commissioned for operation. Programming shall include conversion for all existing and new RTU sites provided under this contract. Upon final completion of this project, all program files shall be provided to the owner for their records.
- B. SCADA/HMI and related Software to be included:
- a.(1 Each) PN: 9701-VWSTENM- Rockwell FactoryTalk View Studio for FactoryTalk View Enterprise
 - b.(2 Each) PN: 9701-VWSB100AENM - Rockwell FactoryTalk View SE Station 100 Display
 - c.(1 Each) PN:9324-RLM0800ENE- Rockwell RSLogix Micro Developer
 - d.(1 Each) WIN-911 Pro Alarm Notification Software
 - e.(1 Each) Sytech- XLReporter, Suite edition with Historical data and pdf option
- Note: All provided HMI and related software shall include a one-year support option. This support option shall allow no cost version updates and web based factory support for the duration of the support. All software support shall be available for continuation by the owner as an option. The support contract time line shall start at the point of substantial completion of related SCADA PC hardware and software upgrades.
- C. SCADA Computer Hardware
- a. (2 Each) Dell Optiplex 7040
 - i.Intel® Core™ i7-6700 Processor
 - ii.Windows 7 Professional 64bit (Includes Windows 10 Pro License)
 - iii.Microsoft Office Home and Business 2016
 - iv.16GB (2x8G) 2133MHz DDR4 Memory
 - v.3.5 inch 1TB 7200rpm Hard Disk Drive
 - vi.nVidia GeForce GTX 745, 4GB VGA (HDMI, DVI-D)
 - vii.Dell Wired Keyboard
 - viii.Dell USB Laser 6-Button Mouse
 - ix.Dell USB Stereo Speaker System - AX210
 - x.Dell 27 Monitor – P2717H
 - xi.5 Years ProSupport Plus with Next Business Day Onsite Service
 - b. (1 Each) 2 TB External USB Hard Drive with Automatic Backup Software

2.14 Communications Equipment and Maintenance

- a. All (35 Each) existing RTU sites shall have the coax cable from the RTU to the antenna inspected and secured. The coax cable shall be properly secured at proper intervals using Stainless Steel Tie Wraps or other means designed for securing coaxial cable. All hardware used to secure the coax shall be Stainless Steel. At all points where the Tie Wraps or clamps contact the coax

cable, a protective rubber cover shall be installed to prevent damage to the coax.

- b. If damage or excessive wear to existing equipment is noted during this process, the owner/engineer shall be notified via a written report notating the site location and details of the damage or wear to equipment. A cost estimate for the additional repairs shall be included in the report. No additional fees/repairs shall proceed without prior authorization by the owner/engineer.

2.15 Cane Creek Tank-Level transducer isolator and grounding

- a. At the existing Cane Creek Tank location provide listed equipment and install for a working system.

I. Water Tank Location

- i.(1 Ea.) New NEMA 4X enclosure with loop powered 4-20mA optical isolator
- ii.(1 Ea.) New NEMA 4X transducer enclosure with isolation and drain valve
- iii.(1 Ea.) New 0-50 PSI Pressure transducer with lightning protector
- iv. Install a minimum of three ground rods at or near the tank and bond to the pressure transducer system. All grounding points to be properly installed to reduce corrosion of the termination points

II.RTU Enclosure Location

- i.(1 Ea.) New 4-20mA optical isolator
- ii.(1 Ea.) New 24VDC Power Supply
- iii.Revise wiring as needed for new power supply and isolator

PART 3 EXECUTION

3.01 FINAL DOCUMENTATION

Upon system substantial completion, (3) copies of as built drawings shall be supplied to the engineer for assembly of Owner's project documentation. Documents that have not changed from the submittal process will not require resubmittal. Field corrected or hand written changes to documentation will not be acceptable for final documentation.

Documents to be included are:

- A. RTU panel drawings (Detailed wiring diagrams with termination points, panel component layout and identification)
- B. HMI and OIT screen shots
- C. Project instrumentation calibration and configuration data sheets

D. Radio signal strength and data quality report.

E. PLC user manuals

F. Radio/Modem user manuals

3.02 DEMONSTRATION & START-UP

- A. Inspect each System for conformity and compliance of materials, equipment and construction.
- B. Inspect each installation for conformity with manufacturer's recommendations. Correct any discrepancies or improper conditions.
- C. Loops: Check each loop from the end element to the respective control display. Include instruments, control devices, panels, termination cabinets, input/output cards and other devices in the loop to ensure proper operation.
- D. Maintain a test set of loops drawings. Document loop checks on the test set.
- E. Energize and verify correct operation of all components of each System. This operation includes verification of accuracy of all interconnecting wiring..
- F. Place System into operation including all System software, logic, and displays.
- G. Adjust all control loop components and parameters to provide stable control of System process.
- H. Check validity of all System alarm displays.
- I. Schedule inspection with Owner to approve and verify satisfactory compliance with this section.

3.03 PLC SPARE INPUTS / OUTPUTS

Provide 25 percent spare capacity (minimum) on all inputs and outputs. Provide extra terminal blocks and extra I/O modules as required to meet this minimum requirement. All PLC I/O shall be wired to field terminal.

3.04 Electrical Components

All electrical circuit components, such a switches, relays, alternators, fuses, etc., shall be manufactured by Allen-Bradley or approved equal.

3.05 SPARE PARTS

Provide the following spare parts.

- (5) Each Fuse-each type used
- (1 Ea.) Spare 0-50 PSI Pressure transducer with lightning protector
- (1 Ea.) 4-20mA optical isolator of each type used

3.06 FACTORY TEST

Before the equipment is shipped to the job site, the factory test shall be performed and recorded. The test shall occur in the supplier's facility. The test shall have a minimum duration of two days after the de-bugging phase.

3.07 FCC LICENSING

The system supplier shall be responsible for collecting all information, generation of all paper work, and paying all fees required obtaining a license on behalf of the Owner as applicable.

3.08 ADJUSTMENTS DURING WARRANTY PERIOD

The SCADA supplier shall supply "Factory" startup service and operator training as required insuring satisfactory operation. Subsequent trips to the job site to correct defects shall be made at no charge to the Owner during the warranty period.

3.09 WARRANTY

The control system supplier shall include a standard one-year parts and labor warranty for all new items supplied under this section as part of the control system. The warranty shall begin from the time of final completion and acceptance of the related completed portion of the project. Damage incurred by acts of vandalism or acts of nature shall be excluded.

3.10 BASIS OF PAYMENT

The payment for the basic telemetry shall include all equipment and installation needed for the SCADA system.

END OF SECTION

SECTION 15100

SMALL PLUMBING VALVES, PLUMBING SPECIALTIES AND SERVICE ACCESSORIES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor, materials, equipment, and incidentals required, and install complete and ready for operation, all valves and appurtenances as show on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Excavation, backfill and grading are included in Division 2
- B. Painting is included in Division 9, Section 09900.
- C. Electrical is included in Division 16.

1.03 SYSTEM DESCRIPTION

- A. All of the equipment and materials specified herein is intended to be standard for use in controlling the flow of wastewater, sludge, water, air or chemicals, depending on the applications.

1.04 QUALITY ASSURANCE

- A. All of the types of valves and appurtenances shall be products of well established firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. All materials of construction shall be of an acceptable type and shall be designated for the pressure and temperature at which they are to be operated, for the materials they are to handle and for the use for which they are intended. The materials shall meet established technical standards of quality and strength necessary to assure safe installations and conform to applicable standards. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

1.05 REFERENCES

- A. Kentucky Basic Building Code.
- B. Kentucky State Plumbing Law, Regulations and Code

1.06 SUBMITTALS

- A. Copies of all materials required to establish compliance with these Specifications shall be submitted in accordance with the provisions of Division 1, Section 01300. Submittals shall include at least the following:
 - 1. Certified drawings showing all important details of construction and dimensions.
 - 2. Descriptive literature, bulletins, and/or catalogs of the equipment.
 - 3. The total weight of each item.
 - 4. A complete total bill of materials.
 - 5. A list of the manufacturer's recommended spare parts.

1.07 OPERATING INSTRUCTIONS

- A. Operating and maintenance instructions shall be furnished to the ENGINEER as provided in Division 1. The instructions shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc., that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. General
 - 1. All valves and appurtenances shall be of the size shown on the Drawings and as far as possible all equipment of the same type shall be from one manufacturer.
 - 2. All valves and appurtenances shall have the name of the maker, flow directional arrows, and the working pressure for which they are designed cast in raised letters on some appropriate part of the body.
 - 3. All buried valves shall open left (counterclockwise). Insofar as possible, all valves shall open counterclockwise.

2.02 VALVES

- A. Gate Valves

Gate valves shall be used in shut-off applications and where the valves are scheduled for infrequent use.

1. Gate Valves for Water

- a. Gate valves shall be for 125-pound water working pressure, 2-1/2 inches and 3 inches for air release. Valves 3 inches and smaller shall be standard brass construction, rising stem, double disc, parallel seat, with handwheel where exposed or key operated when in the ground. The valves shall be Crane No. 440, Jenkins 62U or approved equal.
- b. In copper-solder-joint piping, Chase Style 1334 or approved equal, gate valves are preferred with solder joint connections.

B. Plug Valves

Eccentric plug valves shall be used in shut-off applications for pump stations and where the valves are scheduled for infrequent use.

Eccentric plug valves 3 to 12 inches in diameter shall be rated for 175 psi working pressure. The body and cover shall be cast iron conforming to ASTM A126, Class B. Flange ends shall comply with ANSI B16.1, Class 125 standards. Mechanical joint ends shall comply with AWWA C11/ANSI 21.11. The entire seat surface shall be protected by a welded nickel seat of minimum 1/8" thickness. The plug shall be cast iron ASTM A126, Class B. The portion of the plug in the valve body cavity shall be coated with Buna-N rubber using an injection-mold process. Valve bonnet shall be full sealed and bolted to the body for ease of maintenance. The seal between the body and the bonnet shall be an O-ring. Stem packing shall be Buna-N multiple "V" ring stem packing seals, conforming to AWWA C504 and AWWA C507 standards. The packing seal shall be held in place with an adjustable gland follower. Shaft bearings shall be sintered 316 stainless steel for both the upper and lower trunnions. Bearings shall be permanently lubricated. 3" valves shall be quarter-turn and shall be supplied with a position indicator marked at 10 degree increments. Valves 4" and larger shall be equipped with a worm gear operator. Eccentric plug valves shall be Clow F-5412, F-5413 or approved equal.

C. Ball Valves

Ball valves shall normally be used in quick shut-off and frequent use applications.

1. Ball Valves for Water Service

- a. Ball valves shall be for 125-pound water working pressure, 2 inches and smaller, standard bronze construction, with precision machined bronze ball, twin Buna-N seats, and handle operator with integral stop where exposed. Buried

ball valves shall be as above with key or nut operators.
Valves shall be Lunkenheimer No. 700-SB, Ford, or
approved equal.

2. Ball Valves for Chlorine Solutions

- a. Ball valves shall be for 150 pound water working pressure, 140 degree Fahrenheit maximum temperature, 3 inches and smaller, standard PVC "True Union" construction, with PVC ball, Viton seats, and handle operator where exposed. Buried ball valves shall be as above with key, nut, pneumatic, or electric operators as shown on the DRAWINGS. Valves shall be Utilities Supply Corp., Plastic Piping Systems, or approved equal.

D. Swing Check Valves

Check valves for cast iron and ductile iron pipelines shall be swing type and shall meet the material requirements of AWWA Specification C508-latest revision. The valves shall be cast iron body with reinforced 125 lb flanges conforming to ANSI B 16.1. Valves shall be single disc with Buna-N seat, stainless steel hinge pin, 150 psi working water pressure, non-shock, and hydrostatically tested at 300 psi. The valves shall be manufactured by Clow, Kennedy or approved equal.

1. When there is no flow through the line, the disc shall hang lightly against its seat in practically a vertical position. When open, the disc shall swing clear of the water-way.
2. Valves shall be so constructed that disc and body seat may easily be removed and replaced without removing the valve from the line. Valves shall be fitted with an extended hinge arm with outside lever and adjustable weight.

E. Globe Style Silent Check Valves

1. General

- a. This specification covers the design, manufacture, and testing of 2 in. (50 mm) through 42 in. (1050 mm) Silent Check Valves suitable for pressures up to 500 psig (3450 kPa) water service.
- b. The Check Valve shall be of the silent operating type that begins to close as the forward flow diminishes and fully closes at zero velocity preventing flow reversal and resultant water hammer.

2 Standards, Approvals and Verification

- a. The valves for use in fire protection systems shall be Factory Mutual approved in sizes 2 1/2 in.-12 in.
- b. Stainless steel valves shall meet the requirements of ASME B16.34 and MSS SP-126.
- c. The valves used in potable water service shall be certified to NSF/ANSI 61, Drinking Water System Components – Health Effects, and certified to be Lead-Free in accordance with NSF/ANSI 61, Annex G.
- d. Manufacturer shall have a quality management system that is certified to ISO 9001 by an accredited, certifying body.

3 Connections

- a. Globe style valves shall be provided in sizes 2 1/2 in (75 mm) through 42 in. (1050 mm) and have flat faced flanges in accordance with ASME B16.1 for Class 125 or Class 250 iron flanges. Sizes 10 in (250 mm) and smaller flanged valves shall be capable of mating directly to a wafer butterfly valve without disc interference.
- b. Wafer style valves shall be provided in sizes 2 in (50 mm) through 10 in. (250 mm) for installation between ASME B16.1 Class 125 or Class 250 iron flanges. Stainless steel wafer style valves shall include raised faces for installation between ASME B16.5 Class 150 flanges.

4 Design

- a. The valve design shall incorporate a center guided, spring loaded disc, guided at opposite ends and having a short linear stroke that generates a flow area equal to the nominal valve size.
- b. The operation of the valve shall not be affected by the position of installation. The valve shall be capable of operating in the horizontal or vertical positions with the flow up or down. Heavy duty springs for vertical flow down installations shall be provided when specified on 14 in. and larger valves.
- c. All component parts shall be field replaceable without the need of special tools. A replaceable guide bushing shall be provided and held in position by the spring. The spring shall be designed to withstand 100,000 cycles without failure and provide a cracking pressure of 0.5 psi.

- d. The valve disc shall be concave to the flow direction providing for disc stabilization, maximum strength, and a minimum flow velocity to open the valve.
- e. The valve disc and seat shall have a seating surface finish of 16 micro-inch or better to ensure positive seating at all pressures. The leakage rate shall not exceed the allowable rate for metal seated valves allowed by AWWA Standard C508 or 1 oz (30 ml) per hour per inch (mm) of valve diameter.
- f. The valve flow way shall be contoured and unrestricted to provide full flow areas at all locations within the valve. Cv flow coefficients shall be equal to or greater than specified by the manufacturer cited in Paragraph 7, and verified by an independent testing laboratory.
- g. Wafer-style valve seats shall be fully retained with full size threads, and sealed with an o-ring. Globe style valve seats shall be contained with a machined counterbore and restrained by the mating flange and gasket.

5 Materials

- a. The valve body shall be constructed of ASTM A126 Class B cast iron for Class 125 and Class 250 valves and ASTM A351 Grade CF8M for Class 150 stainless steel valves. Optional body material include ASTM A536 Grade 65-45-12 ductile iron.
- b. The seat and disc shall be ASTM B584 Alloy C83600 cast bronze or ASTM B148 Alloy C95200 aluminum bronze. Optional trim material include ASTM A351 Grade CF8M stainless steel.
- c. The compression spring shall be ASTM A313 Type 316 stainless steel with ground ends.

6 Options

- a. A Buna-N seal shall be provided on the seat when specified to provide zero leakage at both high and low pressures without overloading or damaging the seal. The seal design shall provide both a metal-to-metal and a metal-to-Buna-N seal.
- b. Valve interiors and exteriors shall be coated with an NSF/ANSI 61 certified fusion bonded epoxy in accordance with AWWAC550 when specified.

7 Manufacture

- a. The valves shall be hydrostatically tested at 1.5 times their rated cold working pressure and seat tested at the valve CWP. When requested, the manufacturer shall provide test certificates, dimensional drawings, parts list drawings, and operation and maintenance manuals.
- b. The exterior of the valve shall be coated with a universal alkyd primer.
- c. Silent Check Valves shall be Series #1400A (Wafer Style), 1400A.4 (Stainless Steel Wafer Style) or 1800 (Globe Style) as manufactured by Val-Matic® Valve & Mfg. Corporation, Elmhurst, IL. USA or approved equal.

E. Y Check Valves

Check valves for PVC pipelines shall be Y-type. The valves shall be PVC body with Viton seals, rated for 150 psi working water pressure. The disk guide shall be a PVC coil. The valves shall be manufactured by George Fischer, Hayward, or approved equal.

1. Valves shall be so constructed that the plunger assembly can be easily accessed for cleaning.
2. Valves shall be so constructed such full flow may be achieved. Minimal back pressure shall be necessary to seat the plunger.

F. Blow Off Valves

Blow off valves shall normally be used in quick shut-off and infrequent use applications.

1. Blow Off Valves for Plant Air, Instrument Air, and Water Service
 - a. Blow off valves shall be for 175 pound working pressure, 180 degree Fahrenheit, 3/4 inch thru 2 inches, and shall have a positive sealing system accomplished without metal-to-metal fits. O-ring seals shall be attached to removable plug for ease of replacement. The O-ring seals shall be pre-lubricated with a long life lubricant. Valves shall have a plastic thrust washer on top of the plug to provide a means of reducing thrust and rotary friction between metal plug and body and bronze retaining rings. The valve body and plug shall be cast of composition bronze ASTM B62-latest revision; O-ring shall be synthetic rubber. Connections shall be as shown on the DRAWINGS. All valves shall be subject to the following tests:

- (1) 10-psi air test, valve open and closed position submerged in water. No leaks permitted.
- (2) 175-psi hydrostatic, valve open and closed. No leaks permitted. Valves shall be Mueller Company Mark II Oriseal Valves, Crane, or approved equal.

G. Air Release Valves

1. Air Release Valves shall be furnished and installed at the locations shown on the PLANS. The valves shall be combination air valves as manufactured by A.R.I. Corporation, Kfar Charuv, Israel, or approved equal.
2. The valves shall be the size shown on the PLANS and be A.R.I. Model D-40 "BARAK" or approved equal.
3. The valves shall be designed to allow entrapped air to escape from the pipeline when pumps are started and close water tight when liquid enters the valves via a float and roll seal arrangement. In the event of a vacuum on the pipeline, the valves shall allow air to enter the pipe. Working pressures shall be as follows:
3/4" & 1" valve: 3-150 psi
2" valve: 2-230 psi
4. The body, of each valve assembly shall be constructed of high strength reinforced nylon. All wetted parts shall be corrosion resistant.

H. Automatic Air and Vacuum Relief Valves for Vertical Turbine Pumps

1. Combination air and vacuum valves for vertical turbine pumps shall be equal to APCO Air Valves for Vertical Turbine Pumps, per APCO Bulletin 586, as manufactured by Valve and Primer Corp., Schaumburg, Illinois, or approved equal.
2. Valves shall be the size shown on the drawings and shall be equipped with an automatic air release valve, such as APCO Valve No. 55, or approved equal.
3. Air valves for vertical turbine pumps shall be designed to allow large quantities of air to escape out the orifice when the pump is started and close water tight when the liquid enters the valve. The air valve shall also permit large quantities of air to re-enter through the orifice when the pump is stopped to prevent a vacuum from forming in the pump column.
4. The valve shall consist of a body, cover, baffle, float and seat. The valve shall be designed to prevent prematurely shut-off. The seat shall be fastened into the valve cover, without distortion, and shall be easily removed, if necessary.

5. The entire float and baffle assembly must be shrouded with a perforated water diffuser to prevent the water column entering the valve, from slamming the float shut and eliminate water hammer in the system.
6. The float shall be stainless steel, designed to withstand a minimum of 1,000 psi, or approved equal. The float shall be center guided and not free floating for positive seating.
7. The discharge orifice shall be fitted with an automatic air release valve in order to vent small pockets of air. This valve shall consist of a body, cover, float and seat, and shall be rated at a working pressure of 150 psi.
8. The body, cover, and baffle of this valve assembly shall be constructed of cast iron, conforming to ASTM A48 Class 30, or approved equal. The float shall be stainless steel, conforming to ASTM A240, or approved equal. The seats shall be BUNA-N and the water diffuser shall be brass, or approved equal. All flanges shall be 125# ANSI.

I. Altitude Valves

1. Application: The level control valve for the water storage tank shall be single acting, automatically closing to prevent tank overflow when the high water level is reached, and opening for refilling when the tank water level lowers. Non-throttling action is required for operation (valve will assume either a fully open or fully closed position).
2. Design: The level control valve shall be globe (inline) or angle (90 degree) body with flanged end connections, be fully mounted, external pilot operated, with free floating piston (operated without springs, diaphragm or levers). It shall contain a single full-ported seat, with seat bore equal to size of valve. The minimum travel of the piston shall be equal to 25% of the diameter of the seat. For true alignment (to correct lateral thrust and stem binding), the piston shall be guided above and below the seat a distance equal to no less than 75% of the diameter of the seat. The piston shall be cushioned and so designed as to insure positive closure. The main valve shall be packed with leather (or other soft material) to insure tight closure and prevent metal-to-metal friction and seating. The valve shall be furnished with an indicator rod to show position of piston opening, and pet-cocks for attachment to valve body for receiving gauges for testing purposes. The design shall be such that repairs and dismantling internally of main valve may be made without its removal from the line. The pilot valve, controlling operation of the main valve, shall have a range of adjustment, be easily accessible, and arranged to allow for easy removal from the main valve while the main valve is under pressure. The pilot valve,

external strainer with blow-off, isolation valves, and all associated rigid brass piping and fittings (with the exception of a separate static pressure sensing line, if required) shall be factory assembled and furnished with the valve.

3. Physical and Chemical Properties: Valve body and cap(s) shall be constructed of gray iron castings that conform to ASTM Specification A 126 Class B. Internal bronze components shall conform to ASTM Specification B-584. Internal Stainless Steel components shall conform to ASTM Specification A-743 Grade CF-8 or CF-8M. The control piping shall be rigid red brass, no less than 0.5" in diameter. The flanged assemblies shall conform to ANSI standards for wall thickness of body and caps, and flange thickness and drilling, subject to other specified standards.
4. Paint: Ferrous surfaces of the valve shall be coated with NSF Certified Epoxy (Tnemec Series FC20) in accordance with ANSI/NSF Std. 61, and conforming to AWWA D102 Inside System No. 1.
5. Testing: A trio of tests shall be performed on the completely assembled valve prior to shipment. These shall include a hydrostatic test of up to two (2) times the working pressure (maximum 500 psi testing pressure), a tight seating test, and a performance test for simulated field conditions. The tests may be witnessed by the customer/engineer or representative.
6. Manufacturer and Model: The valve shall be a Model 30AWR as manufactured by Ross Valve Mfg. Co., Inc, 6 Oakwood Ave, Troy, NY 12180, or approved equal.

J. Booster Pump Control Check Valves

1. Function: The Pump Control Valve shall open fully or shut off in response to electric signals. It shall isolate the pump from the system during pump starting and stopping, to prevent pipeline surges.
2. Main Valve: The main valve shall be a center guided, diaphragm actuated globe valve of either oblique (Y) or angle pattern design. The body shall have a replaceable, raised, stainless steel seat ring. The valve shall have an unobstructed flow path, with no stem guides, bearings or supporting ribs. The body and cover shall be ductile iron. All external bolts, nuts, and studs shall be Duplex® coated. All valve components shall be accessible and serviceable without removing the valve from the pipeline.
3. Actuator: The actuator assembly shall be double chambered with an inherent separating partition between the lower surface of the

diaphragm and the main valve. The entire actuator assembly (seal disk to top cover) shall be removable from the valve as an integral unit. The stainless steel valve shaft shall be center guided by a bearing in the separating partition. The replaceable radial seal disk shall include a resilient seal and shall be capable of accepting a V-Port Throttling Plug by bolting.

4. Control System: The control system shall consist of a 3-Way solenoid pilot (for 8" and larger valves, an accelerator shall be added to the solenoid), two check valves (for 12" and larger valves, an additional check valve), a limit switch, and a filter. All fittings shall be forged brass or stainless steel. The assembled valve shall be hydraulically tested.
5. Quality Assurance: The valve manufacturer shall be certified according to the ISO 9001 Quality Assurance Standard. The main valve shall be certified as a complete drinking water valve according to NSF, WRAS, and other recognized standards.
6. Manufacturer and Model: The valve shall be manufactured by Bermad Waterworks, Model WW-(nominal size)-740-03-Y-C-A5-EB-4AC-NN or approved equal.

K. Surge Anticipating Control Valves

1. Function: The Surge Anticipating Valve shall open in response to the pressure drop associated with abrupt pump stoppage to dissipate the returning high pressure wave, eliminating the surge. It shall smoothly close drip tight as quickly as the relief feature allows, while preventing closing surge. The valve shall also relieve excessive system pressure.
2. Main Valve: The main valve shall be a center guided, diaphragm actuated globe valve of either oblique (Y) or angle pattern design. The body shall have a replaceable, raised, stainless steel seat ring. The valve shall have an unobstructed flow path, with no stem guides, bearings, or supporting ribs. The body and cover shall be ductile iron. All external bolts, nuts, and studs shall be Duplex® coated. All valve components shall be accessible and serviceable without removing the valve from the pipeline.
3. Actuator: The actuator assembly shall be double chambered with an inherent separating partition between the lower surface of the diaphragm and the main valve. The entire actuator assembly (seal disk to top cover) shall be removable from the valve as an integral unit. The stainless steel valve shaft shall be center guided by a bearing in the separating partition. The replaceable radial seal disk shall include a resilient seal and shall be capable of accepting a V-Port Throttling Plug by bolting.

4. Control System: The control system shall consist of two adjustable 2-way pilots, a needle valve, a flow stem, a cock valve, and a filter. All fittings shall be forged brass or stainless steel. The assembled valve shall be hydraulically tested.
5. Quality Assurance: The valve manufacturer shall be certified according to the ISO 9001 Quality Assurance Standard. The main valve shall be certified as a complete drinking water valve according to NSF, WRAS, and other recognized standards.
6. Manufacturer and Model: The valve shall be manufactured by Bermad Waterworks, Model WW-(nominal size)-735-55-Y-C-A5-EB-NN-M or approved equal.

L. Pressure Reducing Valves

1. Pressure reducing valves shall be of the single seated balanced design type globe body with threaded inlet and outlet ports. It shall be diaphragm operated, spring loaded permitted adjustment over a range of no less than 30 psi.
2. The body shall be bronze construction with bronze or stainless steel stem and furnished with a replacement rubber seat.
3. The pressure reducing valves shall be G-A Industries, APCO, or equal.

2.03 SPECIALTIES AND ACCESSORIES

A. Yard Hydrants

1. Above ground yard hydrants shall be of the anti-freezing, non-pollutable type, 1-1/2" size for 30" cover over water service line. The yard hydrant assembly shall include a ball-wheel handle, vacuum breaker, 1-1/2" hose connection, and double-ball check valve on the drain. The operating valve shall be located at the bottom of the hydrant assembly. When the operating valve is turned off it shall allow the water remaining in the supply line in the hydrant above the valve to drain from the hydrant by means of a by-pass in the valve stem. The hydrant handle, casing, and base shall be cast iron, and the operating valve red brass.
2. The yard hydrant shall be Murdock BFHM-150, 1-1/2" or approved equal.
3. All hydrants shall be furnished with anti-siphon vacuum breaker.

B. Hose and Nozzles

1. Hose

- a. Furnish 3/4-inch and 1-1/4 inch hose as indicated below. The 3/4 inch hose for hose stations shall be heavy-duty rubber, Gates Figure 35B, or approved equal. Hose for yard hydrants shall be as above in 1-1/4 inch size.
- b. Furnish one 3/4" x 50' hose for each 3/4" hose station and one 1-1/4" x 75' hose for each yard hydrant.
- c. Furnish 1-1/2" x 1-1/4" reducing adaptors for connecting each 1-1/4" hose to each 1-1/2" hydrant.

2. Nozzles

- a. Furnish 1-1/4" x 8" cast plain brass nozzles for each yard hydrant, and 3/4-inch nozzles for each hose station. The 1-1/4-inch nozzles shall be Akron Brass, or approved equal; and the 3/4-inch nozzle for hose stations shall be Leonard N-2, or approved equal.

C. Strainers, Filters, and Dryers

1. Strainers for Water Service

- a. Strainers shall be "Y" type with a cast iron body manufactured in accordance with ASTM A126-latest revision Class B steel, sizes 3/4 inch thru 12 inches. Strainer shall be rated at 200 psi pressure @ -20 to 150 deg F, and 125 @ 450 deg F., with a 304 stainless steel 0.125" perforated screen.
- b. Cover shall be carbon steel manufactured in accordance with ASTM A126-B latest revision. Cover shall contain a blow off outlet with an NPT outlet for connection of a drain valve.
- c. Contractor shall furnish and install on the blow off outlet, a stainless steel ball valve and cast iron piping directed to the floor drain.
- d. Strainers shall be Mueller, Model 758 or approved equal.

D. Vacuum Breakers

1. Vacuum Breakers for Water Service

- a. Vacuum breakers shall be designed to prevent back-siphonage of water lines. Valve types shall be either bottom inlet or side outlet, or top inlet and bottom outlet as required. Internal discs or floats shall be either plastic or silicone. Piping systems with solenoid-operated valves

shall require a vacuum breaker with an "O" ring seal. Breakers shall be Sloan No. V-350-A, V-370-A, V-188-A, Wilkins, or approved equal.

2. Air and Vacuum Valve for Surface Wash

- a. Air and vacuum valve for the surface wash supply pipe shall be 1/2 inch. Valve shall be APCO Model 141 or approved equal.

E. Dielectric Pipe Couplings

1. Dielectric pipe couplings shall be used wherever copper pipe connects to steel or cast iron pipe and appurtenances. Couplings shall have steel bodies with non-conducting bushings on both ends. Ends shall have standard pipe threads. Couplings shall be rated for at least 200 psi at 225°F. Couplings shall be as manufactured by Thermodynamics Corporation, Needham, MA; Water Vallett Company, Detroit, MI; or approved equal.

F. Water-hammer Arresters

1. Water-hammer arresters shall be used on water lines as shown on the DRAWINGS. Arresters shall consist of a permanently pre-charged air chamber and a rugged rubber sealed-in diaphragm to absorb shock. The unit shall be capable of being mounted at any angle. Arresters shall be Watts No. 150, or approved equal.

G. Air Vents

1. Air vents shall be used on water lines as shown on the DRAWINGS for the removal of unwanted air. Vents shall be rated at 150 pounds working water pressure, shall have a safety drain connection, stainless or copper clad steel internal components and a cast iron or brass body and cap. Vents shall be Hoffman No. 78, or approved equal.
2. See Section 15500 of these SPECIFICATIONS for air vents on unit heaters.

H. Rubber Expansion Joints

Rubber expansion joints shall be mounted on the suction and discharge of each pump.

1. Expansion joints shall be single arch type of butyl rubber construction with carcass of high grade woven cotton or suitable synthetic fiber and individual solid steel ring reinforcement. Soft rubber fillers shall be integrally cured into the arches to prevent settling of material into the arch. Interior surface shall comply with NSF 61 for potable water contact. Joints shall be constructed to

pipeline size and to meet working pressure and corrosive conditions similar to the line where installed. Joints shall have full faced fabric reinforced butyl flanges integral with body. Split type steel backup rings shall be provided to ensure a good joint. Rings shall be designed for mating the ANSI Standard 150 lb. flanges. Joints shall have a working pressure rating of 140 psig (minimum). All joints shall be finish coated with Hypalon paint.

2. Expansion joints shall be furnished with control units. Control units shall consist of two (2) drilled plates, stretcher bolts, and rubber washers backed by metal washers. The stretcher bolts shall prevent over-elongation of the joint. Extra nuts shall be provided on the stretcher bolts on the inside of the plate to prevent over-compression. All nuts, bolts and plates shall be galvanized.
3. Expansion joints shall be Style 500B as manufactured by Mercer Rubber Company, Style 4140 by Uniroyal Company, or equal.

I. Water Service Accessories

1. Backflow Preventers
 - a. The reduced pressure principle backflow preventers shall be a complete assembly consisting of two independently acting spring loaded toggle levers or poppet-type check valves together with an automatically operating pressure differential relief valve located between the two check valves. The first check valve shall reduce the supply pressure a predetermined amount so that during normal flow and the cessation of normal flow, the pressure between the checks is less than the supply pressure. In the case of leakage of either check valve, the differential relief valve shall discharge to atmosphere to maintain the pressure between the checks at a level less than the supply pressure.
 - b. Each unit shall include tightly closing shutoff valves located at each end of the device, and shall be fitted with four properly located test cocks. Operation shall be completely automatic. All parts must be removable or replaceable without removal of the unit from the line. The total head loss through the complete backflow assembly shall not exceed 10 psi at rated flow.
 - c. The backflow preventer shall be Watts 9090SOS&Y, or approved equal, shall have prior approval of the State Environmental Protection Agency and shall be in accordance with AWWA C506-latest revision.

- d. Furnish and mount an air gap on the body of the backflow preventer. The air gap shall be Watts No. 909AG, or approved equal.

2. Service Clamps

- a. Service clamps shall have malleable or ductile iron bodies, which extend at least 160 degrees around the circumference of the pipe and shall have neoprene gaskets cemented to the saddle body. Bodies shall be tapped for either corporation stop threads of IPS as required. Clamps with tap sizes 1 inch and smaller shall be of the single strap design. Clamps with tap sizes larger than 1 inch shall be of the double strap design.
- b. Service clamps shall be Style 91 or 291 as manufactured by Dresser Industries, Inc., Type 311 or 313 as manufactured by Smith-Blair, Inc. or equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. All valves and appurtenances shall be installed in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the ENGINEER before they are installed.
- B. Control valves in all locations shall be so grouped and located that they may be easily operated, through access panels, doors, or adjacent to equipment.
- C. After installation, all valves and appurtenances shall be tested at least one hour at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, it shall be repaired to the satisfaction of the ENGINEER.
- D. Install all brackets, extension rods, guides, the various types of operators and appurtenances as shown on the DRAWINGS in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the CONTRACTOR shall check all DRAWINGS and figures which have a direct bearing on their location and he shall be responsible for the proper location of these valves and appurtenances during the construction of the structures.
- E. All materials shall be carefully inspected for defects in workmanship and materials; all debris and foreign material cleaned out of valve openings, etc.; all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves and other equipment

which do not operate easily, or are otherwise defective, shall be repaired or replaced at no additional cost to the OWNER.

- F. Fire hydrants and yard hydrants shall be set at the locations as shown on the DRAWINGS and bedded on a firm foundation. A drainage pit as detailed on the DRAWINGS shall be filled with screened gravel and satisfactorily compacted.
- G. During backfilling, additional screened gravel shall be brought up around, and 6-inches over, the drain port. Each hydrant shall be set in true vertical alignment and properly braced. Concrete thrust blocks shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Minimum bearing area shall be as shown on the DRAWINGS. Felt roofing paper shall be placed around hydrant elbow before placing concrete. CARE SHALL BE TAKEN TO INSURE THAT CONCRETE DOES NOT PLUG THE DRAIN PORTS.
- H. If directed, the hydrant shall be tied to the pipe with suitable rods or clamps, galvanized, painted, or otherwise rustproof treated. Concrete used for backing shall be no leaner than 1 part cement, 2-1/2 parts sand, and 5-1/2 parts stone. Hydrant paint shall be touched up as required after installation.
- I. Buried flanged or mechanical joints shall be made with cadmium-plated bolts. All exposed bolts and nuts shall be cadmium-plated. All exposed bolts and nuts shall be heavily coated with two coats of bituminous paint.
- J. Yard hydrants shall be installed in accordance with manufacturer's recommendation and applicable requirements of the fire hydrants above.
- K. Buried valves and valve boxes shall be set with the valve stem vertically aligned in the center of the box. Valves shall be set on firm foundation and supported by tamping selected excavated material under the sides of the valve. The valve box shall be supported during backfilling and maintained in vertical alignment with the top flush with finish grade.

3.02 SHOP PAINTING

- A. Interior surfaces of all valves, the exterior surfaces of buried valves, and miscellaneous piping appurtenances shall be given a shop finish of an asphalt varnish conforming to Federal Specification TT-V51e for Varnish Asphalt.
- B. The exterior surface of various parts of the valves, operators, floor stands and miscellaneous piping shall be thoroughly cleaned of all scale, dirt, grease or other foreign matter and thereafter one shop coat of an approved rust-inhibitive primer, such as Inertol Primer No. 621, shall be applied in accordance with the instructions of the paint manufacturer.
- C. Ferrous surfaces obviously not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating.

- D. Field painting is specified under Division 9, Section 09900.

3.03 INSPECTION AND TESTING

- A. The various pipelines in which the valves and appurtenances are to be installed are specified to be field-tested. During these tests any defective valve or appurtenance shall be adjusted, removed and replaced, or otherwise made acceptable to the ENGINEER.
- B. Various regulating valves, strainer, or other appurtenances shall be tested to demonstrate their conformance with the specified operational capabilities and any deficiencies shall be corrected or the device replaced or otherwise made acceptable to the ENGINEER.

END OF SECTION

SECTION 15101

LARGE VALVES AND APPURTENANCES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and install complete and ready for operation all valves and appurtenances where shown on the Drawings as specified herein.
- B. The equipment specified herein includes the following:
 - 1. Gate valves with boxes for yard piping
 - 2. Gate valves for inside service
 - 3. Butterfly valves for yard piping
 - 4. Butterfly valves for inside service
 - 5. Plug valves for yard piping
 - 6. Plug valves for interior or above ground service
 - 7. Ball valves
 - 8. Check valves
 - 9. Air and vacuum relief valves (piping application)
 - 10. Automatic air release valves
 - 11. Shock absorbers
 - 12. Service clamps
 - 13. Expansion joints
 - 14. Pressure-reducing valves
 - 15. Back Pressure Sustaining Valves
- C. The work of this Section shall include the installation of valve tags furnished by the CONTRACTOR. All exposed valves provided under this Section shall be tagged.

1.02 RELATED WORK NOT INCLUDED

- A. Excavation, backfill, fill and grading is included in Division 2.
- B. Piping is included in the respective sections of Division 2 and 15.
- C. Valves, hydrants, meters and service lines for distribution system application are included in Division 2.
- D. Valves and service accessories on all plumbing systems are included in this Division, Section 15100.
- E. Pipe hangers and supports are included in this Division, Section 15094.
- F. Electrical is included in Division 16.

1.03 DESCRIPTION OF SYSTEMS

- A. All of the equipment and materials specified herein is intended to be standard for use in controlling the flow of wastewater, sludges, water, air or chemicals, depending on the applications.

1.04 QUALIFICATIONS

- A. All of the types of valves and appurtenances shall be products of well-established firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these SPECIFICATIONS as applicable.

1.05 SUBMITTALS

- A. Complete shop drawings of all valves and appurtenances shall be submitted to the ENGINEER in accordance with the requirements of Division 1.
- B. Furnish all information required in Division 1.

1.06 OPERATING INSTRUCTIONS

- A. Manufacturer's operating and maintenance instructions as set forth in Division 1 shall be furnished to the ENGINEER for equipment furnished under this Section.

1.07 TOOLS

- A. Special tools, if required for normal operation and maintenance, shall be supplied with the equipment.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. General
 - 1. All valves and appurtenances shall be of the size shown on the PLANS and as far as possible all equipment of the same type shall be from one manufacturer.
 - 2. All valves and appurtenances shall have the name of the maker, flow-directional arrows, and the working pressure for which they are designed cast in raised letters on some appropriate part of the body.

3. Handwheel operator shall be no less than 12-inch diameter.
4. Except as otherwise shown on the PLANS or specified herein, all valves with operators located 7 feet or more above the operating floor shall be provided with chain-wheel operators complete with chain guides and galvanized steel chain.
5. All buried valves shall open left (counterclockwise). Insofar as possible, all valves shall open counterclockwise.
6. All butterfly valves, gate valves and plug valves 8 inches or larger shall be furnished with gear operators and gear cases conforming to the requirements of AWWA C504 or as shown on the PLANS.

2.02 VALVES

A. Butterfly Valves for Buried Service

1. Butterfly valves and operators for buried service shall conform to AWWA C504, except as hereinafter provided. Butterfly valves shall be rated for Class 150B and both valve and operator shall be especially designed for service buried in the ground where the ground water may at times completely submerge the valve and operator, and shall be of the totally enclosed type.
2. The valve bodies shall be of cast iron conforming to ASTM A48-CL 40. Valve ends shall be mechanical joint meeting ANSI Specification A21.11.
3. Except as otherwise specified herein, valve shafts shall be of Type 304 stainless steel. Shaft seals shall be rubber O-ring seals. Shafts having a minimum torsional strength equivalent to shafts specified in Section 3.3 of AWWA C504 and completely isolated from the pipeline contents shall be furnished. Connections between shafts and discs shall be designed to transmit full shaft torque.
4. If the rubber seat is in the body, the disc shall be of an alloy cast iron conforming to ASTM A436 Type I with the periphery machined to a smooth spherical surface. If the rubber seat is mounted on the disc edge it shall be held in place by a one-piece Type 304 stainless steel retaining ring and stainless steel screws, the disc shall be of ASTM A48, Class 40 cast iron and a mating Type 304 stainless steel ring shall be installed in the valve body.
5. The unit shall be permanently lubricated with grease or oil. A standard AWWA 2 inch square operating nut shall be provided on the input shaft and it shall have a cap to center the valve box. Valves shall open to the left (counterclockwise).

6. Valve and operator assemblies shall be given two coats of asphalt varnish conforming to Section 4 of AWWA C504.
7. An Affidavit of Compliance in accordance with Section 1.5 of AWWA C504 shall be furnished to the ENGINEER prior to shipment of valves to the job site.
8. Valve boxes shall be provided for each buried valves. Valve boxes and appurtenances are specified in Division 5, Section 05540.
9. Four tee-handled gate wrenches of suitable length shall be furnished to operate all valves with valve boxes.

B. Butterfly Valves (for Interior Service)

1. Butterfly valves and operators shall conform to the AWWA Standard Specification for rubber seated butterfly valves Designation C504, except as hereinafter specified. Valves shall have a minimum 150-psi pressure rating and be equal to those manufactured by Allis-Chalmers, Henry Pratt Company, or equal.
2. Butterfly valves shall be flanged end with face-to-face dimensions in accordance with Table 3 of the above mentioned AWWA Specification for short-body valve, or wafer type.
3. Valve seats shall be full resilient seats retained in the body or the disc edge in accordance with Section 3.5 of the above mentioned AWWA Specification. If the resilient seat is in the body, the disc shall be of an alloy cast iron conforming to ASTM A436 Type 1 with the periphery machined to a smooth spherical surface. If the resilient seat is mounted on the disc edge, it shall be held in place by a one-piece Type 304 stainless steel retaining ring and stainless screws, the disc shall be of ASTM A48, Class 40 cast iron and a mating Type 304 stainless steel ring shall be installed in the valve body. Resilient seats shall be Hycar or equal for water service and Nordel or equal for air service.
4. The valve body shall be constructed of close grain cast iron per ASTM A126, Class B with integrally cast hubs for shaft bearing housings of the through boss-type. Permanently self-lubricating body bushings shall be provided and shall be sized to withstand bearing loads. Stuffing box of liberal dimensions shall be provided at the operator end of the vane shaft, arranged so that the packing can be replaced by removing the bronze follower without removing the operator. Packing shall be of the Chevron type as manufactured by Garlock Packing Company. A sealing element utilizing O-rings shall also be acceptable.

5. The valve shaft shall be of Type 304 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greater dynamic or seating torque.
6. In general, the butterfly valve operators shall conform to the requirements of Section 3.8 of the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, insofar as applicable and as herein specified.
7. Gearing for the operators where required shall be totally enclosed in a gear case in accordance with Section 3.8.3 of the above mentioned AWWA Standard Specification.
8. The manual operators shall conform to Section 3.8.2 of the above mentioned AWWA Standard Specifications, insofar as applicable. Valves shall have Handwheel or lever operators and open left, or counterclockwise. Operators shall have indicators to show position of the valve disc. Operators shall be rigidly attached to the valve body.

C. Gate Valves and Appurtenances for Yard Piping

1. Gate valves for water shall meet the requirements of AWWA C509 covering resilient seated gate valves. Valves shall be rated for 200-psi working pressure and a minimum of 400-psi test pressure. The wedge shall be of cast iron completely encapsulated with rubber. The sealing rubber shall be permanently bonded to the cast iron wedge to meet ASTM tests for rubber metal bond ASTM D429. They shall have non-rising cast bronze stems (unless otherwise shown on the PLANS) and be fitted with "O-ring" seals. The operating nuts shall be 2-inch square. All valves shall open left, or counterclockwise. Stuffing boxes shall be the "O-ring" type with two rings located above thrust collar; the two rings shall be replaceable with valve fully open and subjected to full rated working pressure. Gate valves shall be mechanical joint, ANSI Standard 21.11 except where shown otherwise. The body and bonnet shall be coated with a fusion coating both interior and exterior to meet C50. Each valve shall have maker's name, pressure rating and year in which manufactured cast on the body. Gate valves shall be as manufactured by Mueller Co., or approved equal.
2. Tapping sleeves shall be as manufactured by the Ford Meter Box Company, Inc., with cadmium-plated cast iron nuts and bolts. Sleeves shall be of cast iron, designated for working pressures not less than 200 psi. Lead gaskets shall be provided for the full area of the sleeve flanges.

3. Tapping valves shall conform to the requirements specified above for gate valves except that one end shall be flanged and one mechanical. Tapping valves shall be provided with an over-sized opening to permit the use of full sized cutters.
4. Four tee-handled gate wrenches of suitable length shall be furnished to operate all valves with valve boxes.

D. Gate Valves for Inside Service

1. See Section 15100 of these SPECIFICATIONS for gate valves 2-1/2" in diameter and smaller.
2. Gate valves 3" and larger in size, unless otherwise specified shall be iron body, bronze mounted, solid wedge gate valves with flanged ends and conforming to the AWWA Standard Specification for Gate Valve for Water and Sewage Systems, Designation C509-latest revision, insofar as applicable and in addition to the following requirements:
 - a. Valve shall be outside screw and yoke type with rising stem (unless otherwise shown on the PLANS).
 - b. Flanges shall be faced and drilled to ANSI B16.1 125 pound template, unless otherwise shown on the PLANS.
 - c. Bronze gate rings shall be fitted into grooves of dovetail or similar shape in the gates. For grooves or other shapes, the rings shall be firmly attached to the gates with bronze rivets.
 - d. Handwheels shall turn counterclockwise to open the valves. Handwheels shall be of ample size and shall have an arrow and the word "OPEN" cast thereon to indicate the direction of opening.
 - e. Stuffing box follower bolts shall be of steel and the nuts shall be of bronze.
 - f. The design of the valves shall permit packing the valves without undue leakage while they are wide open and in service.
 - g. O-ring stuffing boxes may be used.
 - h. Gate valves for pipeline installation shall be housed in an adjustable two-piece cast iron valve box and have a cover with the word "Water" or "Sewer" stamped or cast.
 - i. Gate valves with spur gears shall be housed to accommodate the offset of the operating nut.

E. Gate Valves For 16 and 24 Inch Distribution Mains

1. General

Valves to be installed on 16 and 24-inch high service and transmission lines shall conform to the latest revision of AWWA Standard C-509 covering resilient seated gate valves. These large diameter valves shall be as manufactured by Clow Valve Co., M & H Valve Co., or approved equal.

2. Design

The valves shall be either, **non-rising stem**, opening by turning stem left or right and provided with **2" square operating nut or handwheel** with the word Open and an Arrow cast in the metal to indicate direction to open.

The wedge shall be of cast iron completely encapsulated with rubber.

The sealing rubber shall be permanently bonded to the cast iron wedge to meet ASTM tests for rubber metal bond ASTM D429.

Stems for NRS assemblies shall be cast bronze with integral collars in full compliance with AWWA. OS & Y stems shall be on bronze bar stock. The NRS stem stuffing box shall be the o-ring seal type with two rings located above thrust collar; the two rings shall be replaceable with valve fully open and subjected to full rated working pressure.

There shall be two low torque thrust bearings located above and below the stem collar. The stem nut shall be independent of wedge and shall be made of solid bronze. There shall be a smooth unobstructed waterway free of all pockets, cavities and depressions in the seat area.

3. Materials

All cast iron shall conform to ASTM-A-126 Class C. Castings shall be clean and sound without defects that will impair their service. No plugging or welding of such defects will be allowed.

Stems shall be manganese bronze having a minimum tensile strength of 60,000 psi, a minimum yield of 20,000 psi.

Bolts shall be electro-zinc plated steel with hex heads and hex nuts in accordance with ASTM A-307 and A-563, respectively.

4. Testing

Prior to shipment from factory, each valve shall be tested by hydrostatic pressure equal to twice the specified working pressure of 250 psi.

5. Coating AWWA

The body and bonnet shall be coated with a fusion coating both interior and exterior to meet C550.

6. Marking

Valves shall be marked with name of manufacturer, the year of manufacture, the maximum working pressure and size of valve.

F. Plug Valves for Interior or Above Ground Service

1. Plug valves shall be manufactured in accordance with AWWA C-504, shall be of the 1/4 turn, eccentric, non-lubricated type, serviceable under full line pressure, and capable of sealing in both directions at the rated pressure. Valves shall have a minimum port area of 80% of the nominal pipe size. The valve body shall be of cast iron, 30,000 psi tensile strength with added nickel and chromium, ASTM A-126, Class B, 175 psi rating. Valve ends shall be flanged. The valve plug shall be ductile iron conforming to ASTM A-536, Grade 65-45-12 with neoprene resilient facing. The valve seating design shall be resilient and of the continuous interface type having consistent opening/closing torques and shall be non-jamming in the closed position. Closure shall be accomplished by means of an off-set plug design with a resilient seating face that achieves full 360 degree seating contact. Valves shall be of the bolted bonnet design. The resilient faced plug shall be replaceable without removing the valve body from the line. The valve body seating area shall be corrosion resistant by a welded-in overlay of high nickel content. Sprayed or plated seating surfaces will not be acceptable. Valves shall have permanently lubricated Type 316 stainless steel bearings on the upper and lower plug stem journal. Bearings shall be replaceable. Packing shall be Buna N (Vee Type) rated for 150 psig working pressure. Packing shall be adjustable and valves shall be designed such that they can be repacked without removing the bonnet. All exposed nuts, bolts, springs, and washers shall be zinc plated, except exposed hardware for submerged valves that shall be of stainless steel.
2. All valves shall be equipped with gear actuators and handwheel operators (unless otherwise shown on the PLANS). All gearing shall be enclosed suitable for running in oil with seals provided on all shafts to prevent entry of dirt and water into the actuator. All shaft bearings shall be furnished with permanently lubricated bronze bearing bushings. Actuator shall clearly indicate valve position and an adjustable stop shall be provided. Construction of

actuator housing shall be semi-steel. Hardware on actuators shall be of the same materials as the valves.

3. All valves and actuators shall be as manufactured by DeZurik Corporation or equal.
4. All plug valves shall be installed so that the direction of flow through the valve is in accordance with the manufacturer's recommendations.

G. 3-Way Plug Valves

1. Valves shall be of the non-lubricated taper plug type and shall have resilient faced plugs for drip tight shutoff. End connections shall be flanged and shall be drilled to ANSI 125 pound standard. Valves shall be semi-steel and shall have stainless steel bearings in the upper and lower journal areas. The three-way valve shall be furnished as standard with a plug to shut off one port at a time.
2. The valve shall be furnished with a resilient facing bonded to the plug sealing surface and shall have double handwheel actuators. The actuator shall be of the worm and gear type and shall have one handwheel to lift and reseal the plug and one handwheel to rotate the plug. Handwheel actuators shall be totally enclosed and shall have seals and gaskets to prevent entry of dirt, water or corrosive atmosphere. Actuators shall have corrosion resistant bearings on the gear sector. Actuators shall provide plug rotation up to 360°.
3. The 3-way valves, actuators and accessories shall be as manufactured by DeZurik Corporation, or equal.

H. Plug Valves for Yard Piping

1. Plug valves for yard piping shall be as specified above for interior plug valves, except valves shall have mechanical joint ends and stainless steel hardware. Buried actuators shall be as specified above and shall be of buried, submerged service with seals on all covers and shafts and all exposed hardware of stainless steel. Provide valve box, stem extension, and operating nut as specified above for gate valves.

I. Ball Valves

1. See Section 15100 of these SPECIFICATIONS.

J. Check Valves

1. Check valves for cast iron and ductile iron pipelines shall be swing type and shall meet the material requirements of AWWA Specification C508-latest revision Swing-Check Valves for ordinary

water-works service. The valves shall be iron body, bronze mounted, single disc, 150 psi working water pressure, non-shock, and hydrostatically tested at 300 psi. Ends shall be 125 lb. ANSI B16.1 flanges.

- a. When there is no flow through the line the disc shall hang lightly against its seat in practically a vertical position. When open, the disc shall swing clear of the water-way.
- b. Check valves shall have bronze seat and body rings, extended bronze hinge pins and bronze nuts on the bolts of bolted covers.
- c. Valves shall be so constructed that disc and body seat may easily be removed and replaced without removing the valve from the line. Valves shall be fitted with an extended hinge arm with outside lever and spring. Springs with various tensions shall be provided and springs approved by the ENGINEER shall be installed.

K. Automatic Air and Vacuum Relief Valves for Vertical Turbine Pumps

1. Combination air and vacuum valves for vertical turbine pumps shall be equal to APCO Air Valves for Vertical Turbine Pumps, per APCO Bulletin 586, as manufactured by Valve and Primer Corp., Schaumburg, Illinois, or approved equal.
2. Valves shall be the size shown on the drawings and shall be equipped with an automatic air release valve, such as APCO Valve No. 55, or approved equal.
3. Air valves for vertical turbine pumps shall be designed to allow large quantities of air to escape out the orifice when the pump is started and close water tight when the liquid enters the valve. The air valve shall also permit large quantities of air to re-enter through the orifice when the pump is stopped to prevent a vacuum from forming in the pump column.
4. The valve shall consist of a body, cover, baffle, float and seat. The valve shall be designed to prevent prematurely shut-off. The seat shall be fastened into the valve cover, without distortion, and shall be easily removed, if necessary.
5. The entire float and baffle assembly must be shrouded with a perforated water diffuser to prevent the water column entering the valve, from slamming the float shut and eliminate water hammer in the system.
6. The float shall be stainless steel, designed to withstand a minimum of 1,000 psi, or approved equal. The float shall be center guided and not free floating for positive seating.

7. The discharge orifice shall be fitted with an automatic air release valve in order to vent small pockets of air. This valve shall consist of a body, cover, float and seat, and shall be rated at a working pressure of 150 psi.
8. The body, cover, and baffle of this valve assembly shall be constructed of cast iron, conforming to ASTM A48 Class 30, or approved equal. The float shall be stainless steel, conforming to ASTM A240, or approved equal. The seats shall be BUNA-N and the water diffuser shall be brass, or approved equal. All flanges shall be 125# ANSI.

L. Air Release Valves

1. Combination Air Valve Assemblies

- a. Sizes 1-inch through 6-inch. Valve shall be single body, double orifice, allowing air to exit when filling a pipeline, and air to enter when draining. Orifices shall operate independently; the smaller release orifice shall be capable of opening when the larger is in the closed position.
- b. The valve shall be designed to prevent premature closing. The closing mechanism shall be either needle and seat and be Buna-N, or of the rolling seal type made of Rubber E.P.D.M., and attached to the valve cover to ensure drop-tight shut-off. The float shall be stainless steel, hermetically sealed, and designed to withstand pressures up to 1000 pounds per square inch, or approved equal. The float shall be of corrosion resistant materials in accordance with ASTM A240, or approved equal. The plug shall be bronze and in accordance with ASTM B124, or approved equal. The body, cover, and leverage frame shall be cast iron/Delrin and shall be in accordance with ASTM A126 GR, B and ASTM D2133, reinforced Nylon, or approved equal.
- c. Valve exterior shall be painted with Red Oxide Phenolic Primer, or approved equal as accepted by the FDA for use in contact with potable water.
- d. Valve to be APCO Model (corresponding to size) Combination Air Valve as manufactured by Valve & Primer Corp., Schaumburg, Illinois, U.S.A., or approved equal.
- e. Air valves shall be installed as shown in the plans, housed in a valve box with cover. Valve boxes for air valves shall be carefully set to grade with covers at grade.

2. Air Release (Vent) Valve Assemblies

- a. Air Vent Valve No. 50, or approved equal. Valve shall operate under pressure, allowing entrapped air to escape from a pipeline. Orifices shall operate by means of a simple lever mechanism (stainless steel, ASTM A240), rolling seal mechanism, or approved equal to prevent water from escaping as or after air is expelled.
- b. The closing mechanism shall be either needle and seat and be Buna-N, or of the rolling seal type made of Rubber E.P.D.M., and attached to the valve cover to ensure drop-tight shut-off. The float shall be stainless steel, hermetically sealed, and designed to withstand pressures up to 1000 pounds per square inch, or approved equal. The float shall be of corrosion resistant materials in accordance with ASTM A240, or approved equal. The seat shall be of stainless steel, or approved equal. The seat shall have an orifice of 3/32 inches, or approved equal to operate up to 175 pounds per square inch (psi), or a 1/16 inch orifice when operation at pressures higher than 175 psi, or approved equal. The body shall be cast iron, ASTM A48, Class 30, or approved equal, and shall have a 1/2 inch NPT female threaded inlet and outlet, and be rated for 350 psi test pressure.
- c. Valve exterior shall be painted with Red Oxide Phenolic Primer, or approved equal as accepted by the FDA for use in contact with potable water.
- d. Valve to be APCO Model 50 Air Vent Valve as manufactured by Valve & Primer Corp., Schaumburg, Illinois, U.S.A., or approved equal.

M. Shock Absorbers

1. Shock absorbers shall be supplied on the plant water distribution piping where shown on the PLANS. The shock absorbers shall be Model 1485-1 as manufactured by Josam Manufacturing Company, Michigan City, Indiana or approved equal.

N. Service Clamps

1. Service clamps shall have malleable or ductile iron bodies, which extend at least 160 degrees around the circumference of the pipe and shall have neoprene gaskets cemented to the saddle body. Bodies shall be tapped for either corporation stop threads of IPS as required. Clamps with tap sizes 1 inch and smaller shall be of the single strap design. Clamps with tap sizes larger than 1 inch shall be of the double strap design.

2. Service clamps shall be Style 91 or 291 as manufactured by Dresser Industries, Inc., Type 311 or 313 as manufactured by Smith-Blair, Inc. or equal.

O. Expansion Joints

1. Expansion joints shall be single arch type of butyl rubber construction with carcass of high grade woven cotton or suitable synthetic fiber and individual solid steel ring reinforcement. Soft rubber fillers shall be integrally cured into the arches to prevent settling of material into the arch. Joints shall be constructed to pipeline size and to meet working pressure and corrosive conditions similar to the line where installed. Joints shall have full faced fabric reinforced butyl flanges integral with body. Split type steel backup rings shall be provided to ensure a good joint. Rings shall be designed for mating the ANSI Standard 150 lb. flanges. Joints shall have a working pressure rating of 140 psig (minimum). All joints shall be finish coated with Hypalon paint.
2. Expansion joints shall be furnished with control units. Control units shall consist of two (2) drilled plates, stretcher bolts, and rubber washers backed by metal washers. The stretcher bolts shall prevent over-elongation of the joint. Extra nuts shall be provided on the stretcher bolts on the inside of the plate to prevent over-compression. All nuts, bolts and plates shall be galvanized.
3. Expansion joints shall be Style 500B as manufactured by Mercer Rubber Company, Style 4140 by Uniroyal Company, or equal.

P. Pressure Reducing Valves

1. Pressure reducing valves shall be of the single seated balanced design type globe body with threaded inlet and outlet ports. It shall be diaphragm operated, spring loaded permitted adjustment over a range of no less than 30 psi.
2. The body shall be bronze construction with bronze or stainless steel stem and furnished with a replacement rubber seat.
3. The pressure reducing valves shall be G-A Industries, APCO, or equal.

Q. Mud Valves

1. Mud valves shall be flanged end, rising stem type.
2. Bodies shall be cast iron. The stem, stem nut, disk ring, and seat ring shall be bronze. Bolts and nuts shall be rustproof steel.
3. Handwheel operator and floorstand shall be furnished where shown on the PLANS.

4. Provide stem guides for maximum unsupported stem length of 5 feet.
5. The valves shall be Clow F-3085, or equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. All valves and appurtenances shall be installed in the locations shown on the PLANS, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the ENGINEER before they are installed.
- B. After installation, all valves and appurtenances shall be tested at least 1 hour at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If a joint proves to be defective, it shall be repaired to the satisfaction of the ENGINEER.
- C. Install all brackets, extension rods, guides, the various types of operators and appurtenances as shown on the PLANS that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the CONTRACTOR shall check all plans and figures, which have a direct bearing on their location and he shall be responsible for the proper location of these valves and appurtenances during the construction of the structures.
- D. All materials shall be carefully inspected for defects in workmanship and materials; all debris and foreign material cleaned out of valve openings, etc.; all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves and other equipment, which do not operate easily or are otherwise defective, shall be repaired or replaced at no additional cost the OWNER.
- E. Buried flanged or mechanical joints shall be made with cadmium plated bolts. All exposed bolts and nuts shall be cadmium plated. All exposed bolts and nuts shall be heavily coated with two (2) coats of bituminous paint comparable to Inertol No. 66 Special Heavy.
- F. Buried valves and valve boxes shall be set with the stem vertically aligned in the center of the gate box. Valves shall be set on a firm foundation and supported by tamping selected excavated material under the sides of the valve. The valve box shall be supported during backfilling and maintained in vertical alignment with the top flush with finish grade.

3.02 SHOP PAINTING

- A. Interior surfaces of all valves, the exterior surfaces of buried valves and miscellaneous piping appurtenances shall be given a shop finish of an asphalt varnish conforming to Federal Specification TT-V51e for Varnish Asphalt.
- B. The exterior surface of various parts of valves, operators, floor stands and miscellaneous piping shall be thoroughly cleaned of all scale, dirt, grease or other foreign matter and thereafter on shop coat an approved rust-inhibitive primer (such as specified in Section 09900) shall be applied in accordance with the instructions of the paint manufacturer.
- C. Ferrous surfaces obviously not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating.
- D. Field painting is included under Division 9.

3.03 INSPECTION AND TESTING

- A. The various pipe lines in which the valves and appurtenances are to be installed are specified to be field tested. During these tests any defective valve or appurtenance shall be adjusted, removed and replaced, or otherwise made acceptable or the ENGINEER.
- B. Various regulating valves, strainer, or other appurtenances shall be tested to demonstrate their conformance with the specified operational capabilities and any deficiencies shall be corrected or the device replaced or otherwise made acceptable to the ENGINEER.

END OF SECTION

SECTION 15121

LEVEL SENSING AND CONTROL INSTRUMENTATION

PART I GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Level Sensing and Control Instrumentation:
 - a. Submersible Hydrostatic Level Transmitter
 - b. Float switches.
- B. Level sensing equipment furnished as part of factory-fabricated equipment is specified as part of equipment assembly in other Division 15 sections.
- C. Refer to Section 11820 for ultrasonic level sensing equipment.

1.02 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's technical product data, including installation instructions, for each instrument. Include scale range and ratings, certified where indicated.
 - 2. Instrument schedule showing manufacturer's figure number, scale range, location, and accessories for each instrument.
- B. Submit in accordance with Section 01300.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of level sensing equipment, of types and sizes required, whose products have been in satisfactory use in similar service.
- B. Regulatory Requirements:
 - 1. UL Compliance: Comply with applicable UL standards pertaining to gauges.
 - 2. ANSI and ISA Compliance: Comply with applicable portions of

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ANSI and Instrument Society of America (ISA) standards
pertaining to construction and installation of level sensing
equipment.

- C. Certification: Provide equipment whose accuracies, under specified operating conditions, certified by manufacturer.

PART 2 PRODUCTS

2.01 SUBMERSIBLE HYDROSTATIC LEVEL TRANSMITTER

- A. Submersible level transmitters shall have a nominal operating range of zero to 30.0 ft. of water for process tanks and zero to ten feet of water for the plant sump, with a temperature range of 15 to 150°F, with compensated range of zero to 50°C. Accuracy of measurement shall be $\pm 0.5\%$ including linearity, hysteresis, and repeatability.
- B. Transmitter shall be constructed of polypropylene shell with a 316 L stainless steel diaphragm.
- C. Transmitter shall accept a supply voltage of 10 – 30 VDC with a 4 to 20 mA output signal. Electrical connection shall be to an attached three wire, 20 gauge polyethylene or PVC shielded cable.
- D. Transmitter shall be suspended within a 4" diameter stilling well attached to the basin wall. The stilling well shall contain equalization ports spaced as required. The stilling well shall be continuous from a point six inches above the floor to a point six inches below the top of the wall.
- E. Unit shall be a MJK Model 2100 Series Pressure Transmitter or approved equal.

2.02 FLOAT SWITCHES

- A. Float switches shall contain a hermetically sealed non-mercury microswitch housed in a polypropylene shell. It shall be designed for a life of 20 million operations.
- B. Floats shall be compatible with intrinsically safe installations. Electrical connection shall be to an attached three wire 17 gage PVC shielded cable.
- C. Switches shall be provided as normally open or normally closed as indicated on the drawings.
- D. Unit shall be a MJK Model 7030 Float Switch or approved equal.

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PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which level sensing equipment is to be installed. Do not proceed with Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION OF PRESSURE INSTRUMENTATION

- A. Install level sensing instrumentation and ancillaries in a readily accessible location for observation and maintenance. Install per the manufacturer's recommendations.

END OF SECTION

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SECTION 15122

PRESSURE SENSING AND CONTROL INSTRUMENTATION

PART I GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Pressure Sensing and Control Instrumentation:
 - a. Pressure gauges and transmitters
 - b. Pressure gauge cocks.
 - c. Diaphragm seals
- B. Gauges furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 15 sections.

1.02 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's technical product data, including installation instructions, for each type gauge. Include scale range and ratings, certified where indicated.
 - 2. Gauge schedule showing manufacturer's figure number, scale range, location, and accessories for each gauge.
- B. Submit in accordance with Section 01300.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of gauges, of types and sizes required, whose products have been in satisfactory use in similar service.
- B. Regulatory Requirements:
 - 1. UL Compliance: Comply with applicable UL standards pertaining to gauges.
 - 2. ANSI and ISA Compliance: Comply with applicable portions of ANSI and Instrument Society of America (ISA) standards pertaining to construction and installation of gauges.

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- C. Certification: Provide gauges whose accuracies, under specified operating conditions, certified by manufacturer.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

- A. Manufacturers include but are not limited to:
 - 1. Dwyer
 - 2. Ametek/U.S. Gauges.
 - 3. Marsh Instrument Company, Unit of General Signal.
 - 4. Weiss Instruments, Inc.
 - 5. Or approved equal.
- B. Provide pressure gauges of materials, capacities, and ranges indicated, designed, and constructed for use in service indicated.
- C. Type: WOG, 1 % accuracy, Grade A phosphor bronze bourdon type, bottom connection.
- D. Case: Enamel coated steel, 4-1/2 in. dia.
- E. Connector: Stainless steel with 1/4 in. male NPT.
- F. Scale: White coated aluminum with permanently etched markings.
- G. Range: Per Pressure Gauge Schedule on drawings.

2.03 PRESSURE SWITCH

- A. Same as for pressure gages:
- B. Provide pressure switch of materials, capacities, and ranges indicated, designed, and constructed for use in service indicated. Dwyer Series DA, or approved equal.
- C. Type: WOG, 403 SS bourdon type, bottom connection.
- D. Case: Pressed steel w. transparent cover, 5-3/4 in. dia.

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- E. Connector: Stainless steel with 1/4 in. male NPT.
- F. Deadband: Adjustable
- G. Contacts: (3) Screw type
- H. Switch: Hermetically sealed contact mercury switch
- I. Range: 0-100 psi

2.04 PRESSURE GAUGE COCKS

- A. Manufacturers: Same as for pressure gauges.
- B. Provide pressure gauge cocks between pressure gauges and gauge tees on piping systems; or when applicable, between diaphragm seals and gauge tees on piping systems. Construct gauge cock of stainless steel with NPT fittings on each end of size and type consistent with the adjacent fittings, and with a "T" handle brass plug.
- C. Siphon: 1/4 in. straight coil constructed of type 304 stainless steel tubing with 1/4 in. male NPT on each end.
- D. Snubber: 1/4 in. stainless steel bushing with corrosion resistant porous metal disc through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.

2.05 DIAPHRAGM SEALS

- A. Manufacturers: Same as for pressure gauges.
- B. Provide continuous-duty diaphragm seals between pressure gauges and gauge tees on process piping systems. Construct diaphragm seal of stainless steel with NPT fittings on each end of size and type consistent with the adjacent fittings.
- C. Type: Capsule with fill/bleed connection, glycerin filled.
- D. Diaphragm Material: 304L SS, w/ teflon coating
- E. Bottom Housing: 304L SS
- F. O-ring: Viton
- G. Range – Compatible with pressure gage, transmitter or switch.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which meters and gauges to be installed. Do not proceed with Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION OF PRESSURE INSTRUMENTATION

- A. Install pressure instrumentation and ancillaries, located on pipe at most readable position, and adjust faces of gauges to proper angle for best visibility.

3.03 CLEANING

- A. Clean windows of instrumentation and factory-finished surfaces. Replace cracked or broken windows, and repair any scratched or marred surfaces with manufacturer's touch-up paint.

END OF SECTION

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SECTION 16050

BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Raceway Systems
2. Wire, Cables and Connectors
3. Wiring Devices
4. Motor Starters
5. Motor and Circuit Disconnects
6. Fuses
7. Panelboards
8. Transformers

1.02 SUBMITTALS

A. Approval of equipment supplied in this section is contingent upon CONTRACTOR verification of available fault current from electric utility.

1. Notify ENGINEER if available fault current is higher than specified equipment.

B. Product Data:

1. Submit for disconnects, motor starters, panelboards, circuit breakers, overcurrent protective devices, and transformers.
2. Product data sheets with printed installation instructions.

C. Shop Drawings:

1. Submit for motor starters.
2. Show enclosure dimensions, nameplate nomenclature, electrical ratings, and thermal unit schedule.
3. Wiring diagrams and schematics.

- D. Operation and Maintenance (O&M) Data:
 - 1. Maintenance data for materials and products for inclusion in Operating and Maintenance Manual.' "
- E. Submit in accordance with Section 01340.

1.03 QUALITY ASSURANCE

- A. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).
 - 1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
 - 2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.
- B. Regulatory Requirements:
 - 1. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

PART 2 PRODUCTS

2.01 METAL CONDUIT AND TUBING

- A. Galvanized Rigid Steel Conduit ANSI C80.1.
- B. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.
- C. Liquidtight Flexible Metal Conduit: Flexible steel conduit with PVC jacket

2.02 NONMETALLIC CONDUIT

- A. Rigid Nonmetallic Polyvinyl Chloride (PVC) Conduit: NEMA TC 2, Schedule 40 or 80 PVC.

2.03 FITTINGS

- A. Fittings for steel conduits:
 - 1. Steel or malleable iron, zinc galvanized or cadmium plated.
 - 2. Do not use set screw or indentor type fittings.
 - 3. Do not use aluminum or die cast fittings.
 - 4. GRS Connectors and Couplings:
 - a. Threaded.

- b. Insulated throat.
 - c. Gland compression type.
 - d. Rain and concrete type.
- 5. Comply with ANSI C80.4.
- 6. Comply with NEMA FB 1, compatible with conduit materials.
- B. Conduit bodies:
 - 1. Malleable iron with galvanized finish.
- C. Fittings for flexible metal conduit.
 - 1. Insulated throat type:
 - 2. Threaded.
 - 3. Grounding type.
 - 4. Liquidtight: 1 piece sealing "O" rings with connectors when entering boxes or enclosures.
- D. PVC Conduit Fittings:
 - 1. NEMA TC3; match to conduit type and material.
- E. Expansion Joints:
 - 1. Conduit expansion fittings complete with copper bonding jumper, Crouse-Hinds Type XJ.
 - 2. Conduit expansion/deflection fittings with copper bonding jumper, Crouse-Hinds Type XD.
- F. Seals:
 - 1. Wall entrance, OZ/Gedney Type FSK or FSC.
- G. Drain Fittings:
 - 1. Automatic Drain Breather:
 - a. Explosionproof.
 - 1) Safe for Class I, Groups C and D.
 - b. Capable of passing minimum 25 cc water/min and

2. Condensate Drain:
 - a. Conduit outlet body, Type T.
 - b. Threaded, galvanized plug with 3/16 in. drilled holed through plug.

H. Hazardous Areas:

1. Explosionproof.
2. Horizontal seal fittings, Crouse-Hinds Type EYS.
3. Vertical seal fittings, Crouse-Hinds Type EYD.
4. Vertical seal fittings shall have drain plug.

2.04 WIREWAYS

- A. Material: Sheet metal sized and shaped as indicated.
- B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireway as required for complete system.
- C. Select features where not otherwise indicated, as required to complete wiring system and to comply with NEC.
- D. Wireway Covers:
 1. Hinged type for dry locations.
 2. Bolted cover with gasket for wet locations.
- E. Finish: Manufacturer's standard enamel finish unless bother wise noted.

2.05 BOXES

- A. Of indicated types, sizes and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for use and location. Provide items complete with covers and accessories required for. intended use. Provide gaskets for units in damp or wet locations.
- B. Fasteners:
 1. General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.
 2. Damp or Wet Locations: Stainless steel screws and hardware.

C. Outlet Boxes:

1. Boxes shall be of type, shape, size, and depth to suit each location and application.
2. Steel Boxes: Sheet steel with stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior rings and fixture studs..
3. Cast Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location; including mounting ears, threaded screw holes' for devices and closure plugs.

D. Pull and Junction Boxes:

1. Boxes shall have screwed or bolted on covers of material same as box and shall be of size and shape to suit application.
2. Galvanized Steel Boxes: Flat rolled, code gauge, sheet steel with welded seams. Hot-dip galvanized after fabrication. Cover shall be gasketed.
3. Stainless-Steel Boxes: Fabricate of stainless steel conforming to Type 304 of ASTM A167. Cover shall be gasketed.
4. Galvanized Cast-Iron Boxes: Molded of cast iron alloy with gasketed cover and integral threaded conduit entrances.
5. Boxes Approved for Classified Locations: Cast metal or cast nonmetallic boxes conforming to UL 886 listed and labeled for use in specific location classification, and with specific hazardous material encountered. Conduit entrances shall be integral threaded type.

2.06 WIRES, CABLES, AND CONNECTORS

A. Building wires and cables with insulation type, cable construction, and rating as required to meet application and NEC requirements.

B. Manufacturers:

1. Wire and Cable:
 - a. Southwire.
 - b. Rome Cable.
 - c. Houston Wire and Cable.

- d. Belden.
- 2. Connectors:
 - a. Burndy.
 - b. Thomas and Betts.
 - c. Blackburn, Thomas and Berts.:
- C. Copper wire only.
- D. 600 v insulation (ASTM standard compounds) and color code conductors for low voltage (secondary feeders and branch circuits) as required by NEC.
 - 1. Type THWN Stranded: Single conductor No. 12 AWG minimum for branch" circuit and feeder conductors size No. 8 AWG and smaller.
 - 2. Type XHHW Stranded: Single conductor for branch circuits, feeders, and service conductors larger than No. 8 AWG
 - 3. Provide grounding conductor when run with circuit conductors with same insulation as circuit conductors.
 - 4. Type THWN Stranded: Single conductor No. 12 AWG minimum for 120 v control wiring and No. 14 AWG minimum for graphic indication, nonshielded instrumentation and other control wiring operating at less than 120 v unless otherwise noted on Drawings.
 - 5. PVC insulation, tinned copper (19 by 27) stranded. No. 16 AWG, twisted pair cabled with aluminum mylar shielding, stranded, tinned, No. 18 AWG copper drain wire, and overall black FR-PVC, 90°C, 600 volt Jacket for interference sensitive instrumentation wiring.
- E. Joints, Taps, and Splices:
 - 1. Joints, Taps, and Splices in Conductors No. 10 AWG and Smaller: UL listed pre-insulated compression spring-type solderless connectors.
 - 2. Joints, Taps, and Splices in Conductors No. 8 AWG and Larger: Solderless 2 or 4 -bolt compression type connectors of type that will not loosen under vibration or normal strains.
- F. Terminations:
 - 1. Power Conductors: Compression crimp type lugs.

2. Control and Instrumentation Conductors: Compression crimp type fork tongue, insulated support type lugs on terminal strips. Do not splice.

2.07 WIRING DEVICES

A. Manufacturers:

1. Hubbell Wiring Device Division.
2. Pass and Seymour, Inc.
3. Appleton Electric Company.
4. "Crouse-Hinds Company.

B. Color: Ivory unless otherwise indicated or required by NEC.

C. Switches:

1. General Use Lighting Switches: 20 amp toggle, equal to Hubbell No. 1221-1 series.
2. Switches controlling equipment, operation of which is not evident from switch position, shall include flush neon pilot light in conjunction with proper switch. Each switch shall be complete with engraved plate to identify equipment being controlled (white letters on black, 1/8 in. high minimum).

D. Receptacles:

1. General use duplex receptacles: ;NEMA No. 5-20R, grounding type, 20 amp Hubbell No. 5362 Specification Grade.
2. Special purpose receptacles as shown on Drawings and schedules.

E. Ground-Fault Circuit Interrupter Receptacles (GFCI).

1. Ratings: 120 vac., 20 amp.
2. Tripping Requirement: UL Class A.
3. Construction:
 - a. Shallow depth.
 - b. Line and load terminal screws.
 - c. Noise suppression.

- d. Feed through.
 - e. Standard duplex wall plates shall fit.
 - f. NEMA 5-20R configuration.
- 4. Meet requirements of UL 943 ground-fault circuit interrupters.
- F. Wiring Device Plates and Covers:
 - 1. Wall plates for wiring devices with ganging and cut-outs as indicated, provided with metal screws for securing plates to devices, screw heads colored to match finish of plate.
 - 2. Plates for Flush Mounted Devices:
 - a. Hubbell 302/304 stainless steel.
 - 3. Device plates for surface mounted Type FS or FD boxes to be Type FSK galvanized steel.
 - 4. Device plates for surface mounted, 4 in. sq boxes to be 1/2 in. raised galvanized steel covers.
 - 5. Weatherproof plates and covers for exterior devices or devices in damp locations to be galvanized gray cast malleable with gasketed, lift cover plate.
 - 6. Weatherproof plates and covers suitable for wet locations while in use.
 - a. Hinged and gasketed cover/enclosure to maintain weather tight seal while the equipment is plugged into it. TayNac or equal.
- G. Explosionproof Devices:
 - 1. Wiring devices for use in hazardous areas shall be explosionproof approved for Class I, Division 1, Group D areas.
 - 2. Receptacles: Appleton Cat.No.EFS B175-2023M, Crouse-Hinds Cat No. ENR 2I20 or equal NEMA 5-20R.
 - 3. Plugs: Match receptacles. Furnish 1 plug for each receptacle installed.
 - 4. Switches: Appleton EPS series, Crouse-Hinds EDS series or equal.

2.08 MOTOR STARTERS

16050-8

A. Manufacturers:

1. Eaton/Cutler-Hammer.
2. Square D.
3. Alien Bradley.

B. Enclosures:

1. NEMA 1 in electrical equipment rooms
2. NEMA 4X stainless steel with watertight hubs for outdoor and wet locations.
3. NEMA 7 in hazardous classified locations.
4. As otherwise indicated and as required by NEC.

C. Manual Starters:

1. Minimum short circuit withstand rating in combination with motor circuit protective device shall be 10,000 symmetrical amps or as indicated on Drawings.

D. Manual Motor Starter Construction:

1. Quick make and break toggle action.
2. Double break silver alloy contacts.
3. 1-piece melting alloy type thermal overload units.
4. Starter inoperative unless thermal unit in position.
5. Padlock provision.
6. Pilot light.
7. NEMA standards for size and hp rating.

E. Magnetic Starters:

1. Minimum short circuit withstand rating in combination with motor circuit protective device shall be 22,000 symmetrical amps or as indicated on Drawings.

F. Magnetic Motor Starter Construction:

1. Full voltage, nonreversing, across the line, unless otherwise

indicated.

2. Mounted in vertical position, gravity dropout.
3. Double break silver alloy contacts.
4. Molded coil.
5. Contacts and coil replacement without removing starter from enclosure or power wiring from starter..
6. Straight-through wiring.
7. Overload Relay:
 - a. Electronic solid state type with inverse-time-current characteristic, phase loss and phase unbalance protection for size 2 and larger.
 - b. 1-piece thermal unit construction for size 1.
 - c. 1 melting alloy type overload relay per phase, manually reset.
 - d. Interchangeable thermal units.
 - e. Thermal units must be in-place to operate starter.
 - f. Replaceable overload relay circuit contacts.
 - g. NEMA Class 20 heaters or sensors in each phase matched to riamplate full load current of motor, unless otherwise indicated.
8. NEMA standards for size and hp rating.
9. NEMA Size 1 minimum.

G. Combination Starter:

1. Combination Starters:
 - a. Thermal-magnetic circuit breaker type.
 - b. Three-pole, three-phase NEMA size as indicated with three melting alloy or solid state overload relays.
 - c. Hand-Off-Auto selector switch.

H. Control Circuits:

1. Voltage not to exceed 120 v.
2. Control transformer mounted in starter enclosure.
3. Fuses on one secondary line.
4. One secondary line grounded.
5. Transformer sized for device, accessories connected thereto, and 25% extra capacity minimum.

I. Controls:

1. Reset button mounted in enclosure cover.
2. Heavy duty, oiltight green push to test pilot lights mounted in enclosure cover when indicated.
3. Heavy duty, oiltight pushbuttons and selector switches mounted in enclosure when indicated.
4. 6-digit type elapsed time meters in tenths of hr mounted in enclosure cover when indicated.

2.09 MOTOR AND CIRCUIT DISCONNECTS

A. Manufacturers:

1. Eaton/Cutler-Hammer.
2. Square D.

B. Enclosed Circuit Breaker Construction:

1. Dual cover interlock.
2. External trip indication.
3. Provisions for control circuit interlock.
4. Padlock provisions for padlock in Off position.
5. Handle attached to box, not cover.
6. Handle position indicates On, Off or Tripped.
7. Provisions for insulated or groundable neutral.

C. Permanent Trip Circuit Breakers:

1. Thermal and magnetic protection.

2. Magnetic protection only in combination with motor starters and motor circuit protectors (MCP),
3. Single magnetic trip adjustment.
4. Single-handle common trip, 2 and 3 poles (handle ties not acceptable).
5. Push-to-trip test button.
6. Bolt-on type.
7. Quick make and break toggle action.
8. Handle trip indication.
9. Handle position indication, On, Off, and Tripped centered.
10. UL listed for type of wire specified.
11. UL listed short circuit rating (integrated equipment rating).
 - a. Up to 240 v: 10,000 RMS symmetrical amp minimum.
 - b. Up to 480 v: 14,000 RMS symmetrical amp minimum.

D. Safety Switches:

1. NEMA heavy duty Type HD.
2. Dual cover interlock.
3. Visible blades.
4. Provisions for control circuit interlock.:
5. Pin type hinges.
6. Tin plated current carrying parts.
7. Quick make and break operator mechanism.
8. Handle attached to box, not cover.
9. Handle position indication, On in up position and Off in down position.
10. Padlock provisions for up to 3 padlocks in Off position.
11. UL listed lugs for type and size of wire specified.

12. Spring reinforced fuse clips for Class R fuses.
13. Provisions for insulated or groundable neutral.
14. UL listed short circuit rating 200,000 RMS amp with Class R fuses.

E. Enclosures:

1. indicated and as required by NEC.

2.10 FUSES

A. Manufacturers:

1. Bussmann.
2. Gould Shawmut.
3. Littlefuse.

B. 250 v Fuses:

1. Class RK 1,1 -end rejection or to fit mountings specified, 1/10 to 600 amps, 200,000 amp interrupting rating.
 - a. Bussmann Low-Peak. LPN-R, dual element, time delay with short circuit protection for motor, transformer, welder, feeder, and main service protection.

C. 600 v Fuses:

1. Class IUC 1,1 -end rejection or to fit mountings specified, 1/10 to 600 amps, 200,000 amp interrupting rating.
 - a. Bussmann Low-Peak. LPS-R, dual element, time delay with short circuit protection for motor, transformer, welder, feeder and main service protection.
2. Class CC, fast acting, single element, 1/10 to 30 amps, 200,000 amp interrupting rating.
 - a. Bussmann Limitron. KTK-R, UL listed for motor control circuits, lighting ballasts, control transformers, and street lighting fixtures.

D. Spare Fuses:

1. 10%, minimum of 3, of each type and rating of installed fuses.
TANELBOARDS"

2.11 PANELBOARDS

A. Manufacturers:

1. Eaton/Cutler-Hammer.
2. Square D.

B. Panelboard Ratings:

1. UL listed short circuit rating (integral equipment rating):
 - a. Up to 240 v: 10,000 RMS symmetrical amp minimum.
 - b. Up to 480 v: 14,000 RMS symmetrical amp minimum.
 - c. As shown on Drawings.

C. Panelboard Construction:

1. Main breaker or main lugs only, per panelboard schedule.
2. Flush or surface mounted as indicated on panelboard schedule.
3. NEMA Type 1 enclosure, unless otherwise indicated on panelboard schedule.
4. Equipment ground bus adequate for feeder and branch-circuit equipment ground conductors," bonded to box.
5. Listed for use as service equipment for panelboards with main service disconnect.
6. Molded case circuit breakers.
7. Terminals:
 - a. UL listed for type of wire specified.
 - b. Anti-turn solderless compression type.
8. Bussing:
 - a. Distributed phase sequence type.
 - b. 225 amps, 98% conductivity hard drawn copper or as shown on panelboard schedule or Drawings.
 - c. Copper.
 - d. Bussing and mounting hardware behind all usable space.

9. Gutters adequate for wire size used, 4 in. minimum.
10. Boxes:
 - a. Code gauge galvanized steel.
 - b. Without knockouts.
11. Fronts:
 - a. Rust inhibiting primer, baked enamel finish.
 - b. Dead front safety type.
 - c. Concealed hinges.
 - d. Flush stainless steel cylinder tumbler type locks with spring loaded door pulls.
 - e. Circuit Directory:
 - 1) Suitable for complete descriptions.
 - 2) Clear plastic cover.
 - 3) Typewritten card.
12. Special features as shown on Drawings.
13. Engraved laminated nameplate:
 - a. Stock melamine plastic laminate.
 - b. Legend in black letters on white face and punched for mechanical fasteners.
 - c. Except as otherwise indicated, provide single line of text, with 1/2 in. high lettering on 1-1/2 in. high label (2 in. high where two lines are required). Text shall match terminology and numbering of Contract Documents and Shop Drawings.

D. Panelboard Circuit Breakers:

1. Thermal and magnetic protection.
2. Single-handle common trip, 2 and 3 poles (handle ties not acceptable).
3. Bolt-on type unless otherwise noted on Drawings.

4. Quick make and break toggle action.
5. Handle trip indication.
6. Handle position indication, On, Off, and Tripped centered.
7. UL listed for type of wire specified.
8. UL listed short circuit rating (integrated equipment rating).
 - a. Up to 240 v: 10,000 RMS symmetrical amp minimum.
 - b. Up to 480 v; 14,000 RMS symmetrical amp minimum.
9. HACR breakers for air conditioning units.
10. UL SWDL switching duty on 120 v circuits for switched circuits.

2.12 TRANSFORMERS

A. Manufacturers:

1. Eaton/Cutler-Hammer.
2. Square D.

B. Materials and Equipment:

1. Dry type, air cooled.
2. Insulation
 - a. Below 30 kVa: Class F or better, having 115°C rise, average maximum over 40°C ambient temperature.
 - b. 30 kVa and Above: Class Her better, having 150°C rise, average maximum over 40°C ambient temperature.
3. Copper windings.
4. Cores: High grade, non-aging, sheet silicone steel laminations having core plating insulation on both sides of each lamination.
5. Terminal boards.
6. Taps: Two 2-1/2% taps above and below.
7. Overload Capacity: Not less that 10% for intermittent operation.
8. Size: kVa as indicated on Drawings and schedules.

9. Transformers shall be quiet type for installation in areas of low ambient noise levels. Maximum sound levels shall not exceed NEMA standards.
10. Cabinets: Sheet steel, phosphatized having one prime coat and two finish coats of baked enamel.
 - a. Indoor, ventilated unless otherwise indicated.
 - b. Wall mounting brackets through 75 kVa when indicated as wall mounted.
11. Nameplate: Metal nameplate listing manufacturer's name, serial number, type, class, kVa voltage, frequency, and showing internal wiring diagram.
12. Comply with UL 506.

PART 3 EXECUTION

3.01 RACEWAY SYSTEMS

- A. Outdoors, Damp or Wet Locations: Use following wiring methods unless otherwise noted on Drawings:
 1. Exposed: Galvanized rigid steel.
 2. Concealed: Galvanized rigid steel.
 3. Underground Power: As specified in Section 16135.
 4. Underground Shielded Instrumentation Cables: As specified in Section 16135.
 5. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquidtight flexible metal conduit.
- B. Indoor Dry Locations: 'Use following wiring methods unless otherwise noted on Drawings.'
 1. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquidtight flexible metal conduit.
 2. Exposed: Galvanized rigid steel conduit.
 3. Concealed: Galvanized rigid steel conduit.

- C. Hazardous Classified Locations: Use following wiring methods unless otherwise noted on Drawings. 1. Exposed and Concealed:
Galvanized rigid steel conduit.
- D. Use 3/4 in. minimum trade size conduit unless otherwise noted except conduit runs to room light switches may be 1/2 in.
- E. In precast areas, run conduits in insulation space or in floor topping without crossing conduits, using 3/4 in. maximum conduit size.
- F. Raceways Embedded in Slabs: Use galvanized rigid steel conduit. Install in middle third of slab thickness where practical, and leave at least 1 in. (25 mm) concrete cover.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.'
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Run conduit larger than 1 in; trade size parallel to or at right angles to main reinforcement and spaced on center of at least 3 times conduit trade dia. with minimum 2 in. concrete covering. Conduits over 1 in. may not be installed in slab without approval of ENGINEER.
 - 4. When at right angles to reinforcement, place conduit close to slab support.
 - 5. Conduits embedded in concrete frame shall comply with applicable provisions of ACI 31.
- G. Examine surfaces to receive raceways, wireways, and fittings for compliance with installation tolerances and other conditions affecting performance of raceway system.
- H. Coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate headroom, working clearance, and access.
- I. Complete conduit installation prior to installing cables.
- J. Raceway systems shall be continuous from outlet to outlet and from outlets to cabinets, junction or pull. boxes.
- K. Enter and secure to boxes ensuring electrical continuity from point of service to outlets.
- L. Conduit shall be run concealed except exposed surface conduit may be installed where noted on Drawings or where concealment found to be impractical or impossible, and only with approval of ENGINEER.

- M. Provide watertight conduit system where installed in wet places, underground or where buried in masonry or concrete.
 - 1. Use threaded hubs when entering top of enclosures.
 - 2. Use sealing type locknuts when entering sides or bottom of enclosures.
- N. Conduit runs extending through areas of different temperature or atmospheric conditions or partly indoors and partly outdoors shall be sealed, drained, and installed in manner preventing drainage of condensed or entrapped moisture into cabinets, motors or equipment enclosures.
- O. Cap conduits after installation to prevent entry of debris.
- P. Connections to motors and equipment subject to vibration shall be maximum of 3 ft long. Locate where, least subject to physical abuse.
- Q. Install conduit expansion fittings complete with bonding jumper in following locations.
 - 1. Conduit runs crossing structural expansion joint.
 - 2. Conduit runs attached to 2 separate structures.
 - 3. Conduit runs where movement perpendicular to axis of conduit may be encountered.
- R. Keep raceways at least 6 in. away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.
- S. Install separate ground conductor inside flexible conduit connections.
- T. Use approved flexible connections in hazardous locations.
- U. Use explosionproof fittings and seals in hazardous areas in accordance with NEC.
- V. PVC Coated Galvanized Rigid Steel Conduit: Use only fittings approved for use with that material. Patch nicks and scrapes in PVC coating after installing conduit.
- W. Transition under floor conduit to galvanized rigid steel conduit before rising above floor. Wrap with plastic tape to provide 40 mil thick cover to height of 6 in. above floor.

3.02 BOXES

- A. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.
- B. Support and fasten items in accordance with Section 16070.

- C. Do not bum holes, use knockout punches or saw.
- D. Provide outlet box accessories as required for each installation such as mounting brackets, fixture studs, cable clamps, and metal straps for supporting outlet boxes compatible with outlet boxes being used and meeting 'requirements of individual wiring situations.'
- E. Sizes shall be adequate to meet NEC volume requirements, but in no case smaller than sizes indicated.
- F. Location of outlets and equipment shown on Drawings is approximate. Verify exact location.
- G. Flush outlets shall have edges or plaster flush with finished wall or ceiling surfaces so plates can be drawn tightly to wall or ceiling surfaces.
- H. Minor modification in location of outlets and equipment is considered incidental up to distance of 10 ft with no additional compensation, provided notification of modification is given prior to roughing in of outlet.
- I. Outlet Boxes and Fittings: Install outlet and device boxes and associated covers and fittings of materials and NEMA types for each location in conformance with following requirements unless otherwise noted on Drawings:
 - 1. Interior Dry Locations: Sheet steel, NEMA type 1 for flush mounting and feraloy Type FS or PD cast boxes with threaded conduit hubs for surface mounting.
 - 2. Locations Exposed to Weather or Dampness: Stainless steel, NEMA Type 4X.
 - 3. Wet Locations: Stainless Steel, NEMA type 4X enclosures.
 - 4. Corrosive 'Locations: Stainless "Steel, NEMA type 4X enclosures
 - 5. Hazardous (Classified) Locations: NEMA type listed and labeled for location and class of hazard indicated.
- J. Pull and Junction Boxes: Install pull and junction boxes of materials and NEMA types suitable for each location.
- K. Mounting height as follows unless otherwise shown on Drawings:
 - 1. Switches: 48 in. above floor.
 - 2. ac Receptacles: 15 in. above floor in finished areas; 48 in. above floor in unfinished areas.
 - 3. Pushbuttons: 48 in. above floor.

4. Motor Starters and Disconnect Switches: 60 in. above floor.
5. Thermostats: 60 in. above floor.
- L. Do not install boxes back to back or through wall. Offset outlet boxes on opposite sides of wall, minimum 12 in.

3.03 WIRE AND CABLE

- A. Install wires and cables as indicated, according to manufacturer's Written instructions and NECA "Standard of Installation".
- B. Run wire and cable in conduit unless otherwise indicated on Drawings.
- C. On branch circuits, use standard colors.
- D. Run ground wire with power circuits; conduit shall not be grounding path.
- E. Provide separate conduit systems for following.
 1. Line voltage control.
 2. Low voltage control.
 3. Shielded instrumentation.
 4. As required by NEC.
- F. Where power cables and instrument/signal cables enter and pass through same distribution box, steel barrier or steel conduit separation shall be maintained to avoid magnetic interaction between power cables and instrumentation conductors.
- G. Run instrumentation cable into control cabinets or MCC only if terminated therein.
- H. Terminate control, instrumentation, and communication cables on terminal strips in separate terminal cabinets located near conduit entrances of buildings or as shown on Drawings.
- I. Color Coding: Conductors for lighting and power wiring as indicated below.

Phase	208/120 v	480/277 v
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Travlers	Pink	Purple
Neutrala	White	White with Non-green stripe
Ground	Green	Green

- J. Color coding for intrinsically safe systems shall be light blue.

3.04 JOINTS, TAPS, AND SPLICES

- A. Where pre-insulated spring connectors are used for motor and equipment connections, tape connector to wire to prevent loosening under vibration.
- B. Each tap, joint or splice in conductors No. 8 AWG and larger shall be taped with 2 half-lap layers of vinyl plastic electrical tape and finish wrap of color coding tape where required by code.
- C. Cable splices shall be made only in wireways, distribution boxes, and junction boxes,

3.05 WIRING DEVICES

- A. Do not install devices until wiring is. Complete.
- B. Do not use terminals on wiring devices (hot or neutral) for feed-through connections, looped or otherwise. Make circuit connections by using wire connectors and pigtails.
- C. Install gasket plates for devices or system components having light emitting features such as switch with pilot light and dome lights. Where installed on rough textured surfaces, seal with black self-adhesive polyfoam.
- D. Ground receptacles with insulated green ground wire from device ground screw to bolted outlet box connection or as shown on Drawings.
- E. Install GFCI receptacles as required by NEC.

3.06 MOTOR STARTERS

- A. Examine area to receive motor starters to ensure adequate clearance for starter installation.
- B. Anchor firmly to wall or structural surface.
- C. Support and fasten in accordance with Section 16070.

3.07 MOTOR AND CIRCUIT DISCONNECTS

- A. Locate disconnect switches as shown on Drawings and required by NEC.
- B. Provide control circuit interlock as required by NEC.
- C. Overcurrent protective devices.
 - 1. Install fuses just prior to energizing equipment

2. Locate circuit breakers as shown on Drawings.

D. Install on equipment rack or anchor firmly to wall or structural surface.

E. Support and fasten in accordance with Section 16070.

3.08 PANELBOARDS

A. Support panel cabinets independently to structure with no weight bearing on conduits.

B. Install panelboards so top breaker is not higher than 6 ft 0 in. above floor.

C. Adjacent panel cabinets shall be same size and mounted in horizontal alignment

D. Install typewritten directory in each panelboard, accurately indicating rooms or equipment being served after final circuit changes have been made to balance circuit loads.

E. Install filler plates in unused spaces.

3.09 TRANSFORMER

A. Install wall mounted transformers on prefabricated brackets designed for that purpose.

B. Install floor mounted transformers on 4 in. high concrete housekeeping pads.

C. Tighten bus connections and mechanical fasteners.

D. Adjust voltage taps for required system voltage and check grounding requirements.

3.10 FIELD QUALITY CONTROL

A. Control Circuits, Branch Circuits, Feeders, Motor Circuits, and Transformers:

1. Megger check of phase-to-phase and phase-to-ground insulation levels.

a. Do not megger check solid state equipment.

2. Continuity.

3. Short circuit.

4. Operational check.

B. Wiring Devices:

1. Test receptacles with Hubbell 5200, Woodhead 1750 or equal tester for correct polarity, proper ground connection, and wiring faults.

3.11 ADJUSTMENT AND CLEANING

A. Motor Starters and Disconnects:

1. Adjust covers and operating mechanisms for free mechanical movement.
2. Tighten wire and cable connections.
3. Verify overcurrent protection thermal unit size with motor nameplate to provide proper operation and compliance with NEC.
4. Clean interior of enclosures.
5. Touch up scratched or marred surfaces to match original finish.

B. Circuit Breakers:

1. Adjustable settings shall be set to provide selective coordination, proper operation, and compliance with NEC.

END OF SECTION

SECTION 16060 GROUNDING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems.
 - 2. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

1.02 SUBMITTALS

- A. Report of Field Tests and Observations: Certified by CONTRACTOR.
- B. Test Results:
 - 1. Certified field tests and observation reports indicating and interpreting test reports for compliance with performance requirements.
- C. Submit in accordance with Section 01340.

1.03 QUALITY ASSURANCE

- A. Comply with UL 467.
- B. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).
 - 1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
 - 2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.
- C. Regulatory Requirements:
 - 1. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING PRODUCTS

- A. Governing Requirements: Where types, sizes, ratings, and quantities are indicated are in excess of NEC requirements, more stringent requirements and greater size, rating, and quantity indications govern.

2.02 WIRE AND CABLE GROUNDING CONDUCTORS

- A. Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.
 - 1. Material: Copper.
- B. Equipment Grounding Conductors: Insulated with green color insulation.
- C. Grounding-Electrode Conductors: Stranded cable.
- D. Underground Conductors: Bare, tinned, stranded, except as otherwise indicated.
- E. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B3.
 - 2. Assembly of Stranded Conductors: ASTM B8.
 - 3. Tinned Conductors: ASTM B3 3.

2.03 MISCELLANEOUS CONDUCTORS

- A. Grounding Bus: Bare, annealed-copper bars of rectangular cross section.
- B. Braided Bonding Junipers: Copper tape, braided No. 30 AWG bare copper wire, terminated with copper ferrules.
- C. Bonding Straps: Soft copper, 0.05 in. (1 mm) thick and 2 in. (50 mm) wide, except as indicated.

2.04 CONNECTOR PRODUCTS

- A. Pressure Connectors: High-conductivity-plated units.
- B. Bolted Clamps: Heavy-duty type.
- C. Exothermic-Welded Connections: Provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items.

2.05 GROUNDING ELECTRODES

- A. Grounding Rods: Copper-clad steel.
 - 1. Size: 3/4 in. by 120 in. (19 by 3000 mm).

PART 3 EXECUTION

3.01 APPLICATION

- A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.
 - 1. Install equipment grounding conductor with circuit conductors for items below in addition to those required by Code:
 - a. Feeders and branch circuits.
 - b. Lighting circuits.
 - c. Receptacle circuits.
 - d. Single-phase motor or appliance branch circuits. e. Three-phase motor or appliance branch circuits. f. Flexible raceway runs.
 - 2. Nonmetallic Raceways: Install equipment grounding conductor in nonmetallic raceways unless they are designated for data cables.
- B. Separately Derived Systems: Where NEC requires grounding , round according to NEC Paragraph 250-26.
- C. Piping Systems and .Other Equipment: Comply with-NEC Article 250 for. bonding requirements.

3.02 INSTALLATION

- A. Ground electrical systems and equipment according to NEC requirements, except where Drawings or Specifications exceed NEC requirements.
- B. Grounding Rods: Locate minimum of 1 rod length from each other and at least same distance from any other grounding electrode.
 - 1. Drive until tops are 2 in. (50 mm) below finished floor or final grade, except as otherwise indicated.
 - 2. Interconnect with grounding-electrode conductors. Use exothermic welds, except as otherwise indicated. Make these connections

without damaging copper coating or exposing steel.

- C. Grounding Conductors: Route along shortest and straightest paths possible, except as otherwise indicated. - Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- D. Underground Grounding Conductors: Use bare copper wire. Bury at least 24 in. (600 mm) below grade.
- E. Metal Water Service Pipe: Provide insulated copper grounding conductors, sized as indicated, in conduit, ' from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding-clamp connectors. Where dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Do not install grounding jumper across dielectric fittings. Bond grounding-conductor conduit to conductor at each end.
- F. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding-clamp connectors.
- G. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

3.03 CONNECTIONS

- A. Make connections so possibility of galvanic action or electrolysis is minimized, Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces."
- B. Exothermic-Welded Connections: Use for connections to structural steel

and for underground connections. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

- C. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact Metal Raceway Terminations: Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing or a grounding bushing with bare grounding conductor to grounding bus or terminal-in housing. • Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.
- E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL486A and UL486B.
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make visible indication that connector has been adequately compressed on grounding conductor.
- G. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.04 FIELD QUALITY CONTROL

- A. Testing:
 - 1. Subject completed grounding system to megger test at each location where maximum ground-resistance level is specified and at service disconnect enclosure grounding terminal. " "
 - 2. Measure ground resistance not less than 2 full days after last trace of precipitation, and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - 3. Perform tests by 2 point method according to Section 9.03 of IEEE 81.
- B. Maximum grounding to resistance values are as follows:
 - 1. Equipment Rated 500 RVA and Less: 10 ohms.

- C. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify ENGINEER promptly and include recommendations to reduce ground resistance and to accomplish recommended work.
- D. Report: Prepare certified test reports, of ground resistance at each test location; Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

3.05 RESTORATION

- A. Restore surface features, including vegetation, at areas disturbed by work of this Section.
 - 1. Re-establish original grades, except as otherwise indicated"
 - 2. Where sod has been removed, replace it as soon as possible after backfilling is completed.
 - 3. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition.
 - 4. Include topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.
 - 5. Maintain restored surfaces.
 - 6. Restore disturbed paving.

END OF SECTION

SECTION 16100

GENERAL PROVISIONS

PART 1 GENERAL

- 1.01 The General and Special Conditions and all other CONTRACT DOCUMENTS are applicable to WORK under this section of the SPECIFICATIONS. All the WORK under this section of the SPECIFICATIONS shall be governed by any alternates and unit prices called for in the FORM OF PROPOSAL insofar as they affect this portion of the WORK.
- 1.02 Include furnishing of all labor, materials, equipment and other related items required to complete the WORK called for and indicated on the CONTRACT DRAWINGS and specified for a complete system, including excavation, backfilling and tamping. Classification of excavation and payment for same shall be in accordance with applicable provisions of these SPECIFICATIONS.
- 1.03 Abbreviations of organizations and publications:
- | | | |
|-------|---|---|
| NEC | - | National Electrical Code |
| UL | - | Underwriters Laboratories, Inc. |
| IPCEA | - | Insulated Power Cable Engineers Association |
| ANSI | - | American National Standards Institute |
| OSHA | - | Occupational Safety Health Act |
- 1.04 All materials shall be new and the best of their respective kinds unless otherwise specified and shall be listed by the UL and shall be so labeled. All equipment shall conform to the latest approved standards of the IEEE, NEMA, ANSI and OSHA.

PART 2 COOPERATION

- 2.01 Check with other trades on the scope of their WORK and coordinate on all locations of various items of equipment and outlets before they are finally placed and connected. Any relocation of material or equipment necessitated by failure to coordinate WORK shall be at no cost to the OWNER.
- 2.02 Do not cut the WORK of any other trade without first consulting the ENGINEER'S representative. Repair any WORK damaged employing the services of the trade whose WORK is damaged.

PART 3 SCOPE

- 3.01 The WORK covered by this section of the CONTRACT shall include the furnishing of all labor, materials, tools and equipment necessary to complete the electrical WORK as herein specified, or implied and as shown or implied on the CONTRACT DRAWINGS.

- 3.02 The CONTRACTOR shall note that most of the electrical conduit, boxes and wiring are existing. The CONTRACTOR shall visit the site prior to BID and satisfy themselves as to the extent of existing WORK and new WORK required to complete the project as indicated. Submission of a BID will be interpreted that the visit has been done and no extra will be allowed for additional WORK as a result of not doing the inspection of existing conditions.

PART 4 DRAWINGS AND SPECIFICATIONS

- 4.01 The CONTRACT DRAWINGS and SPECIFICATIONS are intended to cover all WORK enumerated under the respective headings. Examine all CONTRACT DRAWINGS and SPECIFICATIONS to determine any references to WORK of an electrical nature and be guided accordingly in prosecuting the electrical WORK. The CONTRACT DRAWINGS are diagrammatic only, as far as final location is concerned. Any item of WORK not clearly included, specified or shown, and any errors or conflict between CONTRACT DRAWINGS, SPECIFICATIONS, codes and field conditions shall be clarified by a written request to the ENGINEER prior to bidding, otherwise all labor and materials required to make good any damage or defect in finished WORK caused by such error, omission or conflict shall be provided at no additional cost to the OWNER.

PART 5 CODE COMPLIANCE, INSPECTION AND CERTIFICATES

- 5.01 The minimum standards for all electrical WORK shall be the 1996 revision of the NEC. Whenever and wherever OSHA and/or federal, state and/or local laws or regulations and/or design require higher standards than the NEC, then these laws and/or regulations and/or design shall be followed.
- 5.02 Furnish electrical inspection by a licensed electrical inspector. Notify the electrical inspector in writing, immediately upon the start of the WORK with a copy of the notice to the ENGINEER. The inspector shall be scheduled for rough as well as finished WORK. Approval from the electrical inspector will not be allowed as reason for deviation from the CONTRACT DRAWINGS and SPECIFICATIONS. All cost incidental to the electrical inspection shall be borne by the CONTRACTOR.

PART 6 CLEANING

- 6.01 At the completion of the WORK required under this contract and just prior to acceptance by the OWNER, thoroughly clean all exposed equipment fittings, fixtures and accessories.

PART 7 CONNECTIONS TO EQUIPMENT BY OTHERS

- 7.01 Provide all conduit, boxes and wire with required connections, including any disconnect switches required by NEC to all electrically powered or controlled equipment furnished and set in place by others. Examine all divisions of the SPECIFICATIONS and all CONTRACT DRAWINGS to determine location and size of all electrically powered or controlled equipment.

PART 8 PHASING

- 8.01 Verify the rotation of all three phase motors with the trade furnishing equipment. These motors shall be "bumped" or run uncoupled in the presence of the trade furnishing the equipment to insure proper rotation.

PART 9 SPECIAL NOTE

- 9.01 All openings in electrical equipment, enclosures, cabinet outlets and junction boxes shall be by means of standard knockouts or shall be sawed or drilled. The use of a cutting torch is prohibited.

PART 10 PIPE SLEEVES AND FIRE RATING OF OPENINGS

- 10.01 Wherever conduit pass through floor slabs in other than slab on grade construction, steel sleeves shall be provided for each conduit. Sleeves shall project 3/8" above slab and spaces between conduit and sleeves shall be caulked with a material which will provide a fire rating substantially the same as the unpierced floor.
- 10.02 Holes through walls and ceilings, chases, shafts, etc., for the passage of cable or conduit shall be made so as to substantially preserve the integrity of the fire rating of such surfaces or passages in accordance with NEC 300-21.
- 10.03 Where conduit penetrates the roof, such penetration shall be through an opening approved by manufacturer of the roof.

PART 11 EXCAVATION AND BACKFILLING

- 11.01 Perform all excavation and backfilling required for completion of WORK indicated on the CONTRACT DRAWINGS and specified herein. Classification of excavation and prices for excavation shall be in accordance with the applicable division of these SPECIFICATIONS.
- 11.02 Backfill material for conduit or direct bury cable unless otherwise specified and/or noted on the DRAWINGS shall be clean earth, free from rock and debris, thoroughly tamped in six inch (6") layers to the finished grade.
- 11.03 During the progress of the project, the premises shall be kept reasonably clean and free from accumulate rubbish and debris. Proper care shall be exercised to protect all trees, shrubbery, and etc., in the vicinity of the work. All surplus earth shall be disposed of as directed by the ENGINEER.
- 11.04 Compaction of backfill in place shall be 95% of maximum density.

PART 12 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

- 12.01 At completion of the CONTRACT, the OWNER shall be provided with two (2) bound copies of operations and maintenance instructions for the various items of the electrical equipment, including existing motor control center, new panelboards, service equipment, lighting fixtures, etc.
- 12.02 In addition to manufacturer's approved SHOP DRAWINGS, manual shall include:
(a) A listing of equipment (identified in accordance with the DRAWINGS nomenclature, e.g. LF-1, M.D.P. etc.) and distribution or supplier of the equipment. In case of lighting fixtures, the type replacement lamp including recommended voltage and other necessary designation shall be included.
- 12.03 Instructions shall be included for routine checking of circuit breakers and fused switches.

PART 13 LABELING

- 13.01 All lighting and power panels, telephone cabinets, switches in distribution equipment, safety switches for remote equipment and all other items noted for labeling shall be properly identified in accordance with the designations shown on the DRAWINGS or the function they perform. This paragraph applies to both new and existing equipment.
- 13.02 Labels shall be 1/4" high, white letters on laminated phenolic engraving stock suitably cemented to the inside of the recessed panels and on the face of surface mounted panels and other equipment.

PART 14 FISH WIRE

- 14.01 All conduit required under this contract which do not receive conductors, shall be provided with a 14 gauge galvanized steel fish wire or approved nylon wire.

PART 15 "OR EQUAL" CLAUSE

- 15.01 The SPECIFICATIONS covering this WORK are open; wherever a specific manufacturer's item is specified, it is intended as a standard to be met and items which are approved equal or superior will be accepted.

PART 16 WARRANTY

- 16.01 CONTRACTOR shall include in BID price the warranty of all labor and equipment that is a part of this CONTRACT, including existing equipment that is reused, for a period of one year from the date of final completion.

END OF SECTION

SECTION 16200

GENERAL MATERIALS AND INSTALLATION

PART 1 GENERAL

- 1.01 In general, conduit shall be zinc-coated, rigid steel conduit and shall meet in all respects, the UL Standards for Rigid Steel Conduit. The conduit shall be metallized, galvanized, sherardized, or approved equal.
- 1.02 Rigid thick wall conduit or IMC shall be installed underground, as required or noted and in all concrete construction. Schedule 40 PVC conduit may be used below grade on exterior and below slab on interior of building. Exterior below grade PVC shall be concrete encased. Interior below slab PVC shall have 3" of cover between slab and conduit. If rock is present, provide 4" pad of same material as backfill. All risers through slab shall be with rigid steel elbows and extensions. Electrical metallic tubing may be used in other places unless otherwise noted. All thick wall terminals shall be capped with insulating bushings. Electrical metallic tubing shall be terminated with connectors with insulated throat. Metallined terminating fittings will not be acceptable. All terminating fittings shall be secured to box or cabinet with double lock-nut type of construction. Couplings and connectors for electrical metallic tubing shall be steel and shall be of the compression type. Set screw and indentation type connectors will not be acceptable, except that approved type steel set screw connectors may be used on EMT 2 - 1/2" or larger and on rigid conduit unless otherwise noted.
- 1.03 Runs of conduit or tubing shall have supports spaced in accordance with the NEC, and exposed conduit shall be installed with runs parallel or perpendicular to walls, structural members on intersections of vertical planes and ceilings, with right angle turns consisting of cast metal fittings or symmetrical bends. Bends or offsets shall be avoided where possible but where necessary shall be made with an approved conduit bending machine. Conduit or tubing which has been crushed or deformed in any way shall not be installed. Expansion fittings or other approved devices shall be used to provide for expansion or contraction where conduit or tubing crosses expansion joints. Conduit and tubing shall be supported on an approved type of ceiling trapeze, beam clamps, strap hangers, or pipe straps, secured by means of toggle bolts on hollow masonry units, expansion shields in concrete or brick and machine screws on metal surfaces. The use of tie wire for suspending conduits or securing same to joists, purlins, beams, etc., will not be allowed. Conduit and tubing shall be installed in such manner as to insure against trouble from the collection of trapped condensation, and all runs shall be arranged so as to be devoid of traps wherever possible. All necessary precautions to prevent the lodgment of dirt, plaster, or trash in conduit or tubing, fittings and boxes during construction shall be taken. A run of conduit or tubing which has become clogged shall be entirely freed of these accumulations or shall be replaced. Conduit shall be securely fastened to all sheet metal outlets, junction and pull boxes with double galvanized locknuts and

insulating bushings. All conduit in floors or below grade shall be swabbed free of debris or moisture before wires are pulled.

- 1.04 All underground metal conduit and conduit below slab shall be protected with (2) heavy coats of asphaltum paint.
- 1.05 The final 18 inch section of conduit connecting each motor shall be liquid tight flexible type.
- 1.06 All conduit shall be installed concealed unless otherwise noted or shown on the drawings.
- 1.07 No conduit smaller than 3/4" shall be used except as noted.
- 1.08 All conduit required under this contract, which do not receive conductors, shall be provided with 14 gauge copper or galvanized steel pull wires for future installation of the conductors by others.
- 1.09 No flexible conduit smaller than 1/2" shall be used except as permitted by NEC 350-3.

PART 2 OUTLET BOXES

- 2.01 Outlets shall be installed in the locations shown on the CONTRACT DRAWINGS. The general building PLANS shall be studied in relation to the spaces surrounding each outlet in order that WORK under this division of the SPECIFICATIONS may fit the WORK required under other divisions. When necessary, outlets shall be relocated so that when fixtures or other fittings are installed they will be symmetrically located according to room layout and will not interfere with other WORK or equipment. Only zinc-coated or cadmium plated, sheet-steel boxes according to NEC, of a class to satisfy the conditions for each outlet shall be used in concealed WORK. Boxes shall be installed in a rigid and satisfactory manner either by wood screws on wood, expansion shields on masonry, or machine screws on steel. Fixture outlet boxes in concrete ceilings shall be four (4") inch octagonal, concrete type, set flush with finished surfaces. Fixture outlet boxes on ceilings shall not be less than 4 inch octagonal.
- 2.02 All supports required for outlet boxes in addition to that furnished under the general building construction, shall be furnished and installed under this division of the SPECIFICATIONS. All supports shall be steel.
- 2.03 For masonry or drywall construction square cornered boxes measuring 3-3/4" high by approximately 2" wide and having interior device mounting holes shall be used.
- 2.04 Single gang boxes for devices shall be not less than 2-1/2" deep unless limited by depth of construction and shall accommodate up to five #12 conductors. When construction depth permits, 3-1/2" deep boxes shall be used for devices where the number of conductors entering a single gang outlet is 6 to 8. Where more than 8 conductors enter an outlet housing a single device, boxes shall be 4" square by 2-1/8" deep to accommodate a maximum of 14 conductors and shall

be provided with single device, square cornered tile wall covers of a suitable depth. Where construction depth is limited or to facilitate installation in cavity walls, 4" square boxes 1-1/2" deep may be used with single gang square cornered tile wallcovers in lieu of single gang, 2-1/2" or 3-1/2" deep boxes. Such installation shall be increased to conform with NEC requirements for conductors larger than #12 AWG.

- 2.05 Where two or more devices are to be ganged at one outlet, 3-3/4" high boxes as specified above and with the required number of gangs shall be used. Each gang shall be subject to the same "fill" limitations as for single gang installation.
- 2.06 Partitions shall be provided in ganged boxes as required for conformity with NEC 380-8.
- 2.07 Where tile covers are used they shall be of sufficient depth to bring the box opening within 1/4" of the finished wall surface.
- 2.08 Provide blank metal coverplates for all boxes which do not receive devices.

PART 3 WIRES AND CABLES (CONDUCTORS)

3.01 LOW VOLTAGE (0-600V)

- 3.1.1 Branch circuit conductors shall be not smaller than No. 12 A.W.G. Conductors for signal and pilot control circuits may be No. 14 A.W.G. Conductors shall be continuous from outlet to outlet and no splices shall be made except within outlet or junction boxes. Junction boxes may be utilized where required. Wire connectors of insulating materials or solderless pressure connectors properly insulated shall be utilized for all splices and wiring where possible. Rubber and friction tape shall conform to NEC and be UL approved. Vinyl plastic tape will be acceptable in lieu of rubber and friction tape. For branch circuit wires sizes #6 and smaller, and for fixture wiring, all splices shall be made with approved type crimp-on sleeves with separate outer insulating cap. In lieu of this, preinsulated, twist on torsion spring type connectors "Scotchlok" may be utilized. The use of threaded connectors with integral insulation of bakelite or other material will not be allowed.
- 3.1.2 Insulation unless otherwise noted shall be thermoplastic Type THHN-THWN. The color code shall be in accordance with the National Electrical Code.
- 3.1.3 All building wires shall be as manufactured by Paronite, General Electric, General Cable, Anconda, Simplex, Phelps-Dodge, Reynolds or approved equal.
- 3.1.4 All conductors shall be copper unless otherwise specified.
- 3.1.5 All existing conductors as well as new conductors shall be megged to level recommended by manufacturer to assure that the conductors and

insulation are not damaged or deteriorated. The engineer shall be furnished a copy of the report. Any conductors which do not meet standards shall be replaced.

PART 4 JUNCTION BOXES AND TERMINAL CABINETS

- 4.01 All junctions and terminals cabinets used under this contract shall be constructed of code gauge, galvanized steel and shall be as manufactured by B & C, Metal Stamping Company, Columbia Manufacturing Company, Boss or approved equal.

END OF SECTION

SECTION 16300

ELECTRICAL SERVICE

PART I GENERAL

- 1.01 The conduit system and neutral conductors of the wiring system shall be grounded in accordance with NEC. Grounding conductors of the electrical system shall be as shown on the contract drawings and shall be extended in conduit to the water service. Connection to the water pipe shall be made by approved ground clamps. All unions, valves, meters, etc., in the water line shall be bonded in accordance with the NEC, from the point of ground connection to the point where the water pipe enters the ground. The grounding system shall be installed in a workmanlike manner and shall be inconspicuous. Continuity of the ground shall be maintained throughout the building. Continuity of equipment and raceway ground shall be insured by the use of double locknuts and insulated grounding bushings bonded to enclosures in accordance with NEC Article 250-79 and Table 250-95 at service equipment at all panelboards, safety switches, pull boxes, etc., and at the terminations of all conduit which (1) house the supply conductors to the main bus or main breaker of a panelboard; (2) house the conductors of any branch or feeder circuit protected at 60 amperes or more. Convenience outlets shall be grounded by means of a bonding wire attached to the outlet box in a manner approved NEC Article 250-114. Service ground shall be run in non-metallic conduit. All equipment or device grounds at panelboards, service or distribution equipment shall be connected to ground bars in such equipment with set screw connectors.

PART 2 ELECTRIC SERVICE

2.01 SECONDARY ELECTRIC SERVICE

Furnish and install cable and conduit from weatherhead to a termination point in the building service equipment. Conduit shall be rigid steel with Type THW insulated copper conductors.

2.02 METERING

Install meter base as furnished by the Utility Company and extend 1- 1/4" conduit from the current transformers cabinet to the meter base location. Current transformer cabinet shall be furnished and installed as required by American Electric Power Company.

PART 3 SERVICE AND DISTRIBUTION EQUIPMENT

3.01 GENERAL

Furnish and install a complete system of service and distribution equipment as shown on the contract drawings and described herein.

3.02 MAIN SERVICE DEVICES

This shall be a molded case circuit breaker, 200 ampere frame size with the indicated trip rating. Unit shall be General Electric, Square "D", Westinghouse, ITE or approved equal. Circuit breaker shall be complete with quick-make, quick-break manual operator. Construction shall include interpole phase barriers, contact position indicator and operating handle. Breaker shall be equipped with dual magnetic, adjustable long-time delay short-time instantaneous trips.

3.03 BRANCH DEVICES

These shall be molded circuit breakers, Square D, Westinghouse, General Electric, ITE or equal.

3.04 All devices shall be mounted in wall mounted panelboard construction.

PART 4 EXISTING MOTOR CONTROL CENTER

4.01 Existing motor control center (N4CC) is Furnas System 89. New combination starters as scheduled on drawing shall be type FVNR with circuit breakers, hand-off automatic switch, start-stop push buttons and red running light.

4.02 All starters requiring repair parts shall be repaired with original equipment parts.

4.03 In some instances wiring has been damaged. Replace wiring with original equipment conductors and test for proper operation.

END OF SECTION 16300

SECTION 16400

DISTRIBUTION SYSTEM

PART 1 CIRCUIT BREAKER PANELBOARDS

- 1.01 Furnish and install where indicated on the CONTRACT DRAWINGS, automatic circuit breaker panelboards. The panelboards shall be of the dead front type and shall be in accordance with the Underwriters Laboratories, Inc., "Standards for Panelboards", and "Standards for Cabinets and Boxes", and shall be so labeled. Cabinets shall be of sufficient size to provide a minimum gutter space of 4" on all sides. Boxes shall be made of code gauge galvanized steel. Fronts shall be of sheet metal with door and directory card, combination lock and catch with two (2) milled type keys. The directory cards shall be filled in (typewritten) showing circuit numbers and description for both new and existing panelboards. The circuit breakers shall be of the indicating type providing "ON", "OFF" and "TRIP" positions of the indicating handle. All multi-pole breakers shall be so designed that an overload on one pole automatically causes all poles to open. Single pole breakers with handle ties will not be accepted. The circuit breakers shall be of the quick-make, quick-break on manual as well as automatic type rated 10000 AIC sym. 208/120 and 240.120 panelboards shall be General Electric Type NLAB, Square D Type NQOB, Cutler-Hammer or approved equal. Each panel shall have a factory installed ground bus.

PART 2 SAFETY SWITCHES

- 2.01 In general, safety switches shall be quick-make, quick-break, fused or unfused as required or specified, rated 240 or 600 volts as required and shall be Type A, Heavy Duty, General Electric, Square D, Bulldog, Cutler-Hammer or approved equal. Each switch shall have the capacity indicated. Exterior switches shall be NEMA 4X, stainless steel.
- 2.02 Each motor shall be provided with a disconnecting means where required by the NEC, even though not indicated on the CONTRACT DRAWINGS. A circuit breaker in a panelboard will be accepted as a disconnect means if located within sight of the motor. A quick-break, quick-make, general use tumbler or snap switch shall be acceptable for capacity less than 30 amperes, provided the ampere rating of the switch is at least double the rating of the controlled equipment and provided the required running protection is supplied by other means.
- 2.03 Safety switches for single phase motors not having thermal overload shall be as manufactured by General Electric, Square D or approved equal, single or two pole as required. Each switch shall be provided with a thermal heater of the correct size for the motor on which installed. All shall be of one manufacture insofar as possible.

PART 3 WIRING DEVICES

3.01 SWITCHES

3.1.1 All switches shall be of the flush tumbler type. All wall switches shall be rated at 20 ampere, 125 volts.

3.1.2 Switches shall be as follows, or approved equal:

GENERAL ELECTRIC		HUBBELL	BRYANT
20A Single Pole	5951	1221	4901
20A Three Way	5953	1223	4903

3.1.3 Provide key operated switches where indicated.

3.02 RECEPTACLES

3.2.1 Convenience outlets shall be 20 amp rated, Hubbell No. 5352, G.E. 5362, or Bryant 5362 of the grounding type.

3.2.2 GFI weatherproof duplex outlets shall be No. GF 5352 with a Hubbell WP26M (cast aluminum) or approved equal cover.

3.2.3 All wiring devices shall be of one manufacturer and shall be grey.

3.03 PLATES

All plates for concealed devices shall be stainless steel series 97000.

PART 4 FUSES

4.01 Fuses shall not be installed in safety switches or panelboards until equipment is ready to be energized.

4.02 Fuses 600 amperes and less shall be current limiting with an interrupting capacity of 200,000 amperes and time delay of 10 seconds at 500% rating. They shall be Bussman Fusetron dual element fuses or approved equal.

END OF SECTION



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