CONTRACT DOCUMENTS and SPECIFICATIONS

2013 Wastewater System Improvements

US 25 - Wrights Lane Pump Station and Force Main

Georgetown Municipal Water & Sewer Service

Georgetown, Kentucky

Kentucky Engineering Group, PLLC

P.O. Box 1034

Versailles, Kentucky 40383

September 2013

KEG Project No. 13009

TABLE OF CONTENTS

Georgetown Municipal Water & Sewer Service
2013 Wastewater System Improvements
US 25 - Wrights Lane Pump Station and Force Main

PAGE

BIDDING REQUIREMENTS, CONTRACT FORMS, AND CONDITIONS OF THE CONTRACT

DIVISION 1
GENERAL REQUIREMENTS

DIVISION 2
SITE WORK

TABLE OF CONTENTS

Georgetown Municipal Water & Sewer Service
2013 Wastewater System Improvements
US 25 - Wrights Lane Pump Station and Force Main

PAGE

DIVISION 3
CONCRETE

DIVISION 4
MASONRY

DIVISION 5
METALS

DIVISION 6
WOOD AND PLASTICS

DIVISION 7
THERMAL AND MOISTURE PROTECTION

TABLE OF CONTENTS

Georgetown Municipal Water & Sewer Service
2013 Wastewater System Improvements
US 25 - Wrights Lane Pump Station and Force Main

PAGE

DIVISION 8
WINDOWS AND DOORS

DIVISION 9
FINISHES

DIVISION 10
SPECIAL EQUIPMENT

DIVISION 11
EQUIPMENT

DIVISION 15
MECHANICAL

TABLE OF CONTENTS

Georgetown Municipal Water & Sewer Service
2013 Wastewater System Improvements
US 25 - Wrights Lane Pump Station and Force Main

PAGE

DIVISION 16
ELECTRICAL

DIVISION 17
INSTRUMENTATION

BIDDING AND CONTRACT REQUIREMENTS

SECTION 00010

Sealed bids for the **"Georgetown Municipal Water & Sewer Service, 2013 Wastewater System Improvements, US 25 - Wrights Lane Pump Station and Force Main"** for the City of Georgetown through its agent, Georgetown Municipal Water and Sewer Service (GMWSS), will be received at the offices of the Georgetown Municipal Water & Sewer Service, located at 125 West Clinton Street, Georgetown, Kentucky, 40324 until 2:30 P.M., Local Time, Thursday, October 3, 2013 and then publicly read aloud.

The program of work for which bids are to be submitted consists of the installation of approximately a total of 600 LF of 8" PVC force main, construction of one new sanitary sewer pumping stations, and renovation of one existing sanitary sewer pumping stations, including all related appurtenances, as shown on the Drawings and described in the Specifications.

The Contract Time allotted for the completion of this Contract is One Hundred Fifty (150) consecutive calendar days.

The Work for this Project is located in Northern Scott County, Kentucky near the intersection of US Highway 25 and Wrights Lane and near Harbor Village Subdivision. Drawings, Specifications and Contract Documents may be examined at:

KENTUCKY ENGINEERING GROUP, PLLC, P.O. Box 1034, Versailles, Kentucky 40383
Phone: (859) 251-4127 Fax: (859) 251-4137.

Georgetown Municipal Water & Sewer Service, 125 West Clinton Street, Georgetown, KY 40324
Phone: (502) 863-7816 Fax: (502) 863-3575.

F.W. Dodge/AGC, 950 Contract Street, Suite 100, Lexington, KY 40505

Reed Construction Data, 30 Technology Parkway South Suite 500, Norcross, Georgia 30092,
Ph. 877- 891-0601, Fax 800-508-5370, E mail: rcdcentralnews@reedbusiness.com,
Web Site: www.reedbusiness.com

Copies of the Drawings, in full size and the Specifications and Contract Documents may be obtained from Lynn Imaging, 328 Vine Street, Lexington, Kentucky 40507, Phone 859-255-1021, upon receipt of a non-refundable amount of $350.00 for each complete set of documents.

All qualified bidders must purchase a set of plans and specifications and must be listed as a plan holder by the plan distributor, Lynn Imaging.

The contract is being funded by the Georgetown Municipal Water & Sewer Service (GMWSS).

State Prevailing Wage Rates apply for this project.

Hearing impaired individuals may call 1-800-247-2510 for information.

No Bidder may withdraw his Bid within ninety (90) days after the actual date of bid opening.

Bidders on this work will be required to comply with Title VI of the Civil Rights Act of 1964, the Anti-Kickback Act, and the Contract Work Hours Standard Act. Bidders must comply with the President's Executive Orders No. 11246 and No. 11375 and any amendments or supplements to those Executive Orders.

Attention of bidders is particularly called to the requirements as to conditions of employment to be observed under the contract, Section 3, Segregated Facility, Section 109 and E.O. 11246.

Bidders must certify they do not and will not maintain or provide for their employees any facilities that are segregated or based on race, color, creed, or national origin.

Minorities and small businesses are encouraged to submit bids on this project.

The Contract will be awarded on the basis of the low evaluated responsive, responsible, best and qualified bidder unless all bids are rejected.

The City of Georgetown through its agent, Georgetown Municipal Water & Sewer Service, reserves the right to waive any bidding informalities and to reject any or all bids, for any reason deemed advisable by the Georgetown Municipal Water & Sewer Service. The right is reserved by the Owner, in the exercise of its sole judgment to reject any or all Bids, and to re-advertise and award the Contract in the regular manner or to waive any informalities, irregularities, mistakes, errors or omissions in any Bid received and to accept any Bid deemed to be responsive to this invitation and favorable to the interests of the Owner.

The sealed bid for this project shall be clearly marked on the outside of the envelope: "Sealed Bid for "**Georgetown Municipal Water & Sewer Service, 2013 Wastewater System Improvements, US 25 - Wrights Lane Pump Station and Force Main**" for the Georgetown Municipal Water & Sewer Service, Georgetown, Kentucky. The bid may be mailed to: Georgetown Municipal Water & Sewer Service, 125 West Clinton Street, Georgetown, Kentucky 40324. A certified check or Bid Bond payable to the Georgetown Municipal Water & Sewer Service in the amount of five (5) percent of the Bid shall accompany the Bid.

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE

Bob Wilhite, General Manager

Advertisement Date: September 14, 2013

SECTION 00100

INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL INSTRUCTIONS AND INFORMATION

1.01 Each Bidder is responsible for inspecting the work site and for being thoroughly familiar with the Contract Documents, including Addenda. The Bidder shall in no way be relieved from any bidding obligation because of unfamiliarity with the site or documents. Neither the Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

1.02 All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply throughout the Contract and they will be deemed to be included in the Contract the same as though herein written out in full.

1.03 Information pertinent to the conditions of the work site is made available to the Bidder in Section 00200, Information Available to Bidders.

1.04 The Owner of the Project is the City of Georgetown through its agent, Georgetown Municipal Water and Sewer Service (GMWSS).

1.05 The Engineer of the Project is Kentucky Engineering Group, PLLC. P.O. Box 1034, Versailles, Kentucky 40383, Phone: 859-351-1714, Mr. Bryan K. Lovan, Project Engineer.

1.06 The Contract Documents contain the provisions for construction of the Project. Information obtained from an officer, agent, or employee of the Owner, or from any other person, shall not affect the risk or obligation assumed by the Contractor or relieves the Contractor from fulfilling any of the conditions of the Contract.

1.07 The Owner may make such investigations as deemed necessary to determine the ability of the Bidder to perform the Work, and the Bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any Bid if the evidence submitted by, or an investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the obligations of the Agreement and to complete the Work.

PART 2 - SPECIAL INSTRUCTIONS AND INFORMATION

The Contract will be awarded on the basis of the low evaluated responsive, responsible, best and qualified bidder unless all bids are rejected. The Owner reserves the right to reject any and all Bids, to waive any and all informalities, to delete the whole or any part of the project, to negotiate contract terms with the successful bidder, and the right to disregard all non-conforming, non-responsive or conditional bids.

PART 3 - BIDDING PROCEDURE

3.01 Bids will be received by the Georgetown Water & Sewer Service at 125 West Clinton Street, Georgetown, Kentucky 40324, until 2:30 p.m., Local Time, Thursday, October 3, 2013 and then publicly opened and read aloud at said office.

3.02 Each Bid must be submitted in a sealed envelope, addressed to Georgetown Municipal Water & Sewer Service, 125 West Clinton Street, Georgetown, Kentucky 40324. Each envelope containing a Bid must be plainly marked on the outside as "Sealed Bid for "**Georgetown Municipal Water & Sewer Service, 2013 Wastewater System Improvements, US 25 - Wrights Lane Pump Station and Force Main** " and the envelope shall bear on the outside the Bidder's name, address and license number, if applicable, and date and time of opening. If

forwarded by mail, the sealed envelope containing the Bid must be enclosed in another envelope addressed to Georgetown Municipal Water & Sewer Service, 125 West Clinton Street, Georgetown, Kentucky 40324.

All qualified bidders must purchase a set of plans and specifications and must be listed as a plan holder by the plan distributor, Lynn Imaging.

3.03 **BIDS MUST BE MADE ON THE REQUIRED BID FORM. EACH BIDDER SHALL COMPLETE THE ENTIRE BID FORM. THE ENTIRE BID FORM CONSISTS OF ALL PAGES IN SECTIONS 00300 AND 00400.** All blank spaces for Bid prices must be filled in, in ink or typewritten, and the Bid form must be fully completed and executed when submitted. Each bid must be submitted on the prescribed form and accompanied by the required certificates. All foregoing certifications must be fully completed and executed when submitted.

3.04 Each Bid must be accompanied by a separate Bid Bond for the Contract payable to the Owner for five (5) percent of the total amount of the Bid on the Contract. As soon as the Bid prices are compared, the Owner will return the Bonds of all except the three lowest responsible Bidders. When the Agreements are executed, the Bonds of the two remaining unsuccessful Bidders will be returned. The Bid Bonds of the successful Bidder will be retained until the Payment Bonds and Performance Bonds have been executed and approved, after which it will be returned. Certified checks payable to the Owner, equal to five (5) percent of the Bids, may be substituted for the Bid Bonds.

3.05 A Bid may be withdrawn prior to the scheduled time for the opening of Bids, or authorized postponement thereof. A Bid received after the time and date specified will not be considered. No Bidder may withdraw a Bid within ninety (90) days after the actual date of the opening. Should the Contract not be awarded within the specified period, the time may be extended by mutual agreement between the Owner and the Bidder.

3.06 The Owner may consider informal any bid not prepared and submitted in accordance with the provisions hereof. The Owner may waive any bidding informalities or minor defects or reject any and all bids. Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered.

3.07 A conditional or qualified Bid will not be accepted. Bid proposals in which the Owner determines that the prices are unbalanced will not be accepted and may cause the bid to be rejected.

3.08 The Bidder shall supply the names and addresses of major suppliers and subcontractors as part of the Bid Proposal.

3.09 The quantities listed in the Bid Schedule are estimates only. Final payment will be based on unit prices and actual or plan quantities of work performed.

3.10 The Owner reserves the right to add, delete or change any parts or portion of the proposed work. Any changes made by the Owner that affect the work will be compensated for.

3.11 Any bidder may modify his/her bid by telegraphic communication at any time prior to the scheduled closing time for receipt of bids, provided such telegraphic communication is received by the Owner prior to the closing time, and provided further, the Owner is satisfied that a written confirmation of the telegraphic modification over the signature of the bidder was mailed prior to the closing time. The telegraphic communication should not reveal the bid price but should provide the addition or subtraction or other modification so that the final prices or terms will not be known by the Owner until the bid is opened. If written confirmation is not received within two days from the closing time, no consideration will be given to the telegraphic modification.

3.12 The successful bidder, upon failure or refusal to execute and deliver the contract and bonds required within 10 days after receiving notice of the acceptance of their bid, shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited (Bid Bond) with the bid.

3.13 Each bidder must inform themselves fully of the conditions relating to the construction of the project and the employment of labor thereon. Failure to do so will not relieve a successful bidder of his/her obligation to furnish all material and labor necessary to carry out the provisions of the contract. Insofar as possible, the contractor, in carrying out the work, must employ such methods or means as will not cause any interruption of or interference with the work of any other Contractor.

3.14 No interpretation of the meaning of the plans, specifications or other pre-bid documents will be made to any bidder orally.

Every request for such interpretation should be in writing addressed to Kentucky Engineering Group, PLLC. P.O. Box 1034, Versailles, Kentucky 40383, Mr. Bryan K. Lovan, Project Engineer and to be given consideration must be received at least five days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications which, if used, will be mailed to all prospective bidders (at the respective addresses furnished for such purposes), not later than three days prior to the date fixed for the opening of bids. Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder from any obligation under his/her bid as submitted. All addenda so issued shall become part of the contract documents.

3.15 At the time of the opening of bids each bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the plans and Contract Documents (including all addenda). The failure or omission of any bidder to examine any form, instrument or document shall in no way relieve any bidder from any obligation in respect of his/her bid.

PART 4 - AWARD OF CONTRACT (AGREEMENT)

4.01 Award of Contract will be made to the lowest responsible Bidder for the Contract unless all Bids are rejected. The Owner reserves the right to reject any and all bids, to waive any bidding informalities, and to disregard all nonconforming, nonresponsive or conditional bids. Discrepancies between words and figures will be resolved in favor of words. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

4.02 The Bidder to whom the Contract is awarded will be required to execute the Agreement and obtain the Performance Bond and Payment Bond within ten (10) calendar days from the date of the Notice of Award. The Notice of Award will be accompanied by the necessary Agreement and Bond forms. In case of failure of the Bidder to execute the Agreement, the Owner may consider the Bidder in default; in which case the Bid Bond accompanying the proposal shall become the property of the Owner.

4.03 A Performance Bond and a Payment Bond each in the amount of 100 percent (100%) of the Contract Price, with a corporate surety approved by the Owner, will be required for the faithful performance of the Contract. Such Bonds shall not be dated with a date earlier than the date of Agreement for the Contract (Project) being bonded.

4.04 Attorneys-in-fact who sign Bid Bonds or Payment Bonds and Performance Bonds must file with each Bond a certified and effective dated copy of their Power of Attorney.

4.05 The Owner within ten (10) calendar days of receipt of acceptable Performance Bond, Payment Bond and Agreement signed by the Bidder to whom the Agreement was awarded, shall sign the Agreement and return to such party an executed duplicate of the Agreement. Should the Owner not execute the Agreement within such period, the Bidder may, by written notice, withdraw the signed Agreement. Such notice of withdrawal shall be effective upon receipt of the notice by the Owner.

4.06 The Notice to Proceed shall be issued by the Owner within ten (10) calendar days of the execution of the Agreement by the Owner. Should there be reasons why the Notice to Proceed cannot be issued within such period, the time may be extended by mutual agreement between the Owner and Contractor. If the Notice to Proceed has

not been issued within the specified periods or the period mutually agreed upon, the Contractor may terminate the Agreement without further liability on the part of either party.

- END OF SECTION -

SECTION 00200

INFORMATION AVAILABLE TO BIDDERS

PART 1 - INFORMATION AVAILABLE BUT NOT A PART OF CONTRACT DOCUMENTS.

1.01 GMWSS will allow site visits by the Contractor. Site visits may be scheduled by calling Calvin Rogers or Daryl Mulder at 502-863-7816.

- END OF SECTION -

BID FORMS

SECTION 00300

BID FORMS

PART 1 - BIDDER'S PROPOSAL FORM

BIDDER'S PROPOSAL
Georgetown Municipal Water & Sewer Service
2013 Wastewater System Improvements
US 25 - Wrights Lane Pump Station and Force Main

Proposal of _____ (hereinafter called "BIDDER"), organized and existing under the laws of the State of _____, doing business as _____ (insert "a corporation", "a partnership", or "an individual" as applicable). To the Georgetown Municipal Water & Sewer Service, Georgetown, Kentucky (hereinafter called "OWNER").

The undersigned BIDDER offers and agrees, if this Bid is accepted, to enter into an Agreement with OWNER in the form included in the Contract Documents to complete all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in the Agreement and in accordance with the Contract Documents.

BIDDER declares that no person or persons other than those named herein are interested in this Bid; or in any portion of the profit thereof. By submission of this Bid, the BIDDER certifies and in the case of a joint Bid each party thereto certifies as to its own organization, that this Bid has been arrived at independently without consultation, communication, or agreement as to any matter relating to this Bid, with any other Bidder, or with any competitor.

In submitting this Bid, BIDDER represents, as more fully set forth in the Agreement, that he has examined the Instructions to bidders, all of the other Bidding Documents and all of the Contract Documents; that he has examined the actual site and locality where the Work is to be performed; that he has familiarized himself with the legal requirements (federal, state and local laws, ordinances, rules and regulations); ;that he has made such independent investigations as he deems necessary; and that he has satisfied himself as to all conditions affecting cost, progress or performance of the Work.

BIDDER further agrees as follows: 1) that this Bid shall remain open and may not be withdrawn for the time period set forth in the Instructions to Bidders; 2) that he accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of his bid security; 3) and that, upon acceptance of this Bid, he will execute the Agreement and will furnish the required Contract security and insurance certificates within the time period(s) set forth in the Instructions to Bidders.

In accordance with the above understanding and agreements and in compliance with the Advertisement for Bids, BIDDER hereby proposes to furnish all equipment, materials and labor for the work required to furnish all equipment, materials and labor for the work required to construct the "**Georgetown Municipal Water & Sewer Service, 2013 Wastewater System Improvements, US 25 - Wrights Lane Pump Station and Force Main**" for the Georgetown Municipal Water & Sewer Service, in strict accordance with the Contract Documents, within the time set forth therein, and at the price stated below. Also, see Section 01025.

BASE BID SCHEDULE

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
2013 WASTEWATER SYSTEM IMPROVEMENTS
US 25 - WRIGHTS LANE PUMP STATION AND FORCE MAIN

ITEM NO.	ESTIMATED QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL BID AMOUNT
1	600	LF	**8" PVC SDR 21 Force Main** Including All Appurtenances Complete-in-Place		
2	120	LF	**16" API-5L Grade B Steel Casing- Open Cut** Including All Appurtenances Complete-in-Place		
3	2	EA	**8" Gate Valves and Boxes** Including All Appurtenances Complete-in-Place		
4	1	LS	**Wrights Lane Pump Station -** Including All Appurtenances, Complete-in-Place (PUMPS FURNISHED BY OWNER, INSTALLED BY CONTRACTOR)		
5	1	LS	**Harbor Village Pump Station Renovation -** Including All Appurtenances, Complete-in-Place (PUMPS FURNISHED BY OWNER, INSTALLED BY CONTRACTOR)		
6	1	LS	**Telemetry Installation - Wrights Lane Pump Station** Including All Appurtenances Complete-in-Place		
7	1	LS	**Telemetry Installation - Harbor Village Pump Station** Including All Appurtenances Complete-in-Place		

TOTAL AMOUNT BID - GEORGETOWN MUNICIPAL WATER & SEWER SERVICE, 2013 WASTEWATER SYSTEM IMPROVEMENTS, US 25 - WRIGHTS LANE PUMP STATION AND FORCE MAIN

(BASE BID ITEMS 1-7):_____

Dollars and_____**(Cents) ($**_____**)**

The above prices shall include all labor, materials, overhead, profit, insurance and other costs necessary to cover the finished work of the several kinds called for. The price per foot for pipe installation includes all labor, materials, unclassified excavation, rock blasting and removal, clean-up, etc. for a finished product. Changes in the work shall be processed in accordance with the General Conditions.

The Contract will be awarded on the basis of the low evaluated responsive, responsible, best and qualified bidder unless all bids are rejected.

By submission of this Bid, the BIDDER certifies, and in the case of a joint Bid each party thereto certifies as to its own organization, that this Bid has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this Bid, with any other BIDDER or with any competitor.

BIDDER hereby agrees to commence work under this Contract on or before a date to be specified in the Notice to Proceed and to fully complete the project within the contract period listed herein. BIDDER further agrees to pay as liquidated damages as listed herein for each consecutive calendar day thereafter as provided in the General Provisions.

TIME OF COMPLETION AND LIQUIDATED DAMAGES

The Time of Completion of the construction of this project is highly important to the OWNER. Should any CONTRACTOR neglect, refuse, or fail to complete his Contract within the Time of Completion specified herein, after giving effect to extensions of time is any, herein provided, then in that event and in view of the difficulty of estimating with exactness the full extent of damages to the OWNER caused by delays, the sums stated herein shall be assessed on the CONTRACTOR for each and every day his work is delayed in its completion beyond the specified Time of Completion and the amount of Liquidated Damages, plus such additional engineering and inspection expenses incurred by the Owner.

Contract for the project are stated as follows and as described in the Advertisement for Bids:

DESCRIPTION OF WORK	CALENDAR DAYS FOR COMPLETION	LIQUIDATED DAMAGES DAY
Total Contract	150	$500.00

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

	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**TOT**
Precipitation	7	7	9	8	8	8	8	7	6	5	5	7	87
Freezing Temperature	10	6	1	0	-	-	-	-	-	-	1	5	22
TOTAL	**17**	**13**	**10**	**8**	**8**	**8**	**8**	**7**	**6**	**5**	**6**	**12**	**109**

When number of days (including Saturdays, Sundays and Holidays) of Precipitation in excess of 0.1" per day or maximum daily temperature of 32 degrees F. exceed those shown above in any month, the CONTRACTOR shall be entitled to that number of additional days for contract completion.

- If, in the ENGINEER'S opinion, sustained bad weather conditions prevent satisfactory performance of the work, he may suspend operations for an executed 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.

- If the project is not completed within the specified time, the CONTRACTOR'S retainage may be used by the OWNER as one source of funds to compensate the ENGINEER for additional engineering services required because of time delays.

Accompanying this Proposal is a certified check or standard Bid Bond in the sum of _____ _____ (Dollars and Cents) ($ _____) in accordance with the Instructions to Bidders. The BIDDER, by submittal of this Bid, agrees with the OWNER that the amount of the bid security deposited with this Bid fairly and reasonably represents the amount of damages the OWNER will suffer due to the failure of the BIDDER to fulfill his agreements as provided in this Proposal.

BIDDER acknowledges receipt of the following Addenda:

_____

_____

BIDDER agrees that the OWNER reserves the right to delete the whole or any part of the Project from the Contract.

BIDDER understands that the OWNER reserves the right to reject any or all Bids and to waive any informalities in the Bidding.

BIDDER agrees that this Bid shall be good and may not be withdrawn for a period of ninety (90) calendar days after the actual date of bid opening.

BIDDER agrees to perform all of the Work described in the Specifications and shown on the Plans for the amount stated above. Within ten (10) calendar days after receiving written notice of the acceptance of this Bid by the OWNER, the BIDDER will execute and deliver to the OWNER ten (10) copies of the Agreement and such other required Contract Documents.

BIDDER:

_____

By _____

Title _____

Address _____

(Seal - If bid is by a corporation)

_____

_____

Date Signed _____

If BIDDER IS

An Individual

By _____
(Individual's Signature)

Doing business as _____

License or Registration Number: _____

Business Address: _____

_____

_____

Phone No.: _____

A Partnership

By _____
(Firm Name)

Doing business as _____

License or Registration Number: _____

Business Address: _____

_____

_____

Phone No.: _____

A Corporation:

By _____
(Corporation Name)

_____
(State of Incorporation)

_____
(Name of Officer Authorized to Sign)

_____
(Title)

(CORPORATE SEAL)

Attest _____
(Secretary)

License or Registration Number: _____

Business Address: _____

_____

_____

Phone No.: _____

A Joint Venture

By _____
(Name)

Business Address: _____

_____

_____

Phone No.: _____

By _____
(Name)

Business Address: _____

_____

_____

Phone No.: _____

(Each joint venture 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.)

- END OF SECTION -

SECTION 00400

SUPPLEMENTS TO BID FORMS

ALL PARTS ARE REQUIRED TO BE COMPLETED AND MUST BE SUBMITTED WITH THE BID. FAILURE TO COMPLETE ALL FORMS MAY BE CAUSE FOR REJECTION OF THE BID.

PART 1 - BIDDER'S QUALIFICATIONS

A. The required names and addresses of all persons interested in the foregoing Bid, as Principals, are as follows:

_____

_____

_____

B. The Bidder shall submit the requested information indicated and for work of a similar character in size and total contract price that is included in the proposed Contract and references to enable the Owner to judge the Bidder's experience, skill and business standing.

1. Number of years in business as a contractor under present business name:

   _____

2. Number of years of experience in type of construction required for this project:

   _____

3. Have you ever been declared in default or failed to complete work awarded to you? If yes, where and why?_____

   _____

4. Have you ever been cited by a regulatory agency for failure to comply with any of its contractual obligations?_____. If yes, where and why?

   _____

5. List and age of owned equipment available for this project:_____

   _____

   _____

6. List similar project experience with references where the Bidder was the prime contractor and percent work completed as prime and percent completed by subcontractors.

Project Name	Description of Work	Date Completed	Contract Amount	% Prime/ % Subcontract	Owner/Contact	Owner Phone No.
1.						
2.						
3.						
4.						
5.						

(Add supplementary pages if necessary)

PART 2 - SUBCONTRACTORS

All proposed subcontractors shall be listed below for each branch of work included in the proposed Contract. All subcontractors are subject to the approval of the Owner. Failure to submit a completed list may be cause for rejection of the Bid. Experience and references of all subcontractors shall be described on separate pages.

BRANCH OF WORK	NAME AND ADDRESS OF SUBCONTRACTOR
Electrical	_____
Pump Stations	_____
Bituminous Pavement	_____
Horizontal Bores	_____
_____ (Other)	_____
_____ (Other)	_____
_____ (Other)	_____

(Add supplementary pages if necessary)

NOTES:
1. The OWNER in no way implies acceptance of any proposed subcontractor by acceptance of the Bid.
2. The CONTRACTOR will not be allowed to substitute subcontractors not listed herein without prior written approval of OWNER.
3. The CONTRACTOR shall indicate the percent or amount of work proposed by subcontractors for the total project or each branch of work listed.

SUBCONTRACTORS' REFERENCES

List similar project experience with references for each subcontractor proposed and the percent work completed by the subcontractors.

Project Name	Description of Work	Date Completed	Contract Amount	% Prime/ % Subcontract	Owner/Contact	Owner Phone No.
1.						
2.						
3.						
4.						
5.						

(Add supplementary pages if necessary)

PART 3 - MANUFACTURER'S LIST

A. The Bidder proposes to furnish the following equipment contingent upon its conformity to the Specifications and review and acceptance by the ENGINEER and OWNER.

B. Only one manufacturer's name is to be listed.

NAME OF MANUFACTURER	DESCRIPTION OF MATERIAL
_____	PVC Piping
_____	DIP Piping
_____	Odor Control Equipment
_____	Suction Lift Sewage Pumps
_____	Electro-Magnetic Flow Meter
_____	Gate Valves
_____	DI Fittings
_____	Air Release Vavles
_____	_____ (Other)
_____	_____ (Other)

(Add supplementary pages if necessary)

NOTES:

1. If listed equipment is not by manufacturers specified, OWNER in no way implies acceptance of such listed equipment by acceptance of the Bid.
2. The CONTRACTOR will not be allowed to substitute manufacturers not listed for the units above without prior written approval of OWNER.

RUS Bulletin 1780-13
Attachment 4

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, _____ _____ as Principal, and _____ _____ as Surety, are hereby held and firmly bound unto _____ as OWNER in the penal sum of _____ _____ for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors, and assigns.

Signed, this _____ day of _____, 20____.

The Condition of the above obligation is such that whereas the Principal has submitted to _____ _____ a certain BID, attached hereto and hereby made a part hereof to enter into a contract in writing, for Wastewater System Improvements, Wastewater Treatment Plant No. 1, Digester & Batch Reactor Covers for the Georgetown Municipal Water & Sewer Service, Georgetown, Kentucky

NOW, THEREFORE,

(a) If said BID shall be rejected, or

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

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

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

(SEAL) _____

Principal (Legal Signature)

(SEAL) _____

Surety

By _____

IMPORTANT - Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and authorized to transact business in the State where the project is located.

DEBARRED FIRMS

The undersigned hereby certifies that the firm of _____ is not and will not award a subcontract, in connection with any contract awarded to it as the result of this bid, to any firm that has been debarred for noncompliance with the Federal Labor Standards, Title VI of the Civil Rights Act of 1964, Executive Order 11246 as amended or any other Federal Law.

_____
Name of Firm Submitting Bid

_____
Signature of Authorized Official

_____
Title

_____
Date

CERTIFIED COPY OF CORPORATE RESOLUTION

_____

(Name of Company)

I hereby certify that I am the duly elected and acting _____

_____, (Insert Title of Officer) a Corporation duly organized and existing under the laws of the State of _____ ; that on the _____ _____ day of _____ , 20___, the Board of Directors of said Corporation authorized and approved a certain Proposal to _____ for the construction of certain improvements for _____

_____ (Insert Name of Project) by said Corporation and any contract resulting there from, and empowered the _____ _____ (Insert Title of Officer) of said Corporation to execute said Proposal and Contract for and in behalf of said Corporation; that said authority is not contrary to any provision in the Articles of Incorporation or code of regulations or code of bylaws of said Corporation; ;that said authority has not been rescinded or modified; and that __ _____ (Insert Name of Signatory) is the duly elected and acting _____ _____ (Insert Title of Office) of said Corporation.

IN WITNESS WHEREOF, I have hereunto subscribed my name on _____ , 20___.

_____

(Signature)

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

(SEAL)

_____

NOTARY PUBLIC

NONCOLLUSION AFFIDAVIT

State of _____

County of _____

Bid Identification _____

Contractor, _____

being first duly sworn, deposes and says that he is _____

_____ (sole owner, a partner, president, secretary, etc.) of _____ , the party making the foregoing bid; that such bid is not made in the interest of or on behalf of any undisclosed person, partnership, company, association, organization, or corporation; that such bid is genuine and not collusive or sham; that said bidder has not directly b or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that said bidder has not in any manner, directly or indirectly, sought by agreement, communication or conference with anyone to fix the bid price of said bidder or of any other bidder, or to fix any overhead, profit, or cost element of such bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract or anyone interested in the proposed contract; that all statements contained in such bid are true; and, further that said bidder has not, directly or indirectly, submitted his bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid and will not pay any fee in connection therewith, to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof, or to any other individual except to such person or persons as have a partnership or other financial interest with said bidder in his general business.

SIGNED _____

TITLE _____

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

(SEAL)

_____

NOTARY PUBLIC

- END OF SECTION -

AGREEMENT FORMS

SECTION 00500

AGREEMENT FORMS

PART 1 - NOTICE OF AWARD

TO: _____

_____

_____

PROJECT Description: **Georgetown Municipal Water & Sewer Service, 2013 Wastewater System Improvements, US 25 - Wrights Lane Pump Station and Force Main Project** for the City of Georgetown through its agent, Georgetown Municipal Water and Sewer Service (GMWSS), Georgetown, Kentucky.

The OWNER has considered the BID submitted by you for the above-described WORK in response to its Advertisement for Bids dated _____, and Instructions to Bidders.

You are hereby notified that your BID has been accepted for items in the amount of **$**_____.

You are required by the Instructions to Bidders to execute the Agreement and furnish the required CONTRACTOR'S Performance BOND, and Payment BOND and certificates of insurance within ten (10) calendar days from the date of this Notice to you.

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

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

Dated this _____day of _____ **2013**.

_____

OWNER

By

Title

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged by

_____, this the _____day of _____, **2013**.

By

Title_____

PART 2 - AGREEMENT

THIS AGREEMENT, made this the _____day of _____, by and between the **GEORGETOWN MUNICIPAL WATER & SEWER SERVICE, Georgetown Kentucky,** hereinafter called "OWNER" and _____ _____doing business as ("a corporation", "a partnership", or "an individual" as applicable), hereinafter called "CONTRACTOR".

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

1. Contractor will commence and complete the construction of the "**Georgetown Municipal Water & Sewer Service, 2013 Wastewater System Improvements, US 25 - Wrights Lane Pump Station and Force Main Project"** for the City of Georgetown through its agent, Georgetown Municipal Water and Sewer Service, Georgetown, Kentucky.

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

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

4. The CONTRACTOR agrees to perform all of the WORK described in the CONTRACT DOCUMENTS and comply with the terms therein for the sum of:_____ _____($) as shown in the Bid Schedule.

5. The term "CONTRACT DOCUMENTS" means and includes the following:

(A) Advertisement for Bids
(B) Instructions to Bidders
(C) Bid
(D) Bid Bond
(E) Agreement
(F) General Provisions
(G) Supplemental General Conditions
(H) Special Conditions
(I) Payment Bond
(J) Performance Bond
(K) Notice of Award
(L) Notice to Proceed
(M) Change Order
(N) Drawings prepared by KENTUCKY ENGINEERING GROUP, PLLC and dated June 2013
(O) Technical Specifications prepared and issued by KENTUCKY ENGINEERING GROUP, PLLC dated June 2013
(P) Addenda:

6. The OWNER will pay to the CONTRACTOR in the manner and at such times as set forth in the General Conditions such amounts as required by the CONTRACT DOCUMENTS.

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

8. The following documents shall constitute integral parts of this AGREEMENT, the whole to be collectively known and referred to as the CONTRACT DOCUMENTS and in the case of discrepancies among any parts of the CONTRACT DOCUMENTS, the most stringent shall apply.

IN WITNESS WHEREOF, the parties hereto have executed or caused to be executed by their duly authorized officials, this AGREEMENT in six (6) copies each of which shall be deemed an original on the date first above written.

_____
OWNER

By_____
(Signature)

Name_____
(Print Name)

Title_____

(SEAL)

ATTEST:

_____
(Signature)

Name_____
(Print Name)

Title _____

_____
CONTRACTOR

By_____
(Signature)

Name_____
(Print Name)

Address_____

_____

(SEAL)

ATTEST:

_____
(Signature)

Name_____
(Print Name)

Title_____

PART 3 - NOTICE TO PROCEED

TO: _____

_____

_____

You are hereby notified to commence WORK in accordance with the AGREEMENT date _____, on or before _____, and you are to complete the WORK within 150 consecutive calendar days thereafter. The date of completion of all WORK is therefore _____,.

_____
OWNER

By_____

Title_____

ACCEPTANCE OF NOTICE

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

this the _day of _____

_____
CONTRACTOR

By_____

Title_____

- END OF SECTION -

BONDS AND CERTIFICATES

SECTION 00600

BONDS AND CERTIFICATES

PART 1 - PERFORMANCE BOND

KNOW ALL PERSONS BY THESE PRESENT: that

_____
(Name of Contractor)

_____
(Address of Contractor)

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

_____
(Name of Surety)

_____
(Address of Surety)

hereinafter called SURETY, are held and firmly bound unto _____

Georgetown Municipal Water & Sewer Service
(Name of Owner)

125 West Clinton Street, Georgetown, Kentucky 40324
(Address of Owner)

hereinafter called OWNER, in the total aggregate penal sum of _____

_____

_____Dollars ($_____)

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

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER, dated the _____ day of _____, 2013, a copy of which is hereto attached and made a part hereof for the construction of the **Georgetown Municipal Water & Sewer Service, 2013 Wastewater System Improvements, US 25 - Wrights Lane Pump Station and Force Main** for the Georgetown Municipal Water and Sewer Service (GMWSS).

PART 1 - PERFORMANCE BOND (Cont'd.)

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

PROVIDED, FURTHER, that the liability of the PRINCIPAL and SURETY hereunder to the GOVERNMENT shall be subject to the same limitations and defenses as may be available to them against a claim hereunder by the OWNER, provided, however, that the GOVERNMENT may, at its option, perform any obligations of the OWNER required by the Contract.

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

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

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

PART 1 - PERFORMANCE BOND (Cont'd.)

IN WITNESS WHEREOF, this instrument is executed in _____ counterparts, each one of which shall be deemed an original, this the _____ day of _____, 2013.

ATTEST:

_____
PRINCIPAL

_____
(PRINCIPAL) Secretary

By_____(s)

SEAL:

Address_____

_____

_____
Witness as to PRINCIPAL

Address_____

_____

ATTEST:

_____
SURETY

_____
Witness to SURETY

By_____
Attorney-In-Fact

Address_____

Address_____

_____

_____

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

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the PROJECT is located.

PART 2 - PAYMENT BOND

KNOW ALL PERSONS BY THESE PRESENT: that

_____
(Name of Contractor)

_____
(Address of Contractor)

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

_____
(Name of Surety)

_____
(Address of Surety)

hereinafter called SURETY, are held and firmly bound unto _____

Georgetown Municipal Water & Sewer Service
(Name of Owner)

125 West Clinton Street, Georgetown, Kentucky 40324
(Address of Owner)

hereinafter called OWNER, and unto all persons, firms, and corporations who or which may furnish labor, or who furnish materials to perform as described under the Contract and to their successors and assigns in the total aggregate penal sum of _____

_____

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

THE CONDITION OF THIS OBLIGATION is such that whereas, the PRINCIPAL entered into a certain AGREEMENT with the OWNER dated the _____ day of _____, 2013, a copy of which is hereto attached and made a part hereof for the construction of the **Georgetown Municipal Water & Sewer Service, 2013 Wastewater System Improvements, US 25 - Wrights Lane Pump Station and Force Main** for the Georgetown Municipal Water and Sewer Service (GMWSS).

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

PART 2 - PAYMENT BOND (Cont'd.)

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

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

PROVIDED, FURTHER, that no suit or action shall be commenced hereunder by any claimant: (a) Unless claimant, other than one having a direct contract with the PRINCIPAL (or with the GOVERNMENT in the event the GOVERNMENT is performing the obligations of the OWNER), shall have given written notice to any two of the following: The PRINCIPAL, the OWNER, or the SURETY above named within ninety (90) days after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the PRINCIPAL, OWNER, or SURETY, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer; (b) After the expiration of eighteen (18) months following the date of which PRINCIPAL ceased work on said Contract, it being understood, however, that if any limitation embodied in the BOND is prohibited by any law controlling the construction hereof, such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

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

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

PART 2 - PAYMENT BOND (Cont'd.)

IN WITNESS WHEREOF, this instrument is executed in _____ counterparts, each one of which shall be deemed an original, this the _____ day of _____, 2013.

ATTEST:

_____
PRINCIPAL

_____
(PRINCIPAL) Secretary

By_____(s)

SEAL:

Address_____

_____

_____
Witness as to PRINCIPAL

Address_____

_____

ATTEST:

_____
SURETY

_____
Witness to SURETY

By_____
Attorney-In-Fact

Address_____

Address_____

_____

_____

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

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the PROJECT is located.

CERTIFICATE OF OWNER'S ATTORNEY

I, the undersigned,_____, the duly authorized and acting legal representative of **Georgetown Municipal Water & Sewer Service**, 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 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 terms, conditions and provisions thereof.

By_____
(Signature)

Name_____
(Print Name)

Title_____

Date_____

NOTE: Delete phrase "Performance and Payment bond(s)" when not applicable.

- END OF SECTION -

SECTION 00700

GENERAL CONDITIONS

KENTUCKY ENGINEERING GROUP, PLLC

TABLE OF CONTENTS – CONT'D

TABLE OF CONTENTS – CONT'D

GENERAL CONDITIONS

SECTION 1

DEFINITIONS

GC-1.01. DEFINITIONS

Whenever the words herein defined or pronouns used in their stead, occur in this Contract, they shall have the meaning given below:

ADDENDUM or **ADDENDA** shall mean the additional contract provisions issued in writing by the Owner prior to the receipt of bids.

BID shall mean the offer or proposal submitted, signed and sealed, in the form prescribed in the Contract Documents setting forth the prices for the Work to be performed.

BONDS shall mean any or all of the following: performance, payment, labor and material bonds and other instruments of security furnished by the Contractor and his surety or sureties in accordance with the Contract Documents.

CHANGE ORDER shall mean the formal document executed by the Owner incorporating any Modifications into the Contract.

CLAIM shall mean a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and the Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

CONTRACT or CONTRACT DOCUMENTS shall mean any or all of the following: the Advertisement or Invitation, Information for Bidders, Bid, Agreement, General Conditions, Special Conditions, Technical Specifications, Payment Items, Contract Drawings, all interpretations or Addenda thereto and Change Orders issued by the Owner or by the Engineer with the approval of the Owner.

Anything shown on the Contract Drawings and not mentioned in the Specifications or mentioned in the Specifications and not shown on the Drawings, shall have the same effect as if shown or mentioned, respectively, in both.

CONTRACT DRAWINGS shall mean those plans and drawings, which show the scope and character of the Work and are specifically referred to as such in these Documents or in any Addendum or Addenda.

CONTRACTOR shall mean the Party of the Second Part to this Contract or the person, persons, partnership or corporations entering into this Contract for the performance of the Work required by it, and the legal representatives of said party or the agents appointed for said party in the performance of the Work.

ELEVATION or any abbreviation of the word shall mean the distance in feet above or below the datum established for the Project.

ENGINEER shall mean the Consulting Engineer or Engineers engaged by the Owner for the project and shall include any properly authorized assistants acting for the Consulting Engineer within the scope of the particular duties assigned to them.

FIELD ORDER shall mean a written notice issued by the Engineer to the Contractor for the purpose of clarifying or interpreting the Contract Documents, or to authorize minor changes or alterations in the Work, which will not result in a change in the Contractor's cost or completion time.

INVERT shall mean the inside bottom of a pipe or the surface upon which sewage or water flows along the plan centerline of the completed Work.

MODIFICATION shall mean a written order to the Contractor, signed by the Engineer and the Owner on which is stated the addition, deletion or revision in the Work, together with any adjustment in Contract price or Contract time. One or more Modifications may be incorporated into a Change Order for making payments to the Contractor.

OWNER shall mean the Party of the First Part to this Contract or any person duly authorized to act for said First Party.

PROCEED ORDER shall mean a written order issued by the Owner to the Contractor to proceed with certain Work pending the resolution of disputes.

PROJECT shall mean the entire improvement to which the Contract relates.

SITE shall mean the area included within the property lines shown on the Contract Drawings including temporary easement, and other such areas adjacent thereto as may be designated by the Owner in writing.

SPECIFICATIONS shall mean any or all of the following: the Special Conditions, Technical Specifications, Payment Items and any Addenda pertaining thereto.

SUBCONTRACTOR shall mean any person, firm or corporation other than employees of the Contractor, who or which contracts with the Contractor to furnish, or actually furnishes labor, or labor and materials, or labor and equipment, or labor, materials and equipment at the Site.

SUBGRADE shall mean the bottom line or surface to which excavations are necessarily made for purpose of building the Work in accordance with the Contract Drawings, not including the additional depth of excavation required for any special foundation that may be ordered.

SURETY or SURETIES shall mean the Bondsmen or party or parties who have made secure the fulfillment of the Contract by a Bond and whose signatures are attached to said Bond.

WORK shall mean everything expressly or implied required to be furnished and done by the Contractor under the Contract, including extra work.

WRITTEN NOTICE. The term "notice" as used herein shall mean and include all written notices, demands, instructions, claims, approvals and disapproval's required to obtain compliance with contract requirements. Written Notice shall be deemed to have been duly served if: 1) delivered in person to the individual or to a member of the firm or to an officer of the corporation at the location specified in the Contract Documents, or 2) if delivered at the last business address provided by the person to whom addressed, or 3) if sent by certified or registered mail, or ordinary mail, or 4) if sent by facsimile followed by ordinary mail, certified mail, postage paid, return receipt requested, or 5) if sent by nationally recognized overnight carrier (against receipt) or 6) if sent by telegraph to the last business address.

SECTION 2

PERFORMANCE OF WORK

GC-2.01. PERMITS, LAWS AND REGULATIONS

Where the Owner is required to obtain permits for the Project, the permits have been or will be obtained and are noted in the Special Conditions. The Contractor shall take out all other necessary permits from the County, State, municipal or other public authorities; shall give all notices required by the law or municipal ordinances and shall pay all fees and charges incidental to the due and lawful execution of the Work done under this Contract.

The Contractor shall keep itself fully informed for the duration of the Contract of all laws, ordinances, regulations, and applicable codes affecting those engaged or employed in the Work, or the materials used in the Work, or affecting the conduct of the Work, and of all orders, decrees and instructions of bodies or tribunals having jurisdiction or authority over the same. If any discrepancy or inconsistency should be discovered in the Contract Documents in relation to any such law, ordinance, regulation, codes, order, decree, or instruction, the Contractor shall forthwith report the same in writing to the Engineer.

The Contractor shall at all times observe and comply with and shall cause all its agents and employees to observe and comply with all such existing and future laws, ordinances, regulations, codes, orders, decrees and instructions.

Any provisions of these General Conditions which is shown with the agreement of the Owner to contradict or conflict with the mandates of the applicable law in the jurisdiction where the Project is located, shall be interpreted and enforced to comply 1) with, the requirements of the applicable law and 2) to the maximum practicable extent, with the original intent of these General Conditions.

GC-2.02. CARE AND PROTECTION OF THE WORK

From the commencement until the acceptance of the Work, the Contractor shall be solely responsible for the care of the Work covered by the Contract and for the materials, supplies and equipment delivered at the Site intended to be used in the Work; and all injury or damage to the same from whatever cause, shall be made good at his expense. The Contractor shall provide suitable means of protection for and shall protect all materials intended to be used in the Work, all Work in progress, and all completed Work. The Contractor shall take all necessary precautions to prevent injury or damage to the Work by flood, fire, freezing or from inclemency's of the weather.

The Contractor shall neither load nor permit any part of a structure to be loaded with weights that will endanger the structure, and shall not subject any part of the Work to stresses or pressures that will endanger it.

In the event that the Owner must take occupancy and the Contractor is behind schedule, the provisions of the article still apply.

GC-2.03. CLEANING STRUCTURES AND SITE

As the Work progresses, the Contractor shall remove all unused materials, tools, equipment and machinery, waste materials, rubbish, refuse and other debris from the Site and see to it that the Site is at all times maintained in a neat and orderly condition.

At the completion of the Work, the Contractor shall promptly remove all construction tools, equipment and machinery, surplus materials, waste materials, rubbish, refuse and other debris from the Site

and leave the Site in a neat and orderly condition. The Contractor shall also see to it that all pipelines, buildings, and other structures are left in a bright, polished, and new-appearing condition.

Whenever the Contractor neglects his responsibilities as set forth above, or neglects the repairing of streets, roadways, passageways or areas, or the repairing of fences or damages, the Engineer will give notice to that effect to the Contractor. If the Contractor does not take reasonable steps upon receipt of such notice to correct the neglected situation, the Owner may do so, and the expense thereby incurred shall be deducted from any monies due or that may become due to the Contractor.

If a dispute arises between the separate Contractors as to their responsibilities for cleaning up, etc., as required above, the Owner may do such work as it deems appropriate and charge the cost thereof to the several Contractors as it shall determine to be just. The Owner's determination shall be binding and final.

GC-2.04. SANITARY REGULATIONS

Sanitary conveniences in sufficient numbers and convenient locations for the use of all persons employed on the Work, properly screened from public observation, shall be provided, maintained, and removed by the Contractor or by the General Contractor. The contents of the same shall be removed and disposed of in accordance with applicable laws codes and regulations. The Contractor shall rigorously prohibit the committance of nuisances within, on, or about the Work.

The Contractor and each Subcontractor shall supply sufficient drinking water to all of his employees.

The Contractor shall also obey and enforce such other sanitary regulations and orders and shall take such precautions against infectious diseases as may be deemed necessary by the responsible authority.

GC-2.05. FIELD CONTROL OF THE WORK

All work shall be constructed in accordance with the lines, grades and elevations shown on the Contract Drawings or as given by the Engineer in the field. The Contractor shall be fully and solely responsible for maintaining alignment and grade.

Control lines and elevations will be established by the Engineer as outlined in the Special Conditions. The Contractor shall, without additional compensation, provide all stakes, grade boards, cleats, nails, and such other materials and give such assistance to the Engineer as may be required to establish control lines and elevations. The Contractor shall inform the Engineer in writing a reasonable time in advance of the times and places at which he intends to do work in order that control lines and elevations may be established with the minimum of inconvenience to the Engineer or delay to the Contractor.

The Contractor shall protect and safeguard all points, stakes, grade marks, monuments, and bench marks at the Site of the Work, and shall re-establish, at its expense, any marks, which are removed or destroyed due to construction operations. The Contractor shall bear the entire expense of rectifying Work improperly installed due to not maintaining or protecting marks, or to removing, without the Engineer's written approval, any such established points, stakes, or marks.

GC-2.06. LAND AVAILABLE TO CONTRACTOR

The Owner will furnish not later than the date when needed by the Contractor, reasonable access to the lands upon which the Work is to be done, rights-of-way for reasonable access thereto, and such other lands, which are designated, for the use of the Contractor. Land and easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by the Owner.

The Contractor shall provide at its expense all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

The Contractor shall confine its operations to such portions of the property of the Owner, as may be designated by the Owner from time to time for such use and to the rights-of-way or easements acquired for the Work. Private property adjacent to the Work shall not be entered upon or used by the Contractor for any purpose whatsoever without the written consent of the owner thereof.

All Work in connection with the Contract within or bordering on private or public property shall be conducted in such manner as will cause the minimum inconvenience and disturbance to it. No excavated materials or supplies of any kind shall be stored on private or public premises without the Owner's written consent and in accordance with all applicable regulations, and all walks and driveways shall be kept open to uninterrupted passage.

The Contractor shall at its expense whenever so required by the Owner, erect and maintain fences along the roadways and around the grounds occupied by the Contractor, which fences shall be sufficient for the protection of the adjoining property and all persons lawfully using the same.

GC-2.07. TRAVEL NOT TO BE OBSTRUCTED

The Contractor shall not allow travel upon any street, park, roadway, or alley to be hindered or inconvenienced needlessly, nor shall the same be wholly obstructed without the written permission of the owner thereof. Upon receipt of such permission, the Contractor shall cause plain and properly worded signs announcing such fact to be placed, with proper lighted barricades, at the nearest cross streets, upon each side of such obstructed portion, where travel can pass around the same in the shortest and easiest way.

The driveways to and from all fire department buildings and those required by all manufacturing plants, industrial establishments, and other business concerns for the proper continuance of their commerce shall be kept open and maintained in passable condition at all times unless modified by agreement between the Contractor and the property owner. The Contractor shall give reasonable notice to the owners of all private ways before interfering with them.

The Contractor shall give reasonable written notice to concerned police, bus, fire, ambulance, and school bus departments before initiating any activity, which will restrict public travel or access to private property.

GC-2.08. MAINTAINING FLOW OF SEWERS, WATER LINES AND DRAINS

The Contractor shall, at its expense, provide for and maintain the flow of all sewers, drains, house inlet connections, and water courses, which may be met with during the progress of the Work. The Contractor shall not allow the contents of any sewer, drain, or house inlet connection to flow into trenches, sewers, or other structures to be constructed under the Contract, and shall at its expense, immediately remove from the vicinity of the Work and cart away to a proper disposal site all offensive matter.

The Contractor shall, at its expense, provide for and maintain the flow in all water mains or laterals, which may be met with during the progress of the Work. When water mains or laterals are to be disturbed to the extent that the water will be shut off, the superintendent of the water utility and all parties being served by the lines involved shall be notified 72 hours in advance concerning time and duration of the shut-off period. In cases involving fire hydrants, the fire department shall be so notified.

In the case of accidental damage to a water or sewer line, gas main or electrical conduit, the repairs of such break shall have priority over all other operations. The parties whose services are affected by the break shall be notified at once and all assistance given to supply emergency water, gas, or electricity where necessary by temporary lines, tank truck, or other means. The Contractor shall have the obligation at its expense to assure that all water, gas, electric and sewer connections serving private or public property shall be promptly and correctly restored to the utility company’s specifications.

GC-2.09. COLLATERAL WORK

During the progress of the Work, the Owner reserves the right to award other contracts relating to the Project or for work on sites adjoining or adjacent to that on which the Work covered by this Contract is to be performed. The Contractor shall afford the other contractors who are parties to such contracts reasonable opportunity for the introduction and storage of materials and equipment and the execution of Work and shall properly connect and coordinate its Work with theirs.

The Contractor shall keep itself informed of the progress and the detail work of other contractors and shall notify the Engineer immediately in writing of lack of progress or defective workmanship on the part of other contractors where such delay or such defective workmanship will interfere with its own operations. Failure of a Contractor to keep informed of the Work progressing on the Site or failure to give notice of lack of progress or defective workmanship by others shall be construed as acceptance of the status of the Work as being satisfactory for proper coordination with its own Work and shall constitute a waiver of any and all claims against the Owner or Engineer relating thereto in any way.

The Contractor shall do all cutting, fitting, and patching for its Work that may be required to make its several parts come together properly and fit it to receive or be received by the work of others. The Contractor shall not endanger any Work of others by cutting, excavating, or otherwise altering their work, except with the written consent of the other contractor and the Engineer.

If the performance of additional Work is undertaken by other contractors, and if the Contractor believes that the performance of such additional Work will cause additional expense or will require an extension of time, a claim therefor may be made as provided for herein.

The Contractor agrees that it has and will make no claim for damages against the Owner by reason of any act or omission to act by any other contractor or in connection with the Engineer's or Owner's acts or omissions to act in connection with such other contractor, but the Contractor shall have a right to claim such damages from the other contractors, under a provision similar to the following provision which has been or will be inserted in the Contract with such other contractors.

Should any other contractor, having or who shall hereafter have a contract with the Owner relating to the Project or in connection with the Work on sites adjoining or adjacent to that on which the Work covered by this Contract is to be performed, sustain any damage through any act or omission of the Contractor, the Contractor agrees to reimburse such other contractor for all such damages and it further agrees to defend, indemnify, and save harmless the Owner from all claims for such damages by whomever made or presented.

GC-2.10. FURNISHING AND USE OF CONTRACT DOCUMENTS

Unless otherwise stated in the Special Conditions, the Contractor will be furnished, free of charge, three copies of the Contract Documents, including three sets of reduced and three sets of full-size Contract Drawings where drawings have been reduced. Additional sets will be furnished to the Contractor, but only to the limit of availability. Any other copies of the Contract Documents, which the Contractor may desire, can be obtained by the Contractor from the Engineer at the cost of duplication thereof.

The Contractor shall keep at the Site of the Work at least two copies of the Contract Documents and shall at all times provide the Engineer, and other representatives of the Owner, access thereto. One copy shall be available for ready reference and the other shall be used for record purposes.

GC-2.11. RECORD DRAWINGS

The copy of the Contract Drawings provided to the Contractor for record purposes in accordance with Section GC-2.10 above, shall be annotated by the Contractor to record all changes made during the construction process. Said copy shall be available to the Engineer and shall be delivered to the Owner by the Contractor upon completion of the Project.

GC-2.12. SLEEVES, INSERTS, CHASES AND OPENINGS

Where there is more than one Contractor on a Project and unless otherwise designated on the Contract Drawings, the General Contractor shall install in new floors, roofs, walls, and other structures constructed by it all sleeves, inserts, chases, and openings to fit its own Work and that of other contractors. The sleeves and inserts shall be provided by the installers of the pipes, ducts, conduits, and related equipment but shall be placed by the General or otherwise designated Contractor as directed by the installers of the pipes, ducts, conduits and related equipment. It is the responsibility of the General or otherwise designated Contractor to give other contractors reasonable notice as to when items provided by the other contractors will be placed in the Work.

Patching and finishing around the pipes, ducts, conduits, and related equipment after installation shall be by the same Contractor or Contractors installing the pipes, ducts, conduits, and related equipment.

Where sleeves, inserts, chases, or openings are required in existing floors, roofs, walls, and other structures, they shall be installed by the same Contractor or Contractors installing the pipes, ducts, conduits, and related equipment.

GC-2.13. PROVISIONS REQUIRED BY LAW DEEMED INSERTED

Each and every provision required by law to be inserted in this Contract shall be deemed to be inserted herein, and the Contract shall be read and enforced as though such provisions were included herein. If through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the application of either party, the Contract shall forthwith be physically amended to make such insertion.

GC-2.14. INVALID PROVISIONS

If any term or provision of the Contract Documents or the application thereof to any person, firm or corporation, or circumstance shall, to any extent, be invalid or unenforceable, the remainder of the Contract Documents, or the application of such terms or provisions to persons, firms or corporations, or circumstances other than those to which it is held invalid or unenforceable, shall not be affected thereby and each term or provision of the Contract Documents shall be valid and be enforced to the fullest extent permitted by law.

GC-2.15. APPLICABLE STANDARDS

Reference to codes, manuals or standard specifications of any technical society, organization or association or to the code of any governmental authority, whether such reference be specified or implied, shall mean the latest code, manual or standard specification in effect at the time of opening of the Bids, except as may be otherwise specifically provided in the Contract Documents.

However, no provision of any referenced standard specification, manual or code (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of OWNER, CONTRACTOR or ENGINEER, or any of their consultants, agents or employees from those set forth in the Contract Documents, nor shall it be effective to assign to ENGINEER, or any of ENGINEER's consultants, agents or employees, any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of the Contract Documents.

SECTION 3

TIME PROVISIONS

GC-3.01. COMMENCEMENT AND COMPLETION OF WORK: TIME OF ESSENCE

The Contractor shall commence the Work within ten days following the date of notice to proceed and fully complete the Work within the time specified in the Bid. The Contractor shall notify the Engineer, in writing, of its intention to enter upon the Site of the Work at least five days in advance of such entry.

Time is of the essence of this Contract with respect to the Work to be performed. The Contractor shall proceed expeditiously with the Work with adequate forces. The Contractor hereby confirms that the times set forth for completion of the Work are reasonable periods of time for performing and completing the Work.

GC-3.02. RATE OF PROGRESS

The progress of the Work shall be in accordance with the approved schedule and shall be such that all Work under the Contract will be completed within the time specified, or before such later date to which the time of completion may have been extended by the Owner.

The Contractor shall within ten days following the execution of this Contract prepare and submit to the Engineer for approval, two copies of a practical and feasible Work schedule showing the order and date on which the several salient features (including equipment) will be started and completed.

The Work schedule shall be in the form of a cash and resource loaded critical path schedule.

Where there is more than one Contract on the Project, the General Contractor shall, within ten days following the execution of its Contract with the Owner, submit two copies of its own proposed Work schedule to the Engineer for review. After review, sufficient additional copies of the schedule shall be submitted to the Engineer for transmittal of two copies to each of the other Contractors, who shall then prepare and submit their own Work scheduled for review. The General Contractor shall then incorporate these schedules into its schedule.

The Contractor on each Contract shall adhere to the approved Work schedule for its Contract. In the event a Contractor does not adhere to its Work schedule and causes other Contractors to be damaged, the Contractor causing the delay shall defend, indemnify, and save harmless the Owner and Engineer from all actions and charges of the other Contractors against the Owner or Engineer caused by said delay including all costs, disbursements and attorneys' fees.

The Contractor shall update and resubmit its own schedule every month, unless the Engineer requests less frequent updating.

GC-3.03. EXTENSION OF TIME

If the Contractor is obstructed or delayed in the prosecution or completion of the Work by any cause beyond the control of the Contractor, including the neglect, delay or default of the Owner, Engineer or of any other contractors for adjoining or contiguous work, or by any damage that may happen thereto, unusual action of the elements taking account of the location of the Project, or by the abandonment of the Work by the employees in a general strike, or by any delay on the part of the Owner or Engineer doing work or furnishing material, the Contractor shall have no claim for damages against the Owner or Engineer for any such cause or delay, but may in such case be entitled to a reasonable extension of time specified herein for the completion of the Work, provided, however, that claim for such extension of time be made by the Contractor in writing within thirty calendar days from the time when such alleged cause for delay shall occur. Any extension

granted shall constitute the sole and only redress to the Contractor for any claims of any nature whatsoever caused or in any way related to such delay.

An application for an extension of time must set forth in detail using a critical path analysis the source and the nature of each alleged cause of delay in the completion of the Work, the date upon which each such cause of delay began and ended, and delay attributable to each of such causes. The Contractor shall, however, be entitled to an extension of time for such causes only for the number of calendar days of delay which the Owner may determine to be due solely to such causes, and then only if the Contractor shall have strictly complied with all of the requirements of this Section.

The Contractor shall not be entitled to receive a separate extension of time for each one of several causes of delay operating concurrently, but, if at all, only for the actual period of delay in completion of the Work as determined by the Owner irrespective of the number of causes contributing to produce such delay. If one of several causes of delay operating concurrently results from any act, fault or omission of the Contractor or of his subcontractors or materialmen, and would of itself (irrespective of the concurrent causes) have delayed the Work, no extension of time will be allowed for the period of delay resulting from such act, fault or omission.

SECTION 4

SURFACE AND SUBSURFACE CONDITIONS

GC-4.01. PROTECTION, EXISTING STRUCTURES

It shall be the sole responsibility of the Contractor and at its expense to protect adjacent and other property or premises from damage of any kind during the progress of the Work and shall erect and maintain guards around its Work in such a way as to afford protection to the public. The Contractor shall be held responsible for improper, illegal, or negligent conduct of itself, and its subcontractors, employees and agents in and about said Work or in the execution of the Work covered by this Contract.

It shall be the sole responsibility of the Contractor, and at its expense to sustain in their places and permanently protect from direct or indirect injury any and all pipelines, subways, pavements, sidewalks, curbs, railways, buildings, trees, poles, wells, and other property in the vicinity of his Work, whether over- or underground, or which appear within the trench or excavations, and it shall assume all costs and expenses for direct or indirect damage which may be occasioned by injury to any of them.

The Contractor's liability shall also include the damage or injury sustained by any structure whatsoever due to settlement of trenches or excavations or to settlement or lateral movement of the sides of such trenches or excavations, whether such movement occurs during or after excavation or backfilling of such trenches or excavations. The responsibility to so support and protect all such structures from damage or injury shall continue, without limitation, throughout the Contract period and during the period of guarantee.

The Contractor shall at all times have available onsite suitable and sufficient material and shall use the same as may be necessary or required for sustaining and supporting any and all such structures which are uncovered, undermined, weakened, endangered, threatened, or otherwise materially affected.

In case injury occurs to any portion of a pipeline or structure, or to the material surrounding or supporting the same, through blasting or similar operations, the Contractor shall immediately notify the Engineer, and, at the Contractor's expense, shall remove such injured Work and shall rebuild the pipeline or structure and shall replace the material surrounding and supporting the same, or shall furnish such material and perform such work of repairs or replacements as the Engineer may order. In the case of utilities, the Contractor shall immediately notify the utility company, and provide all assistance for the repair of the utility by the utility company unless authorized to undertake such repairs directly by the utility company. Any damage whatsoever shall be promptly, completely, and satisfactorily repaired by the Contractor at its expense to the satisfaction of the Owner, or owner of the utility.

GC-4.02. EXISTING SUBSURFACE STRUCTURES

(a) General

Certain existing subsurface structures likely to be encountered during the performance of the Work embraced in this Contract or located in close proximity to the Work hereunder as to require special precautions and methods for their protection, such as sewers, drains, water mains, and conduits, together with appurtenances, are shown on the Contract Drawings. The sizes, locations, and depths shown are approximate.

It is the obligation of the Contractor to verify the accuracy and completeness of the information shown, and the Contractor agrees that it shall neither have nor assert against the Owner or Engineer any claim for damages or extension of time or relief from any obligation of this Contract by reason of the inaccuracy, inadequacy, incompleteness, or other deficiency of the information given or the failure to furnish additional or further information in the possession of the Owner or Engineer, except as set forth in subsection (b) and (c) below.

Contractor is hereby given notice that subsurface structures and facilities may be located on the site which are either not identified or are mislocated on the Contract Documents.

Where any existing subsurface structure such as a sewer, drain, gas pipe, water pipe, conduit, or other structure is found which is not anticipated by the Contract Documents or which is found to be materially different in size, location, or depth from that anticipated by the Contract Documents, the Contractor shall immediately notify the Engineer, and also the superintendent of the utility, before disturbing the structure.

Contractor shall use due care to avoid damage to subsurface facilities identified, not identified or mislocated on Contract Documents.

If ordered by the Engineer, such structure shall be uncovered and supported by the Contractor, at its cost and expense, as constituting a part of the Contract, and the Contractor shall not become entitled to claim any damages for or on account of the presence of such structure or the uncovering and supporting of same.

(b) Existing subsurface structures, which require changes in the Work of the Contract.

The Engineer will determine whether changes should be made in the Contract Documents for construction of the Work of the Contract to avoid the subsurface structure, whether the Work of the Contract can proceed without changes in the Contract Documents, or whether the structure should be removed, realigned, or changed.

Any increase in cost of the Work resulting from any changes in the Contract Documents necessitated by the unanticipated presence or difference in size, location, or depth of the subsurface structure will be adjusted in the manner provided herein for changes in Contract amount.

(c) Existing subsurface structures, which require changes in the existing structure.

Where the size, location, or depth of the existing subsurface structure has been anticipated and the Contract Documents require removal, realignment, or change, all Work under this Contract shall be done in accordance with the Contract Documents in mutual cooperation with the utility or other parties concerned.

Where the presence of the subsurface structure or its size, location, or depth is not anticipated by the Contract Documents, any work by the Contractor required to remove, realign, or change the structure shall be done under the provisions for changes in the Work for the removal, realignment, or change and shall be done as mutually agreed by the Contractor, Engineer, and utility or other parties concerned.

(d) Interruption of Service

Where it is necessary to interrupt water, gas, or other public utility service to remove, realign, or change a subsurface structure, the Work shall proceed with expedience and shall be continuous after interruption of service until completion of the removal, realignment, or change and return of the utility service to its normal state.

GC-4.03. SUBSURFACE CONDITIONS OTHER THAN STRUCTURES FOUND DIFFERENT

Reference is made to the Information for Bidders Section of these Contract Documents and the obligations of the Contractor to perform all necessary subsurface investigations prior to bidding. Furthermore, the Contractor shall not be entitled to rely upon the subsurface investigation performed by the Owner or the Engineer.

GC-4.04. PROTECTION OF UTILITIES

All utilities whose facilities may be affected by the Work of the Contract shall be notified by the Contractor at least 72 hours in advance of the start of any operations, which might affect such facilities.

The removal, replacement, support, or other handling of private and public utilities coming within the lines of the Work shall be accomplished by the Contractor at its expense in accordance with arrangements satisfactory to the owner or operator of the utility involved. The Contractor, at its expense, shall remove, replace, or support all utilities as required.

The Contractor shall not permit nor cause any hindrance to or interference with any individual, municipal department, public service corporation, or other company or companies in protecting its or their mains, pipes, poles, posts, or other structures, nor in shifting, removing, or replacing the same. The Contractor shall allow said individual, department, company, or companies to take all such measures as they may deem prudent to protect their structures.

GC-4.05. REPLACEMENT OF PROPERTY

The Contractor shall replace all pavement, driveways, fences, shrubs, lawns, trees, and any other public or private property damaged as a result of the Work under this Contract. All such replacement shall be done in accordance with the applicable specifications and no separate or extra payment will be made unless specifically provided for in the Payment Items. In all cases, said replacement shall be new and at least equal to the original conditions.

SECTION 5

OWNER'S STATUS

GC-5.01. OWNER'S RIGHT TO SUSPEND WORK

If, in the opinion of the Owner the Work is defective, or the Contractor fails to supply sufficient skilled workmen or suitable materials or equipment, or if the Contractor fails to make prompt payments for labor, materials or equipment, or if other good cause exists, the Owner may order the Contractor to suspend the Work or any portion thereof until the cause for such order has been eliminated. This right of the Owner to suspend the Work shall not give rise to any duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other party. The Contractor shall have no claim or damages against the Owner for any delay due to such suspension of Work, provided, however, that in case of the suspension of Work due to circumstances beyond the control of the Contractor, the time within which the Contractor is required to complete the Work, shall be extended by as many calendar days as the Work was suspended. Such extended time of completion shall be the Contractor's only compensation for the suspension of Work as above provided.

GC-5.02. CONTRACTOR'S DEFAULT

In addition to those instances provided in other sections of this Contract, the Owner shall have the right to declare the Contractor in default of the whole or any part of the Work under conditions including but not limited to:

(a) The Contractor files a voluntary petition in bankruptcy or shall be adjudicated a bankrupt or insolvent, or shall file any petition or answer seeking any reorganization, arrangement, liquidation, dissolution, or similar relief for itself under any statute, law, or regulation, or shall seek or consent to or acquiesce in the appointment of any trustee, receiver, or liquidator of the Contractor, or of all or any substantial part of his properties or assets, or shall make any general assignment for the benefit of creditors, or shall admit in writing to inability to pay its debts generally as they become due; or if

(b) A petition is filed against the Contractor seeking any reorganization, arrangement, liquidation, dissolution, or similar relief under any statute, law, or regulation, and shall remain undismissed or unstayed for an aggregate of thirty days (whether or not consecutive); or if

(c) Any trustee, receiver, or liquidator of the Contractor or of all or any substantial part of its properties or assets is appointed without the consent or acquiescence of the Contractor and such appointment shall remain unvacated or unstayed for an aggregate of thirty days (whether or not consecutive); or if

(d) A receiver or receivers are appointed to take charge of the Contractor's property or affairs; or if

(e) The Contractor fails to commence work when notified to do so by the Owner; or if

(f) The Contractor abandons the Work as evidenced by removing workman, materials or equipment from the site; or if

(g) The Contractor refuses to proceed with the Work when and as directed by the Owner; or if

(h) The Contractor without just cause reduces its working force to a number which, if maintained, would be insufficient, in the opinion of the Owner to complete the Work in

accordance with the approved time progress schedule, and fails or refuses to sufficiently increase such working force when ordered to do so by the Owner; or if

(i) The Contractor sublets, assigns, transfers, conveys, or otherwise disposes of the Contract other than as permitted by the contract; or if

(j) The Owner is of the opinion that the Contractor is or has been unnecessarily or unreasonably or willfully delaying the performance and completion of the Work, or the award of necessary subcontracts; or if

(k) The Owner is of the opinion that the Work cannot be completed within the time herein provided therefor or within the time to which such completion may have been extended, provided however, that the impossibility of timely completion is, in the Owner's opinion, attributable to conditions within the Contractor's control; or if

(l) The Work is not completed within the time herein provided therefor or within the time to which the Contractor may be entitled to have such completion extended; or if

(m) The Owner is of the opinion that the Contractor is or has been willfully or in bad faith violating any of the provisions of this Contract; or if

(n) The Owner is of the opinion that the Contractor is not or has not been executing the Contract in good faith and in accordance with its terms.

The Owner’s exercise of this right shall not give rise to any claim or cause of action by the Contractor for damages of any nature whatsoever.

Before the Owner shall exercise its right to declare the Contractor in default by reason of the conditions set forth in the above items a, e, f, g, h, j, k, l, m and n, it shall give the Contractor and/or surety three working day's notice of its intention to declare the Contractor in default and unless, within such three day period, the Contractor shall make arrangements satisfactory to the Owner to correct or eliminate the conditions set forth in the Owner's aforesaid notice, the Contractor may be declared in default at the expiration of such three-day period or at the expiration of such longer period of time as the Owner may determine.

The right to declare the Contractor in default for any of the grounds specified or referred to shall be deemed exercised by the Owner sending the Contractor and surety a written notice at the address provided herein setting forth the ground or grounds upon which such default is to be declared. Upon receipt of notice that it is to be declared in default, the Contractor shall do only those acts reasonably related correcting the default or concluding its operations and demobilizing the site; leaving untouched all plant, materials, equipment, tools and supplies then on Site except as the Owner may otherwise direct.

The Owner, after declaring the Contractor in default, may then have the Work completed by such means and in such manner, by contract, with or without public letting, or otherwise, as it may deem advisable, utilizing for such purpose such of the Contractor's plant, materials, equipment, tools, and supplies remaining on the Site, and also such subcontractors as it may deem advisable, or it may call upon the Contractor's surety at its expense to do so.

In the event that the Owner declares the Contractor in default of the Work or any part of the Work, the Contractor, in addition to any other liability to the Owner hereunder or otherwise provided for or allowed by law, shall be liable to the Owner, for all of Owner’s costs and expenses, including, without limitation legal fees and expenses the Owner incurs for additional advisory and engineering services necessary, in its opinion, because of the default and, for the total amount of liquidated damages from the date when the Work should have been completed by the Contractor in accordance with the terms hereof to the date of actual completion of the Work, any of which shall be considered as expenses incurred by the Owner in completing the Work and

the amount may be charged against and deducted out of such monies as would have been payable to the Contractor or its surety if the Work had been completed without default.

If the Owner completes the Work, the Engineer shall issue a certificate stating the expenses incurred in such completion, including the cost of reletting. Such certificate shall be final, binding, and conclusive upon the Contractor, its surety, and any person claimed under or through the Contractor as to the amount of such expenses, except as may be modified by the Owner to reflect damages incurred.

The costs and expense of such completion, as certified by the Engineer, shall be charged against and deducted out of such monies as would have been payable to the Contractor if it had completed the Work; the balance of such monies, if any, subject to the other provisions of the Contract, shall be paid to the Contractor without interest after such completion. Should the expense of such completion, as certified by the Engineer, exceed the total sum which would have been payable under the Contract if the same had been completed by the Contractor, such excess shall be paid by the Contractor to the Owner upon demand.

In the event the Owner shall determine to complete the Work without calling upon the Contractor's surety to do so, the Contractor shall not be entitled, from and after the effective date of the declaration of the default, to receive any further payment under the Contract until the said Work shall be wholly completed and accepted by the Owner.

In case the Owner shall declare the Contractor in default as to a part of the Work only, the Contractor shall discontinue such part, shall continue performing the remainder of the Work in strict conformity with the terms of the Contract, and shall not hinder or interfere with any other contractors or persons whom the Owner may engage to complete the Work as to which the Contractor was declared in default.

The provisions relating to declaring the Contractor in default as to the entire Work shall be equally applicable to a declaration of partial default, except that the Owner shall be entitled to utilize for completion of the part of the Work as to which the Contractor was declared in default such plant, materials, equipment, tools, and supplies as the Owner may direct.

In completing the whole or any part of the Work, the Engineer and the Owner shall have the power to depart from or change or vary the terms and provisions of the Contract, provided, however, that such departure, change or variation be made for the purpose of reducing the time or expense of such completion. Such departure, change or variation, even to the extent of accepting a lesser or different performance, shall not affect the conclusiveness of the Engineer's certificate of expense to any action to recover the amount by which such certificate exceeds the amount which would have been payable to the Contractor hereunder but for his default.

GC-5.03. CONTRACTOR PERFORMANCE FOLLOWING DEFAULT

Notwithstanding Owner’s declaration of Contractor to be in default of the Work pursuant to GC-5.02, whether such declaration is in-whole or in-part, Contractor, with the written concurrence of Owner, or at the written direction of Owner, may perform mutually agreed upon Work for the benefit of the Owner, including, coordination of suppliers and/or subcontractors, completion of specified portions of the work in progress, and/or correction of defective and/or Guarantee Work. Such mutually agreed upon Work by Contractor shall not modify or supersede Owner’s declaration of default, but shall be strictly for the purpose of limiting or reducing the default liability of Contractor to Owner. Contractor shall be paid as provided in the Contract Documents for Work satisfactorily performed pursuant to this GC-5.03.

GC-5.04. OWNER'S RIGHT TO TERMINATE CONTRACT FOR CONVENIENCE

Upon thirty days' written notice to the Contractor and the Engineer, the Owner may without cause and without prejudice to any other right or remedy, elect to abandon the Work and terminate the Agreement. In such event, the Contractor shall be paid for Work executed and expenses sustained plus a reasonable profit.

GC-5.05. NO WAIVER OF RIGHTS

Neither the inspection by the Engineer, Owner, or any of their respective employees or agents, nor any order of the Owner for payment of money, nor any order, measurement or certificate by the Engineer, nor payment for, nor acceptance of the whole or any part of the Work by the Engineer or Owner, nor any extension of time, nor any possession taken by the Owner or its employees or agents shall operate as a waiver of any provision of this Contract, or of any power herein reserved to the Owner or of any right to damages herein provided, and no waiver of any breach of this Contract shall be held to be a waiver of any other subsequent breach. All remedies provided in this Contract to the Owner shall be construed as cumulative, i.e., in addition to each and every other remedy herein provided, and the Owner shall have any and all equitable and legal remedies which it would in any case have.

SECTION 6

INSPECTION OF WORK

GC-6.01. OWNER'S REPRESENTATIVE

The Engineer will be the Owner's representative during the construction period. A representative of the Engineer will make visits to the Site to observe the progress and quality of the executed Work and to determine, in general, if the Work is proceeding in substantial compliance with the Contract Documents. The Engineer will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. On the basis of the on-site observations, the Engineer will keep the Owner informed of the progress of the Work and will endeavor to guard the Owner against defects and deficiencies in the Work of Contractors. The Engineer may disapprove Work as failing to conform to the Contract Documents. Whenever the Engineer considers it necessary or advisable for the proper carrying out of the intent of the Contract Documents, the Engineer shall have authority to require the Contractor to make special examination or testing of the Work (whether or not fabricated, installed or completed).

No matter how extensive or intensive the Engineer's inspection, the Engineer will not have any duty or obligation with reference to and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, and will not be responsible for the Contractor's failure to carry out the Work in substantial compliance with the Contract Documents. The Engineer's duties, services, and work shall in no way supersede or dilute the Contractor's obligation to perform the Work in conformance with all contract requirements. The Engineer is empowered when directed by the Owner to act on its behalf with respect to the proper execution of the Work and to give instructions when necessary to require such corrective measures as may be necessary in the Engineer's professional opinion to endeavor to protect the Owner's interest.

The Engineer is empowered to determine the amount, quality, acceptability, and fitness of all parts of the Work, to interpret the Contract Documents, to waive provisions of the Specifications to meet unforeseen conditions or circumstances revealed or arising during the course of the Work, and to decide all other questions in connection with the Work, but this authority shall not give rise to any duty or responsibility of the Engineer to the Contractor, the subcontractor, or any of their agents or employees to do so.

GC-6.02. ACCESS TO WORK

The Owner, its Engineers, Inspectors, Agents, other employees, and any other parties who may enter into contracts with the Owner for doing work within the territory covered by this Contract shall, for all purposes which may be required by their contracts, and representatives of State and Federal regulatory agencies shall for any purpose have access to the Work and the premises used by the Contractor, and the Contractor shall provide safe and proper facilities therefore. The Contractor shall, whenever so requested, provide to the Engineer access to the proper invoices, bills of lading, etc., and shall provide scales and assistance for measuring and testing any of the materials.

GC-6.03. COVERING OF WORK

No backfilling or covering of underground Work or covering of Work in structures shall be done without authorization by the Engineer. Any Work covered without such authorization shall be uncovered to such extent as directed or removed and replaced by the Contractor at its expense. If covering of the Work is ordered stopped, no more Work shall be done until such order is withdrawn.

SECTION 7

CONTRACTOR'S STATUS

GC-7.01. REPRESENTATIONS OF THE CONTRACTOR

The Contractor represents and warrants:

(a) That it is financially solvent, that its financial condition is in all material respects the same as represented and certified at the time of bidding, and that it is experienced in and competent to perform the type of Work or to furnish the plant, materials, supplies or equipment, to be so performed or furnished by it; and

(b) That it is familiar with all Federal, State, County and Municipal laws, ordinances, and regulations which may in any way affect the Work or those employed therein including, but not limited to, any special acts relating to the Work or to the project of which it is a part; and

(c) That such temporary and permanent Work required by the Contract Documents as is to be done by it can be satisfactorily performed and constructed and used for the purpose for which it is intended and that such construction will not injure any person or damage any property; and

(d) That it has carefully examined the Contract Documents and the Site of the Work and that, from its investigations, it has satisfied itself as to the nature and location of the Work, the character, quality and quantity of surface and subsurface materials and structures likely to be encountered, the character of equipment and other facilities needed for the performance of the Work, the general and local conditions, and all other materials which may in any way affect the Work or its performance.

(e) The Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with each and every phase of the Work. The Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to all employees on the Work and any other persons who may be affected thereby.

GC-7.02. CONTRACTOR'S ADDRESS: NOTICES

Both the address given in the Bid upon which the Contract is founded and the Contractor's office at or near the Site of the Work are hereby designated as places to either of which notices, letters or other communications to the Contractor may be delivered. Notices to the Contractor may be given: 1) by personal delivery to any partner or officer of the Contractor, or, to the Contractor if a sole proprietor, or to any authorized representative of the Contractor, or, 2) by depositing in a postpaid wrapper directed to either of the places above designated in any post office box regularly maintained by the U.S. Postal Department, or, 3) by registered mail, certified mail, postage paid, return receipt requested, or, 4) by facsimile followed by regular mail, or, 5) by nationally recognized overnight courier (against receipt), or, 6) by telegraph. The date of service shall be the date of such delivery or mailing. The first named address may be changed at any time by an instrument in writing executed by the Contractor and delivered to the Owner.

Nothing herein contained shall be deemed to preclude or render inoperative the service of any notice, letter, or other written communication upon the Contractor or his authorized representative personally.

GC-7.03. SUPERVISION AND SUPERINTENDENCE

The Contractor shall continuously supervise and direct the Work efficiently and with its best skill and attention. The Contractor shall have sole responsibility for the means, methods, techniques, sequences, and procedures of construction. The Contractor shall be responsible to see that the finished Work complies accurately with the Contract Documents.

The Contractor acknowledges and agrees that it is fully responsible for the safety, supervision and control of the Work and of Contractor's agents, employees, subcontractors and suppliers and that the Owner and its Officers, employees and agents have no obligation with respect to supervision of Contractor's employees, agents, subcontractors or suppliers and the manner in which the work is performed.

The Contractor shall at all times have a competent superintendent agreeable to the Owner on the Site of the Work who shall have full authority to act for the Contractor and who shall see that the Work under the Contract is executed in accordance with the Contract Documents. The superintendent shall be an authorized representative of the Contractor for the purposes of Section GC-7.02.

The Contractor shall be responsible for the acts of its agents, superintendents, and employees during the life of the Contract.

GC-7.04. CONTRACTOR'S EMPLOYEES

The Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction and related activities as required by the Contract Documents. It shall, at all times, maintain good discipline and order at the Site.

GC-7.05. CONTRACTOR'S RESPONSIBILITY AND LIABILITY FOR INJURIES TO PERSONS OR DAMAGE TO PROPERTY

The Contractor shall be solely responsible and liable for the safety and protection of property, including but not limited to, the premises, its appurtenances and equipment and for the safety and protection of all persons entering on, in or about the Site including, but not limited to, the employees of the Owner, Engineer, Contractor, or subcontractors. The Contractor shall be solely responsible for all physical injuries, including death, to any such persons and for all damage to any such property occurring on account of the Work under this Contract, whether or not due to the negligence, fault, or default of the Contractor, its officers, employees, or agents, or of a subcontractor, its officers, employees, or agents.

To the fullest extent permitted by the law of the State in which the work is performed the liability of the Contractor under this Contract shall be absolute and shall not be dependent upon any question of negligence on the Contractor's part or on the part of its officers, agents, servants, or employees. Neither the approval by the Engineer of the methods of doing the Work, nor the failure of the Engineer to call attention to improper or inadequate methods or to require a change in methods, nor the neglect of the Engineer to direct the Contractor to take any particular precautions or to refrain from doing any particular thing shall excuse the Contractor from its obligations hereunder in case of any such injury to person or damage to property.

The provisions of this paragraph are intended for the sole benefit and protection of the Owner and Engineer and shall not create any cause of action in favor of any person, corporation or entity, other than the Owner and Engineer.

GC-7.06. CONTRACTOR'S DUTY OF INDEMNIFICATION

The Contractor shall fully protect, defend, indemnify, and save harmless the Owner and the Engineer, their officers and agents, against all liability, judgments, costs, damages and expenses, including reasonable attorneys' fees, upon any claims for injuries to, or death of, any persons or damage to any property occurring on account of the Work hereunder, whether such damages or injuries to be attributable to the negligence of

the Contractor, its officers, employees, agents, the Owner, Engineer, or others, provided, however, where such indemnification is precluded by statute, this clause shall not be deemed to provide indemnity to the Owner or Engineer to the extent that such liability, judgements, costs, damages and expenses are attributable to the negligence of the Owner or Engineer.

The Contractor shall fully protect, defend, indemnify, and save harmless the Owner and the Engineer against all liability judgments, costs, damages, and expenses, including without limitation reasonable attorneys' fees, upon all claims relating to labor and material furnished in connection with the Work hereunder or on account of the failure, omission, or neglect of the Contractor or its Subcontractors, their officers, employees, or agents to do or perform any of the covenants, acts, matters, or other duties required by this Contract.

The provisions of this Section GC-7.06 shall not be deemed to provide indemnity of the Engineer for the liability of the Engineer, its agents or employees, to the extent that the liability of the Engineer, its agents or employees arises out of (a) or (b) below.

(a) the preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs, or specifications, or

(b) the negligent giving or failure to give, directions or instructions required by this contract or statute of the Engineer, its agents or employees as part of the Work, where such giving or failure to give directions or instructions, is the primary and principal cause of the bodily injury or property damage.

GC-7.07. CLAIMS

If the Contractor claims: 1) that any Work it has been ordered to do is extra work, or 2) that it has performed or is going to perform extra work, or 3) that any action or omission of the Owner or the Engineer is contrary to the terms and provisions of the Contract, it shall:

(a) Promptly comply with such order;

(b) File with the Owner and the Engineer within ten working days after being ordered to perform the Work claimed by it to be extra work or within ten working days after commencing performance of the extra work, whichever date shall be the earlier, or within ten working days after the said action or omission on the part of the Owner or the Engineer occurred, a written notice of the basis of its claim and a request for a determination thereof;

(c) File with the Owner and the Engineer, within thirty calendar days after said alleged extra work was required to be performed or said alleged extra work was commenced, whichever date shall be earlier, or said alleged action or omission by the Owner or the Engineer occurred, a verified detailed statement, with documentary evidence, for the items and basis of its claim;

(d) Produce for the Owner's examination, upon notice from the Owner, all of the Contractor’s and its subcontractors' (of any tier) books of account, bills, invoices, payrolls, subcontracts, time books, progress records, daily reports, bank deposit books, bank statements, checkbooks, and canceled checks showing all of its actions and transactions in connection with, or relating to, or arising by reason of, its claim, and submit itself, persons in its employment, and persons in its subcontractor's employment for examination under oath by any person designated by the Owner to investigate any claims made against the Owner under the Contract, such examination to be made at the offices of the Owner or the Owner's agent;

(e) Proceed, prior to and subsequent to the determination of the Owner with respect to any such disputed matter, with the performance of the Contract diligently and in accordance with all instructions of the Owner and the Engineer.

The Contractor's failure to comply with any or all of the foregoing provisions of this Section shall be deemed to be: 1) a conclusive and binding determination on its part that said order, work, action, or omission does not involve extra work and is not contrary to the terms and provisions of the Contract; and 2) a waiver by the Contractor of all claims for additional compensation or damages as a result of said order, work, action or omission.

No person shall have power to waive or modify any of the foregoing provisions. In any action against the Owner to recover any sum in excess of the sum certified by the Owner to be due under or by reason of the Contract, the Contractor must allege in its complaint and prove at the trial compliance with each and all the provisions of this Section.

Nothing in this Section shall in any way affect the Owner's right to obtain an examination before trial or a discovery and inspection in any action that might be instituted by, or against, the Owner or the Contractor.

GC-7.08. NO CLAIMS AGAINST INDIVIDUALS

No claim whatsoever shall be made by the Contractor against any trustee, beneficiary, officer, agent, or employee of the Owner for, or on account of, anything done or omitted to be done in connection with the Contract.

This Section shall also apply with equal force and effect to the directors, officers and employees of the Engineer provided, however, that this Section shall not apply to partners or other persons who by law would be liable for the acts of the legal entity, whether the Owner or Engineer, it being the intent of this Section that claims against the legal entity itself shall not be precluded.

GC-7.09. SAFETY AND PROTECTION

In addition to the published safety rules and practices of the Owner, if any, applicable to activities at the Site the Contractor shall comply with all applicable laws, ordinances, rules, regulations, and orders of public bodies having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss, including, without limitation, the Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of l970 (PL 91-596), as amended, and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54) and the Labor Laws of the State within which the project is located and the codes, rules and regulations promulgated therewith and all amendments or successor statutes or regulations to any of the foregoing. The Contractor shall erect and maintain as required by the conditions and the progress of the Work, all necessary safeguards for safety and protection and shall comply with all applicable recommendations of the Manual of Accident Prevention in Construction of the Associated General Contractors of America, Inc.

In compliance with the foregoing the Contractor shall have on site while any work is being performed an appropriately trained, responsible member of its organization whose duty shall be compliance with the above referenced laws, ordinances, rules, regulations and orders and the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated in advance in writing by the Contractor to the Owner.

The Contractor shall be responsible for developing, adopting and enforcing a project specific health and safety plan. The Contractor may not use any health and safety plan provided by Owner or Engineer as a substitute for conducting a full independent analysis of the materials, substances, equipment and conditions to be encountered during the project or as part of Contractor’s work. The Contractor shall be responsible for determining and applying the most current applicable codes, rules, regulations and generally accepted

standard of practice for each element of Contractor's health and safety plan. The Contractor shall not be permitted to rely on any project health and safety plan provided by Owner or Engineer.

The Contractor shall be responsible for providing to all its employees, agents and subcontractors or any other person under its control all safety equipment including but not limited to, hard hats, safety helmets, safety eye wear, respirators, and protective clothing required by law and the project specific health and safety plan, and shall be responsible for insuring the proper use thereof.

The Contractor shall place a post adjacent to the principal entry point into each excavation. Following each inspection of the excavation as required by 29 CFR 1926 (Subpart P) the Contractor shall prominently post in a manner protected from loss or damage by weather or other conditions, a certification of inspection. Such certification shall be 8 1/2" x 11" and shall be headed

"Excavation Safety Inspection"

and shall set forth in letters and figures, at least 2 inches high and 1/2 inch in thickness, the time and date of the last inspection of the excavation. The certification shall also state that no evidence was found on inspection of: 1) a situation that could result in possible cave ins, 2) indication of failure of protective systems, 3) hazardous atmospheres, or 4) other hazardous conditions. The certification shall be signed by a competent person (as defined in 29 CFR 1926.650).

The duties, responsibilities and liability of the Contractor as set forth herein shall be deemed incorporated in and applicable to each and every separate division, section and provision of the Contract Documents as if set fort fully therein.

The Contractor shall keep upon the Site, at each location where Work is in progress, a completely equipped first-aid kit and stretcher and shall provide ready access thereto at all times when personnel are employed on the Work.

The Contractor alone shall be responsible for the safety, efficiency, and adequacy of his plant, appliances and methods.

GC-7.10. EMERGENCIES

In emergencies affecting the safety of persons on the Work or property at the Site or adjacent thereto, the Contractor, without special instruction or authorization from the Engineer or Owner, shall act, at its discretion, to prevent threatened damage, injury or loss. It shall give the Engineer prompt written notice of any significant changes in the Work or deviations from the Contract Documents caused thereby. If the Contractor believes that additional Work done by it in an emergency which arose from causes beyond its control entitles it to an increase in the Contract price or an extension in the Contract time, it shall make claim as provided for in this Contract.

GC-7.11. PATENTS AND LICENSING AGREEMENTS

The Contractor shall protect, defend, indemnify, and save harmless the Owner and Engineer from all liabilities, judgments, costs, damages, and expenses which may in any way come against either of them by reason of the use of any material, machinery, devices, equipment, software or processes furnished or used in the performance of the Work for which patents or licensing agreements exist or by reason of the use of designs furnished by the Contractor for which patents or licensing agreements exist.

In the event that any claim, suit, or action at law or in equity of any kind whatsoever is made or brought against the Owner involving any such patents or licensing agreements, the Owner shall have the right to retain from the money due and to become due the Contractor a sufficient amount of money as shall be considered necessary by the Owner to protect itself against loss until such claim, suit, or action shall have been settled and evidence to that effect shall have been furnished to the satisfaction of the Owner.

GC-7.12. CONTRACTOR TO CHECK CONTRACT DOCUMENTS

The Contractor shall verify all dimensions and quantities in the Contract Documents. Any discrepancies found between the Contract Documents and Site conditions or any errors or omissions found shall be immediately reported to the Engineer, who shall promptly correct such error or omission in writing. Any Work done by the Contractor after its discovery of such discrepancies, errors, or omissions shall be done at the Contractor's sole risk and expense.

SECTION 8

SUBCONTRACTS AND ASSIGNMENTS

GC-8.01. ASSIGNMENT

The Contractor shall not assign, transfer, convey, or otherwise dispose of this Contract, or any portion thereof, or of its right, title, or interest therein, or its power to execute such Contract, to any other person or corporation without the previous consent in writing of the Owner.

The provisions of this Section shall not hinder, prevent, or affect an assignment by the Contractor for the benefit of creditors made pursuant to law, nor is it intended to prohibit subcontracting a portion of the Work of the Contract in accordance with the provisions of law and this Contract.

GC-8.02. SUBCONTRACTS

In the event that the Contractor desires to subcontract any part of the Work, it shall first submit to the Engineer a statement showing the character and amount of the Work to be subcontracted and the party to whom it is proposed to subcontract the same. Submission of said statement shall be 30 days prior to the time the Contractor plans to actually employ the proposed subcontractor. The Contractor shall also furnish a statement as to the proposed subcontractor's experience, financial ability, or other qualifications for properly performing the Work proposed to be subcontracted. In the event that the Owner or the Engineer objects for any reason to the Contractor contracting with a particular Subcontractor, the Owner or the Engineer shall provide the Contractor with notice of the same within ten (10) business days after submission by the Contractor to the Owner and the Engineer of the name and qualifications of such Subcontractor. The Contractor shall not contract with any such Subcontractor and shall promptly provide the Engineer with the name, experience, financial ability and other qualifications of a substitute Subcontractor.

The Contractor warrants that all subcontractors selected by it are financially able, sufficiently experienced, and otherwise qualified to perform the work of their subcontracts.

The Contractor shall be solely responsible for the acts or defaults of subcontractors and of such subcontractors' officers, agents and employees each of whom shall, for this purpose, be deemed to be the agent or employee of the Contractor to the extent of its subcontract.

The Contractor shall be fully responsible for the administration, integration, coordination, direction, safety practices and supervision of all of its subcontractors.

No subcontractor shall be permitted to work at the Site unless it furnishes and maintains the insurance required by this Contract. Certificates of Insurance shall be provided to the Owner, prior to admission of each subcontractor to the site.

The Contractor shall execute with each of its subcontractors and all subcontractors shall execute with their sub-subcontractors a written agreement which shall bind the latter to the terms and provisions of this Contract insofar as such terms and provisions are applicable. The Contractor and all subcontractors and sub-subcontractors shall promptly, upon request, file with the Owner a conformed copy of such agreements, from which the price and terms of payment may be deleted.

If, at any time during the progress of the Work to be performed, the Owner decides that any subcontractor of any tier is incompetent, careless or uncooperative, the Engineer as directed by the Owner will notify the Contractor accordingly and immediate steps will be taken by the Contractor for cancellation of such subcontract. Such termination, however, shall not give rise to any claim by the Contractor or by such subcontractor for loss of prospective profits on work unperformed or work unfinished, and a provision to that effect shall be contained in all subcontracts.

No provisions of this Contract shall create or be construed as creating any contractual relation between the Owner and any subcontractor or sub-subcontractor or with any person, firm or corporation employed by, contracted with or whose services are utilized by the Contractor.

The divisions or sections of the Contract Documents are not intended to control the Contractor in dividing the work among subcontractors or to limit the work performed by any trade.

The Owner reserves the right to limit the total amount of subcontracts to fifty percent (50%) of the total contract price.

SECTION 9

CHANGES

GC-9.01. OWNER'S CHANGES IN THE WORK

(a) The Owner at any time may make changes in the Work of the Contract by making alterations therein, by making additions thereto, or by omitting Work therefrom, and no such action shall invalidate the Contract, relieve or release the Contractor from any guarantee under the Contract, affect the terms or validity of any bond, relieve or release any Surety, or constitute grounds for any claim by the Contractor for damages or loss of anticipated profits. If changes in work exceed 20% of the Contract, notice must be given to Surety. All Work required by such alterations, additions, or omissions shall be executed under the terms of the Contract not withstanding the extent thereof. Said changes alterations, additions or omissions shall not constitute a cardinal change in the Contract.

(b) Other than in an emergency endangering life or property or pursuant to a Field Order, the Contractor shall not make any change in the Work nor furnish any labor, equipment, materials, supplies, or other services in connection with any change except pursuant to, and after, receipt of a written authorization from the Owner in the form of a Change Order, Modification, or Proceed Order. The Contractor shall not be entitled to any increase in the Contract price or extension of the Contract time, and no claim therefor shall be valid, unless such written authorization has been so issued to the Contractor, by the Owner.

(c) The Engineer may authorize minor changes in the Work which do not alter the character, quantity, or cost of the Work as a whole. These changes may be accomplished by a Field Order. The Contractor shall carry out such Field Orders promptly and without any adjustment of the Contract price or Contract time.

GC-9.02. ADJUSTMENTS IN PRICE

Any increase or decrease in the Contract price resulting from changes in the Work ordered by the Owner shall be determined as provided in this Section:

(a) By such applicable unit prices, if any, as set forth in the Contract; or

(b) If no such unit prices are so set forth, then by unit prices or by a lump sum mutually agreed upon by the Owner and the Contractor; such unit prices or lump sum being arrived at by estimates of reasonable value prepared in general conformance with the outline set forth in (c) below.

(c) If no such unit prices are so set forth and if the parties cannot agree upon unit prices or a lump sum, then determination shall be made as the sum of the following amounts for all Work necessary for the changes:

(1) Cost of materials delivered to the job Site for incorporation into the Contract Work.

(2) Wages paid to workmen and foremen and wage supplements paid to labor organizations in accordance with current labor agreements.

(3) Premiums or taxes paid by the Contractor for workmen's compensation insurance, unemployment insurance, FICA tax and other payroll taxes as required by law.

(4) Sales and use taxes paid as required by law.

(5) Allowances for necessary use of construction equipment (exclusive of hand tools and minor equipment), as approved by the Engineer.

(6) An amount for overhead.

(7) An amount for profit.

Construction equipment rental rates shall be in accordance with those published in that issue of the Associated Equipment Distributors (AED) Rental Guide, current at the time the work is done. In the event that rental rates for equipment used in the performance of extra work are not listed in the AED Rental Guide, rental rates will be approved for payment which are consistent with those prevailing in the construction industry in the area of the Work. Monthly, weekly, or daily rates shall apply, prorated to the actual time the equipment is in use; the classification of monthly, weekly, or daily rate to be used shall be determined by the length of time the piece of equipment under consideration was in use on the total project under Contract plus either the time used in the performance of the extra work or the time used in the performance of the extra work plus additional subsequent time used on the total project under contract. Gasoline, oil and grease required for operation and maintenance will be paid for at the actual cost. When, in the opinion of the Contractor as approved by the Engineer, suitable equipment is not available on the Site, the moving of said equipment to and from the Site will be paid for at actual cost.

The Contractor shall submit evidence satisfactory to the Engineer to substantiate each and every item included in an estimate prepared pursuant to GC-9.02 (b) or a determination pursuant to GC-9.02 (c).

The amounts allowed for overhead and profit for a change resulting in an increase in Contract price may be less than, but shall not exceed, the applicable percentages as follows:

(a) For work done directly by the Contractor, the sum of overhead amount plus profit amount shall not exceed 20% of the cost.

(b) For work done by subcontractors of any tier, the sum of total overhead amounts of the subcontractors and Contractor, plus total profit amounts for the subcontractors and Contractor, shall not exceed 25% of the cost. Subcontractors shall be limited to 15% and Contractors shall be limited to 10% for combined overhead and profit.

Overhead is defined as all expense not included in the amounts outlined in GC-9.02 (c) (1) through GC-9.02 (c) (5), including administration, superintendence, insurance not outlined in GC-9.02 (c) (1) through GC-9.02 (c) (5), material used in temporary structures, additional premiums placed upon the labor and performance bonds of the Contractor and small hand tools.

Where Work necessitated by the change involves overtime, no payroll taxes, overhead or profit will be allowed on the premium portion of overtime pay.

GC-9.03. PROCEED ORDER

If the Owner and the Contractor cannot agree upon an equitable adjustment of the Contract price prior to performance of the change in the Work, a Proceed Order will be issued authorizing the change, and Contractor shall proceed with the work thereof by the most economical methods. Upon completion of the change in the work and a determination of the adjustment in the Contract price, a Change Order will be issued.

GC-9.04. EXTRAS BY CONTRACTOR

Extras for Increase in Contract Price: If the Contractor claims that any instructions given to him by the Owner or Engineer, by the drawings or otherwise, involve extra Work not covered by the Contract, then, except in emergencies endangering life or property, the Contractor shall give the Owner written notice thereof before proceeding to execute the Work. Said notice shall be given promptly enough to avoid delaying the Work and in no instance later than 10 days after the receipt of such instructions. Should it not be clear to

the Contractor that a change will involve extra Work, written notice given within 10 days that the change may involve extra Work will be considered sufficient notice. If the Owner agrees that the Work involved in such instruction was extra work, a change order shall be issued as provided in GC 9.02 of these General Conditions, and the additional compensation to be paid therefore shall be determined by one of the three methods provided in said GC 9.02, selected by the Owner. Except as otherwise specifically provided, no claims for extra Work shall be allowed unless the notice required by this Section is given by the Contractor within the time allowed and unless such Work is performed pursuant to the written order of the Owner as provided in said GC 9.02. The Owner's written order shall designate which of the three methods for computing charges and credits set forth in GC 9.02.

SECTION 10

CORRECTION AND GUARANTEE OF WORK

GC-10.01. CORRECTION OF WORK PRIOR TO ACCEPTANCE

If the Work, or any portion thereof, is damaged or defective in any way or if defects not readily detected by inspection develop before acceptance of the Work, the Contractor shall forthwith remove and replace, without additional compensation, such damaged or defective work. This requirement to remove and replace is notwithstanding that the Work may have previously passed the prescribed inspections and tests.

If the Contractor shall fail to replace any defective or damaged work within thirty days following written notice from the Engineer, or such other period of time designated by written notice from the Engineer, the Owner may cause such Work, material or equipment to be replaced; the expense thereof shall be charged to the Contractor and the amount deducted from any monies due or to become due the Contractor.

Any materials brought upon the Site which shall be rejected by the Engineer as not in conformity with the Contract Documents shall be removed immediately by the Contractor from the Site of the Work and replaced with materials complying with the Contract Documents without any additional costs or expense to the Owner.

Failure or omission on the part of the Engineer or any of its assistants or agents to reject defective or inferior work, material, or equipment, shall not release the Contractor from the obligations of tearing out, removing, and properly replacing the defective or inferior Work, materials, or equipment at Contractor's sole cost and expense at any time, upon the discovery of said defective or inferior work, material or equipment, prior to the written acceptance of the Work under this Contract, notwithstanding that such Work, material, or equipment may have been estimated for payment or that partial payments have been made on the same.

GC-10.02. CORRECTION OF WORK AFTER ACCEPTANCE

Any Work requiring rebuilding or replacement, as set forth in the subsection entitled "Guarantee", will be brought to the attention of the Contractor by written notice. The Contractor shall, within five days of such written notice, advise the Owner of his schedule for the timely rebuilding or replacement of such Work. Thereafter, such rebuilding or replacement shall be accomplished in accordance with said schedule.

GC-10.03. ACCEPTANCE OF UNCORRECTED WORK

If, instead of requiring correction or removal and replacement of Work which deviates from the Contract, the Owner–may choose to accept it. In such case, a Change Order shall be issued with appropriate reduction in the Contract price as set forth in General Conditions Section entitled Deductions for Uncorrected Work.

GC-10.04. GUARANTEE

The Contractor guarantees the Work under the Contract against any and all defects in workmanship and materials for a period of one year following the date of Substantial Completion of the Work or the date of Beneficial Occupancy of that portion of the completed Work where Beneficial Occupancy may have occurred whichever shall later occur. Specific items of work and/or equipment may require extended warranty (beyond one year), the duration and terms of which shall be as specified in the Technical Specifications.

Pursuant to this guarantee, the Contractor agrees to make good, without delay and at its expense, any and all failures of any parts due to faulty materials, construction, or installation, or to the failure of any equipment to perform successfully within the limits prescribed by the Specifications; in addition, the

Contractor shall make good any damage or injury to any other part of the Work caused by such failure of parts or equipment (Guarantee Work). Notwithstanding this provision, Owner may elect to apply the provisions of Sections 10.03 "Acceptance of Uncorrected Work" and 11.09 "Deduction for Uncorrected Work" to Guarantee Work.

Where the total value of all replacement or rebuilding required during the guarantee period is equal to or less than $5,000 or such other value as may be stated in the Special Conditions, the guarantee period shall terminate at one year following the later to occur of the date of Substantial Completion or Beneficial Occupancy. Where the total value of said replacement exceeds $5,000 or such other value as may be stated in the Special Conditions, the guarantee period for the total replacement or rebuilding shall be extended to a date one year following the date of completion of the rebuilding or replacing of the last item which failed.

The guarantee period for minor items contained on the Estimate of Work Remaining shall terminate at a date one year following the completion or correction by the Contractor of the Estimate of Work Remaining items. However, in the event of failure of a minor item or items following completion or correction of said minor items, the value of subsequent replacement or rebuilding of such item or items shall be included in the total value of all replacement or rebuilding for determining an extension of the guarantee period as set forth in the previous paragraph.

The Contractor shall furnish such labor and equipment as the Engineer may require to facilitate any one-year inspections of the Project at such times as shall be determined by the Engineer or Owner.

The guarantee under this provision shall not impair or limit the other rights and remedies available to the Owner by contract, statute or common law.

SECTION 11

PAYMENTS AND COMPLETION

GC-11.01. ESTIMATED QUANTITIES

The Contractor agrees: 1) that it will make no claim of any nature against the Owner or Engineer because of a difference between the quantities for unit price items of Work actually furnished and the estimated quantities stated in the Bid even though the estimated quantities prove grossly different from the quantities actually used, and 2) that the quantity of any unit price item of Work may be increased or decreased as may be deemed necessary without alteration or modification of the Contract.

In the event that the quantities of various items actually used are either higher or lower than the quantities stated in the Bid, the Contractor agrees as follows:

(a) where the change in quantities for any item in the original bid does not exceed 15% of the original bid quantity, the applicable unit prices bid shall be the sole basis for computing payment.

(b) where the change in quantities for any item in the original bid exceeds 15% of the original bid quantity, the Owner may review the unit price for said item to determine if a new unit price should be negotiated.

GC-11.02. PRICES

The prices herein agreed to for the performance of the Work shown and as specified shall include not only the doing of the Work but also the furnishing of all labor, tools, and materials therefor, whether the same are required directly or indirectly, unless otherwise specified.

Where Work is to be measured for payment by units of length, area, volume, or weight (as stated in the Bid), only the net amount of Work actually done, as it shall appear in the finished Work and as measured only within the payment limits described in the Contract Documents or as is ordered, shall be paid for, local customs to the contrary notwithstanding.

Where a lump sum price is bid for an item in the Bid, the lump sum price shall be for the Work complete as described in the item and shall include the cost of all specified or implied equipment, materials, and labor incidental to the Work, complete and ready for service and in accordance with the Contract Documents.

GC-11.03. BREAKDOWN OF LUMP SUM ITEMS

At least ten days prior to the submission of its first application for a progress payment, the Contractor shall present to the Engineer for its review a detailed schedule showing the breakdown of all lump sum bid prices in the Contract. Such schedule shall contain the amount estimated for each part of the Work and an estimate of quantities for each part of the Work. Work to be performed by subcontractors shall be separately identified. Upon request of the Engineer, said schedule shall be apportioned by the Contractor for labor and for materials. Such schedule shall be revised by the Contractor until the same shall be satisfactory to the Engineer and shall not be changed after the Engineer has approved the same without the express written consent of the Engineer. The approved schedule will be used in the preparation of the current estimate but will not be considered as fixing the basis for additions to or deductions from the Contract.

GC-11.04. CURRENT ESTIMATES

The Owner will establish dates during the respective months of the Project on which the Owner will accept applications for payment.

At least ten days before each date set for consideration for payment, the Contractor shall submit to the Engineer for review an application for payment, filled out and signed by the Contractor and covering the Work completed as of the date of the application, in satisfactory form and supported by such data as the Owner and Engineer may reasonably require.

The Engineer will, within ten days after receipt of each application for payment, either indicate in writing its recommendation of payment and present the application to the Owner or return the application to the Contractor, indicating in writing his reasons for not recommending payment. In the latter case, the Contractor shall make the necessary corrections and resubmit the application.

The Engineer's recommendation of any payment request shall constitute its advice to the Owner: that to the best of its knowledge, information, and belief, based on the Engineer's on-site observations of the Work in progress and on its reliance upon application for payment and supporting data, the Work has progressed to the point indicated; that the quality of the Work appears to be in substantial compliance with the Contract Documents (subject to any subsequent tests and qualifications stated in his final review); and that the Contractor is entitled to the payment of the amount recommended. However, by recommending any such payment, the Engineer shall not thereby be deemed to have represented that it made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, that it has reviewed the means, methods, techniques and sequences, or that it has made any examination to ascertain how or for what purpose the Contractor has used the monies paid or to be paid to the Contractor on account of the Contract price.

Where Work has been included in the current estimate recommended by the Engineer for payment, and where such Work is later found to be defective, and where such defective Work has not been corrected, the Engineer will recommend to the Owner that the value of such uncorrected Work be deducted from the amount due or to become due the Contractor.

The Engineer may decline to act upon requests for monthly payment if lists of vendors and sub-contractors, shop drawings, samples, work schedules, instruction manuals, and breakdowns of lump sum bid items necessary for orderly prosecution of the Work, are not submitted as required.

GC-11.05. TITLE TO MATERIALS, EQUIPMENT AND SUPPLIES

The Contractor warrants and guarantees that it will have good title to all materials, equipment, and supplies delivered to the Site for use in the Work.

Title to all materials, equipment and supplies to be sold by the Contractor to the Owner pursuant to this Contract or to be installed or incorporated into the Project shall immediately vest in the Owner upon delivery of such materials, equipment and supplies to the Site and prior to their installation or incorporation into the Project. Such materials, equipment, and supplies shall then become the sole property of the Owner subject to the right of the Owner to reject the same as hereinafter provided. The Contractor shall mark or otherwise identify all such materials, equipment, and supplies as the property of the Owner. The Contractor, at the request of the Owner, shall furnish to the Owner such confirmatory bills of sale and other instruments as may be required by it, properly executed, acknowledged, and delivered, confirming to the Owner title to such materials, equipment, and supplies free of liens or encumbrances of any kind. In the event that, after title has passed to the Owner, any of such materials, equipment, and supplies are rejected as being defective or otherwise unsatisfactory, title to all such materials, equipment, and supplies shall upon such rejection re-vest in the Contractor, and the Contractor shall then replace the rejected material, equipment, and supplies with acceptable material, equipment, and supplies at no additional cost to the Owner.

Nothing in this Section is intended, or shall be construed, as relieving the Contractor from its obligations under this Contract, and the Contractor shall have the sole continuing responsibility to install the materials, equipment, and supplies purchased or furnished in accordance with the provisions of this Contract, to protect the same, to maintain them in proper condition, and to forthwith repair, replace, and make good

any damage thereto or loss thereof, without cost to the Owner until such time as the Work covered by the Contract is accepted by the Owner in accordance with Section GC-11.13.

The Contractor warrants and guarantees that no materials, equipment, or supplies delivered to the Site for use in the Work will have been acquired by the Contractor (or any other person performing work at the Site or furnishing materials, equipment or supplies for the project) subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller (or otherwise imposed on the Contractor by any person).

GC-11.06. PAYMENTS FOR MATERIALS DELIVERED TO SITE

In making estimates of the value of the Work done and materials incorporated in the Work, the Contractor may, subject to the approval of the Owner or as required by law, include in the current estimates the delivered cost, as modified below, of equipment and non-perishable materials which have been tested for adequacy and which have been delivered to the Site and adequately protected from fire, theft, vandalism, the effect of the elements, and any damage whatsoever, or similarly placed in approved storage facilities adjacent thereto. Such materials and equipment shall at all times be available for inspection by the Engineer and the Owner.

No progress payment shall, however, be made for said material and equipment until each of the following conditions has been fulfilled:

(a) The Contractor shall have furnished to the Engineer invoices establishing the value of the said materials and equipment with the full amount the Contractor agrees to pay the vendor. Such invoices shall be furnished at least ten days in advance of the date of preparation of monthly estimates as established by the Engineer.

(b) The Engineer shall have inspected said material and equipment and recommended payment therefor.

(c) The Contractor shall have furnished to the Owner the fire and other casualty insurance policies, as provided in this Contract and with the broad form extended coverage endorsement, for said material and equipment in an amount equal to 100% of the value thereof and which policies shall be maintained, at the sole cost and expense of the Contractor, until said material and equipment has been incorporated into the Project and which shall name the Owner as an additional insured and loss payee and shall also name the Engineer as additional insured.

Contractor shall submit with each application for payment, satisfactory evidence that all suppliers, materialmen and subcontractors have been paid all amounts previously invoiced with respect to their services and agreeing to defend and hold Owner harmless from any liens and encumbrances placed against the Project on account of Contractor's failure to promptly pay its suppliers, materialmen and subcontractors. Satisfactory evidence shall be: a canceled check in the correct amount and including identification of the invoice or invoices paid; a letter or telegram, from the vendor and signed by his properly authorized employee, stating the amounts and invoices that have been paid; or a receipted invoice. Neither the Owner nor the Engineer shall have an obligation to pay or see to the payment of money to a Subcontractor except as may otherwise be required by law.

Should the above evidence of payment not be furnished, the Engineer will recommend the deduction of any funds included in previous estimates for such materials and equipment for which said evidence has not been furnished from the current estimate or subsequent current estimates.

Any payment made for materials and equipment delivered will not relieve the Contractor of any responsibility for furnishing all the necessary equipment and materials required for prosecution of the Work in the same manner as if such payments had not been made.

GC-11.07. OWNER'S PAYMENT OF MONTHLY ESTIMATES

The Owner will, within thirty days of presentation to it of an approved application for payment (current estimate), pay the Contractor the approved amount of such estimate, which unless otherwise set forth in the special provisions, shall be less retainage of five (5) percent.

In lieu of all or part of the cash retainage, the Owner may accept securities negotiable without recourse, conditions or restrictions, a release of retainage bond, or an irrevocable letter of credit provided by the Contractor. The Owner may accept only securities, bonds or instruments acceptable under the laws of the State where the Owner is resident and/or the work is performed in lieu of any or all of the cash retainage.

Acceptance by the Contractor of the monthly payment shall constitute its warranty that it will pay each of its subcontractors and vendors all monies due them as required by applicable State and Federal Laws and Regulations.

GC-11.08. OWNER'S RIGHT TO WITHHOLD PAYMENTS

The Owner may withhold from the Contractor so much of any approved payments due it as may in the judgment of the Owner be necessary to assure the payment of any claims, liens or judgments against the Contractor, resulting from performance or non performance of the Work of the Contract, which have not been suitably discharged. The Owner shall have the right as agent for the Contractor to apply any such amounts so withheld in such manner as the Owner may deem proper to satisfy such claims, liens or judgments. Such application of such money shall be deemed payments for the account of the Contractor.

The Owner may also withhold from the Contractor so much an amount of any payments due it as may in the judgment of the Owner be necessary:

(a) to protect the Owner from loss due to previous payment for Work subsequently found to deviate from the Contract requirements and which has not been corrected by the Contractor, and

(b) to protect the Owner from loss due to previous payment for materials and/or equipment delivered to the Site for which evidence of payment to vendors has not been furnished by the Contractor.

GC-11.09. DEDUCTIONS FOR UNCORRECTED WORK

If the Owner deems it expedient to accept uncorrected Work, the Contract price shall be decreased by an amount, determined by the Owner, which is equal to the difference in value of the Work as performed by the Contractor and the value of the Work had it been satisfactorily performed in accordance with the Contract, or which is equal to the cost of performing the corrective Work, whichever shall be the higher amount.

GC-11.10. SUBSTANTIAL COMPLETION

The Work of the Contract shall be deemed Substantially Complete when either of the following occurs:

(a) When the Work of the Contract is at least 99% complete as evidenced by a list of minor items to be completed with estimated value equal to or less than 1% of the value of the Contract payments as shown in current estimates of Work completed.

(b) When the Owner and Contractor reach mutual written agreement that the Work is Substantially Complete.

The Contract will be considered as a single unit for determination of Substantial Completion except as follows:

(a) Where a division of major parts of the Contract is set forth in the Special Conditions for purposes of separate determinations of Substantial Completion for each part.

(b) Where the Owner and Contractor reach mutual written agreement that a major part of the Contract can be separately determined to be Substantially Complete.

(c) Where part of the Work of the Contract has been previously accepted into Beneficial Occupancy.

The date of Substantial Completion shall be evidenced by a Certificate of Substantial Completion signed by the Contractor, Engineer, and Owner.

GC-11.11. FINAL INSPECTION AND CERTIFICATE OF SUBSTANTIAL COMPLETION

The Owner, Engineer, and Contractor will make an inspection of the Work as soon as possible after written notification by the Contractor to the Owner that, in the judgment of the Contractor, the Work is 99% complete, or after the Owner and Contractor mutually agree that the Work appears Substantially Complete (the "Final Inspection"). Following said Final Inspection the Engineer will advise the Contractor of remaining items to be completed or corrected to arrive at completion of the Work inspected.

When the remaining items of Work to be completed or corrected are of sufficiently reduced value that Substantial Completion is indicated, the Engineer will prepare a detailed estimate (hereinafter referred to as Estimate of Work Remaining) of the value of said items showing each item's separate value as well as the total value of all items. The Contractor shall endorse said Estimate as evidence of agreement.

Substantial Completion will be evidenced by a Certificate of Substantial Completion signed by the Contractor, Engineer, and Owner. The date of Substantial Completion shall be that date specified in the Certificate of Substantial Completion. The Estimate of Work Remaining will be attached to the Certificate of Substantial Completion.

GC-11.12. PAYMENT AT SUBSTANTIAL COMPLETION

The Application for Payment at Substantial Completion shall be in a form satisfactory to the Owner and shall be accompanied by the following documents:

(a) Certificate of Substantial Completion with Estimate of Work Remaining attached.

(b) A schedule endorsed by the Contractor showing time of completion of all remaining Work.

(c) An affidavit of the Contractor: 1) that the claims of all subcontractors, materialmen, laborers, and all other persons and parties furnishing labor and materials with respect to the Contract have been paid in full except as noted; 2) that the Contractor will pay in full the exceptions stated from the proceeds of this payment; and 3) that the Contractor acknowledges that the Owner has made this payment in reliance upon this affidavit.

(d) Releases or receipts evidencing payment of all liens which may have been filed as a result of the performance of the Work of the Contract.

(e) A written statement from Surety that the Labor and Material Bond and the Performance Bond, each in the amount of 100% of the value of the Contract, are in force and will remain in

force for a period of one year following the date of Substantial Completion or such later date as may be established by an extension of the guarantee period.

GC-11.13. ACCEPTANCE OF WORK

Acceptance by the Owner of the Work of the Contract will occur on the dates as follows:

(a) The date of Substantial Completion specified in the Certificate of Substantial Completion for all Work not included in (b) or (c) below.

(b) The date of Beneficial Occupancy for all Work taken into Beneficial Occupancy.

(c) The date of payment of the requisition of the Contractor at the time of 100% completion (correction for all Work included in the Estimate of Work Remaining).

GC-11.14. CONTRACTUAL RELEASE TO OWNER

The submission by the Contractor of an Application for Payment at Substantial Completion shall be, and shall operate as, a release to the Owner of all further claims and liability to the Contractor for all things done or furnished in connection with the Contract, and for every act and neglect of the Owner and others relating or arising out of the Contract excepting the Contractor's requests for payment for completion or correction of Work items included in the Estimate of Work Remaining, the Application for Payment at Substantial Completion, and interest on said Payment if payment is improperly delayed. However, no Application for Payment, or payment of same, shall operate to release the Contractor from any obligations under the Contract or the Surety bonds.

GC-11.15. PAYMENT FOR MINOR ITEMS WHEN COMPLETED OR CORRECTED

The minor items of Work contained in the Estimate of Work Remaining shall be completed or corrected by the Contractor in a timely manner in accordance with the schedule submitted with the application for Payment at Substantial Completion. Upon such completion or correction, and upon Application for Payment in a form satisfactory to the Owner, the Owner will pay an amount equal to the value, and only that value, of the item or items of Work completed or corrected. The remaining amount held as determined when making Payment at Substantial Completion will be retained by the Owner until the Contractor has completed all items of Work contained in the Estimate of Work Remaining and has submitted evidence that all claims, liens, and judgments have been satisfied. No payment will be made which is less than one thousand dollars, except upon 100% completion or correction of all items included in the Estimate of Work Remaining.

GC-11.16. FINAL PAYMENT (Affidavit)

The Contractor's application for final payment (constituting the entire unpaid balance of the Contract sum) upon 100% completion (correction of all items included in the Estimate of Work Remaining) shall be accompanied by an affidavit of the Contractor ("Contractor Affidavit") as follows:

(a) That in accordance with the provisions of the applicable law of the State, in which the work is performed and other applicable State and Federal laws and regulations, all claims, liens, and judgments with respect to the Contract have been paid in full;

(b) that the Contractor has no further claims with regard to the Contract against the Owner or its agents; and

(c) that the Contractor acknowledges that the Owner has made this Final Payment in reliance upon this affidavit.

GC-11.17. OWNER'S RIGHT TO COMPLETE THE CONTRACT

During the time period extending from the date of Substantial Completion to a mutually acceptable date, the Contractor shall complete or correct all items contained in the Estimate of Work Remaining in accordance with the schedule established at Substantial Completion as such Estimate of Work Remaining and Schedule may be modified or supplemented prior to the end of the warranty period. Where Work items are not completed or corrected in accordance with the established schedule, and following reasonable notice by the Owner to the Contractor, the Owner may complete or correct said Work items. The cost for such completion or correction may be paid by the Owner, without review by the Contractor, and the Contractor shall reimburse the Owner for all costs so incurred.

It is hereby mutually agreed that six months following the date of Substantial Completion or the mutually acceptable later date, and at any time thereafter, the Owner (having given prior notice as set forth in the preceding paragraph) may, without additional notice to the Contractor, complete and correct any items contained in the Estimate of Work Remaining which are remaining to be completed or corrected. The cost for such completion and correction may be paid by the Owner, without review by the Contractor, and the Contractor shall reimburse the Owner for all costs so incurred. In the event that the Owner commences legal proceedings to recover all costs not reimbursed, there shall be included as an item of damage all reasonable attorneys' fees.

Any funds previously held by the Owner at the time of payment at Substantial Completion may be applied by the Owner to offset the costs incurred for completion or correction of items contained in the Estimate of Work Remaining. All costs incurred by the Owner in excess of funds previously held will be billed to the Contractor, and the Contractor shall promptly reimburse the Owner for said costs. The Owner may add reasonable amounts for administrative, engineering, and supervisory services to the cost of construction for those items completed or corrected by the Owner. In the event that the Owner commences legal proceedings to recover all costs not reimbursed, there shall be included as an item of damage all reasonable attorneys' fees.

GC-11.18. BENEFICIAL OCCUPANCY

The Owner reserves the right to accept for Beneficial Occupancy any portion of the Work, whether or not Substantially Complete, at anytime without prejudice to the Owner in enforcing any provisions of the Contract.

Beneficial Occupancy by the Owner shall occur when the Owner accepts a part of the Work, but not all Work of the Contract, and places such accepted Work in the service therefor intended.

Upon Beneficial Occupancy by the Owner the following procedures will apply:

(a) The Engineer, with the approval of the Owner, will notify the Contractor as to what portion, or portions of the Work have been accepted into Beneficial Occupancy.

(b) The retained percentage for the completed Work taken into Beneficial Occupancy will be released.

(c) The guarantee period applicable to that portion of the Work accepted into Beneficial Occupancy will start as of the date of Beneficial Occupancy.

(d) As of the date of Beneficial Occupancy, the Owner will assume responsibility for maintenance, heat, utilities, and insurance on that portion of the Work accepted for occupancy.

(e) The Contractor shall subsequently complete or correct all unfinished items in the Work accepted by the Owner for Beneficial Occupancy.

(f) Such action by the Owner will in no way affect the obligations of the Contractor under the terms and provisions of the Contract with respect to uncompleted Work.

(g) Upon completion of unfinished items in the Work beneficially occupied, sufficient to establish Substantial Completion as defined herein, all procedures set forth herein for Work deemed Substantially Complete shall apply.

GC-11.19. CONTRACTOR'S AUTHORITY TO SIGN

All Current Estimates, applications for payment, affidavits, and other documents required hereunder and the Certificate of Substantial Completion, shall be signed on behalf of the Contractor by a person evidencing its authority to do so and shall be acknowledged where required in form satisfactory to the Owner.

GC-11.20. CHARGES FOR DELAY CAUSED BY THE CONTRACTOR

It is hereby agreed that time is of the essence of the Contract with respect to the Work to be performed and that the Owner will suffer damages from failure to complete the Work in the time specified. When the Work embraced in the Contract is not 100% Completed on or before the date specified herein or on or before the later date to which the time of 100% Completion may have been extended in writing by the Owner, the engineering and inspection expenses incurred by the Owner, upon the Work from said date to the date of 100% Completion of the Work shall be charged to the Contractor and be deducted by the Owner from monies due the Contractor, and in addition, the Contractor shall be charged the liquidated damages stated in the Contract for the same period, said sums being not in the nature of a penalty, but a part of the consideration of the Contract.

The Owner shall have the right to deduct such amounts from any monies due or to become due the Contractor and the amount still owing, if any, after such deduction shall be paid on demand by the Contractor or its Surety. Such payment shall not relieve the Contractor or its Surety from any other obligation under this Contract.

GC-11.21. DELAYS CAUSED BY OTHERS

If the Contractor is unreasonably delayed at any time in the progress of the Work by any act, omission, or neglect of the Owner or Engineer, its agents or employees which are beyond their control, or if the Contractor is delayed at any time in the progress of the Work by any act, omission or neglect of any separate contractor engaged by the Owner, or by strikes, fires, unusual delays in transportation, abnormal adverse weather conditions or unavoidable casualties not caused by the Contractor, or by any other cause beyond the Contractor's control, the time for Substantial Completion or 100% Completion, as applicable, shall be extended for the length of time that the substantial Completion or 100% Completion of the Work was actually delayed thereby and the Contractor shall not be charged with liquidated or actual damages for the delay during the period of such extension nor shall the Contractor be due compensation for extended general conditions expense, other expense related to the delay, overhead, or profit for the period covered by such extension. No extension shall be granted unless the Contractor demonstrates a delay in the Substantial Completion or 100% Completion of the Work, as applicable, by showing a delay on the critical path of the CPM schedule.

GC-11.22. OWNER'S RIGHT TO ACCELERATE

If the Owner or Owner's Representative elects to direct the Contractor to accelerate the work at no additional cost to the Owner to eliminate delays pursuant to GC 11.20, the Contractor shall immediately implement the acceleration. Acceleration can be in the form of additional manpower, overtime and/or additional shift work or a combination thereof. If the Contractor refuses to immediately proceed with the directed acceleration, the Owner may exercise its right to declare the Contractor in default as stipulated in GC 5.02.

SECTION 12

INSURANCE AND BONDS

GC-12.01. INSURANCE

The Contractor at its expense shall procure and shall maintain the insurance required in this section and elsewhere in this Contract to be provided by the Contractor. The Contractor shall require each subcontractor to procure and maintain the insurance required by this Contract to be provided by subcontractors.

The contractor shall procure (in addition to the coverage required in other sections of this Contract):

(a) Workers' Compensation and Disability Benefits with coverage to the statutory limits as required by the laws of the state in which the project is located in sufficient limits to discharge obligations under all applicable state Workers' Compensation laws, and, where applicable, the United States Longshoremen and Harbor Workers Act, the Jones Act and Admiralty or Maritime Law.

(b) Employers Liability Insurance, including occupational disease coverage, in the amount of at least $1,000,000.

(c) Commercial General Liability Insurance providing coverage for the Contractor for legal liability and customarily covered expenses for bodily injury and property damage with respect to the Work under this Contract, including but not limited to liability for bodily injury and property damage: 1) arising out of operations performed for the Contractor by independent contractors or arising out of acts or omissions of the Contractor in connection with its general supervision of such operations (Contractors' Protective Liability Insurance), 2) occurring after operations have been completed or abandoned (Completed Operations Insurance), 3) arising, after physical possession of the products has been relinquished, 4) out of the Contractor's products or reliance upon a representation or warranty with respect thereto (Products Liability Insurance), and5) assumed under this Contract (Contractual Liability Insurance). This policy shall include coverage for explosion, collapse and underground operations (XCU hazards) and shall provide coverage in the amount of at least $1,000,000 per Occurrence, $3,000,000 in the General Aggregate, and $3,000,000 in the Products Completed Aggregate. This policy shall contain a per Project Aggregate Endorsement.

(d) Comprehensive Automobile Liability insurance providing coverage for the Owner and the Contractor for legal liability (and customarily covered expenses) for bodily injury and property damage arising out of the ownership, maintenance, operation, use, loading, or unloading owned, nonowned and hired automobiles. The policy shall provide coverage in the amount of at least $1,000,000 Combined Single Limit, and shall include the MCS-90 Sudden and Accidental Pollution endorsement.

(e) Owners protective liability insurance providing coverage for the Owner as the named insured for legal liability (and customarily covered expenses) for bodily injury and property damage arising out of the operations under this Contract performed for the Owner by the Contractor or any of its subcontractors or out of acts or omissions of the Owner in connection with the Owner's general supervision of such operations. The policy shall provide coverage in the amount of at least $2,000,000 Per Occurrence and $2,000,000 in the Aggregate.

(f) The Contractor shall obtain and maintain Builders Risk/Installation Floater insurance in a form acceptable to the Owner upon the entire Project for the full cost of replacement at the

time of any loss. This insurance shall include as named insureds the Owner, Contractor, Engineer, and Subcontractor of any tier. This insurance shall insure against loss from the perils of fire and extended coverage, and shall include "all risk" insurance for physical loss or damage including without duplication of coverage at least: theft, vandalism, malicious mischief, transit, collapse, false work, temporary buildings, debris removal, flood, earthquake, testing and damage resulting from defective design, workmanship or material. This insurance shall not be restricted, canceled or lapsed for reasons of occupancy. The limits of the coverage shall be at least equal to the full contract amount for the project.

(g) Umbrella Coverage/Excess Liability Insurance providing coverage for the Owner and the Contractor for costs in excess of the limits set forth in paragraphs (b), (c) and (d) above. This policy shall provide coverage in the amount of at least $5,000,000 Per Occurrence and $5,000,000 in the Aggregate. Owner reserves the right to increase or decrease the minimum limits depending on the project value and complexity.

Owner and Engineer shall be named as additional insureds on policies (c), (d), (f) and (g).

Each subcontractor shall provide (in addition to the coverage required in other sections of this Contract):

(a) Comprehensive General Liability Insurance providing coverage for the subcontractor in the form as hereinabove required of the Contractor including Contractors Protective Liability Insurance, Completed Operations Insurance, Products Liability Insurance, and Contractual Liability Insurance.

(b) Comprehensive automobile liability insurance providing coverage for the subcontractor as hereinabove required of the Contractor.

Each policy of insurance required under the Contract whether for Contractor or Subcontractor shall be issued by an insurance company approved by the Owner, authorized to issue such policy in the State in which the Project is located, shall be in form and content satisfactory to the Owner and its attorney, with a minimum of A-Best Insurance rating and shall provide: 1) that the policy shall not be changed or canceled until the expiration of thirty days after written notice to the Owner and Contractor, and 2) that it shall be automatically renewed upon expiration and continued in force unless the Owner and Contractor are given thirty day's written notice to the contrary, 3) that Contractor's insurance shall be primary to any other coverage of Owner or engineer and, 4) that the insurer has agreed to waive rights of subrogation as the Owner and Engineer.

No Work shall be commenced under the Contract until the Contractor has delivered to the Owner proof of issuance of all policies of insurance required by the Contract to be procured by the Contractor. Before commencing any Work under the Contract, each subcontractor shall deliver to the Owner proof of the issuance of all policies of insurance required to be provided by the subcontractor. Nothing herein shall limit or substitute for the liability of Contractor for the liabilities of its subcontractors in connection herewith. The Contractor and subcontractors shall deliver to the Owner duplicate originals of each policy in which the Owner is named insured, certificates of all other insurance in such number as the Owner may require, and such alternate or additional proof of coverage as the Owner demands. The Contractor and each subcontractor shall from time to time upon the demand of the Owner promptly deliver to the Owner such proof of insurance as the Owner may require.

In the event of the failure of the Contractor to furnish and maintain such Insurance, Owner shall have the right to take out and maintain such insurance for and in the name of the Contractor, and the Contractor agrees to pay the cost thereof and to furnish all necessary information to permit Owner to take out and maintain such insurance for the account of the Contractor. Compliance by the Contractor with the foregoing requirements to carry insurance and furnish certificates shall not relieve the Contractor from liability under any provision of this Contract.

All liability insurance required by this Contract shall be maintained in force during the term of this Contract and until the later of one year after the date of final acceptance or one year after the Contractor or any subcontractor performs any Work under the Contract.

GC-12.02. ALTERNATIVE OR ADDITIONAL INSURANCE

If required by the Owner, the Contractor and any subcontractor shall provide any other alternative or additional insurance coverage, with appropriate additions or deductions from the Contract price to be made pursuant to the provisions applicable to change orders.

GC-12.03. SECURITY FOR FAITHFUL PERFORMANCE

Simultaneously with his delivery of the executed Contract, the Contractor shall furnish, in form satisfactory to the Owner, a performance bond and a labor and material bond, each in an amount at least equal to 100% of the accepted Bid, as security for faithful performance of this Contract and for the payment of all persons performing labor on the Project under this Contract and furnishing materials in connection with this Contract. The Surety company on each bond shall be duly authorized to do business in the State in which the Project is located and shall be satisfactory to the Owner. Each bond shall remain in force during the guarantee period provided in this Contract. The cost of these bonds shall be paid by the Contractor and shall be included in the Bid submitted.

GC-12.04. ADDITIONAL SECURITY

If, at any time, the Owner shall be or become dissatisfied with any Surety or Sureties then upon the Surety bonds, or if for any other reason such bonds shall cease to be adequate security to the Owner, the Contractor shall within five days after notice from the Owner to do so, substitute an acceptable bond in such form and sum and signed by such other Sureties as may be satisfactory to the Owner. The premiums on such bond shall be paid by the Contractor. No payments on current estimates shall be deemed due or shall be made until the new Sureties shall have qualified.

Payment at Substantial Completion will be an amount equal to the value of all of the Work of the Contract which has been declared Substantially Complete including the estimated value of the minor items to be completed or corrected less an amount equal to twice the total Estimate of Work Remaining, less an amount withheld to satisfy any outstanding claims, liens, or judgments, less any charges for delay, and less all prior payments to or for the account of the Contractor. All prior estimates and payments including those related to Change Orders, shall be subject to correction by the payment at Substantial Completion.

SECTION 13

MATERIALS AND EQUIPMENT

GC-13.01. QUALITY AND WORKMANSHIP

All items of equipment and materials of like type furnished under one Contract shall be the product of one manufacturer, unless otherwise specified.

All materials furnished or incorporated in the Work shall be new, unused, of the best quality, and especially adapted for the service required; whenever the characteristics of any material are not particularly specified, such material shall be utilized as is customary in first class work of a nature for which the material is employed.

All materials and workmanship shall be subject to inspection, examination, and tests by the Engineer and other representatives of the Owner at any and all times during manufacture or construction and at any and all places where such manufacture or construction are carried on.

The selection of bureaus, laboratories, and agencies for the inspection and tests of supplies, materials, and equipment shall be subject to the approval of the Engineer. Satisfactory documentary evidence that the material has passed the required inspection and tests shall be furnished to the Engineer by the Contractor prior to the incorporation of the material in the Work.

All laboratory and field testing shall be at the sole cost and expense of the Contractor unless specifically stated otherwise in the Contract Documents.

GC-13.02. EQUIVALENT PRODUCTS AND CHANGES TO SPECIFICATIONS

The words "similar and equal to," "or equal," "equivalent," and such other words of similar content and meaning (hereinafter, “or equal”) shall, for the purposes of this Contract, be deemed to mean similar and equivalent to one of the named products.

Whenever any product is specified in the Contract Documents by a reference to the name, trade name, make or catalog number of any manufacturer or supplier, the intent shall not be to limit competition, but to establish a standard of quality which the Engineer has determined is necessary for the project. If any product other than that specified is proposed for use by the Contractor, it shall submit to the Engineer either its certification that the “or equal” strictly conforms to the Specifications, or a statement specifically identifying all differences between the “or equal” and the Specifications. Any variation of a proposed “or equal” from the Specifications which is not specifically noted in the Shop Drawing or Contractor’s submittal shall be at the sole risk and expense of Contractor. Engineer’s review and stamping of Shop Drawings or Contractor submittals shall not be deemed to be, or constitute Engineer’s acceptance of any such “or equals” or deviation from the Specifications which are not specifically noted on Contractor’s submittal. In addition Contractor shall provide all the information that the Engineer requests concerning the product. The proposed product shall not be used until it is accepted by the Engineer. Any “or equal” incorporated into the Work without Engineer’s written acceptance shall be at the Contractor’s sole risk, and Engineer may require the removal and replacement of any unaccepted “or equal”.

In all cases, the Engineer will be the sole judge as to whether a proposed “or equal” is acceptable, and the Contractor shall have the burden of proving, at its expense, to the satisfaction of the Engineer that the proposed “or equal” is similar and equal to the named product. In making such determination the Engineer may establish such criteria as it deems proper for acceptance of the “or equal”.

Any requested change in the Specifications not pertaining to an "or equal" must be submitted to Engineer in writing and must be stated with sufficient clarity and detail to permit proper consideration by Engineer. Unless accepted by Engineer after submission as herein provided, any deviation from the Specifications, or the use of any product which varies from the Specifications, shall be at Contractor's sole risk and expense.

With respect to the acceptance or rejection of "or equals" by Engineer, neither the review and stamping of Shop Drawings and/or Contractor submittals as provided in Section GC-14.05, nor Engineer's failure to observe and note any variation from the Specifications (unless such variation is specifically noted and identified in Contractor's Submittal), shall reduce, transfer, or modify Contractor's responsibility to provide products which fully comply with the Specifications.

"Or equals" or changes to Specifications proposed by Contractor, which are judged by the Engineer to represent no-cost improvements or enhancements to the design, shall be reviewed without cost to Contractor. All other submissions of "or equals" or changes to the Specifications shall be considered after review of specific products submitted at the same time or earlier, and regardless of whether such "or equals" are accepted or rejected, Contractor shall reimburse Owner for the costs (including labor costs) and expenses of Engineer incurred in the review of "or equals" or changes to the Specifications, including the cost of Engineer's conflict review, and any revisions made as a result of such review, plus a 10% administrative charge. Contractor shall reimburse Owner for such sums upon demand.

Where the Engineer accepts an "or equal" by the Contractor and such "or equal" requires a revision or redesign of any part of the Work covered by the Contract, all such revision and redesign and all new drawings and details required therefor shall be acceptable to the Engineer and shall be provided by the Contractor at its expense. If an acceptable substitution of an "or equal" requires a different quantity or arrangement of duct work, piping, wiring, or any part of the Work from that in the Contract Documents, the Contractor shall provide the same at its expense.

GC-13.03. SUPPLIERS

All supplies and equipment shall be furnished by manufacturers who shall have at least three years' experience in the design, production, assembly, and field service of equipment of like type, size, and capacity. Where required by the Engineer, the Contractor shall supply a list of at least three successful installations.

GC-13.04. TOOLS, ACCESSORIES AND SPARE PARTS

The Contractor shall, unless otherwise stated, furnish with each type, kind, and size of equipment, one complete set of any special tools and appliances which may be needed to adjust, operate, maintain, or repair the equipment.

Each piece of equipment shall be provided with a substantial nameplate, which is securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, and principal rating data.

Where the Technical Specification Sections of this Contract require spare parts to be furnished by the Contractor, said spare parts for each item of equipment shall be kept separate and tagged to identify the specific item of equipment to which they belong, shall be packaged so as to preclude damage from handling and storage, and shall be bagged or packaged together where items are small in dimension.

GC-13.05. EQUIPMENT INSTALLATION

The Contractor shall have on hand sufficient proper equipment and machinery of ample capacity to facilitate the Work.

The General Contractor shall furnish, install, and protect all necessary concrete pads, which shall include guides, track rails, bearing plates, anchor and attachment bolts, and all other appurtenances needed

for the installation of the devices included in the equipment specified. The location, size and templates for the concrete pads shall be furnished by the Contractor supplying the equipment along with all guides, track rails, bearing plates, anchor and attachment bolts and other appurtenances required.

Anchor bolts shall be made of ample size and strength for the purpose intended. Unless otherwise specified, anchor bolts in submerged locations shall be bronze or stainless steel; all other anchor bolts shall be cadmium plated. Substantial templates and working drawings for installation shall be furnished.

All equipment shall be correctly aligned, leveled and adjusted for satisfactory operation and shall be installed so that proper and necessary connections can be made readily between the various units.

The Contractor shall furnish all oils and greases for initial operation of each item of equipment and shall furnish the lubricant chart as indicated in Paragraph GC-13.08. Insofar as possible, all lubricants shall be obtained from one manufacturer approved by the Owner. Each item of equipment shall be tagged to show the date lubricated, the name and type of lubricant used and the recommended frequency of lubrication.

All mechanical and electrical equipment shall be checked for correctness of installation by a qualified representative of the manufacturer, and the manufacturer shall certify in writing to the Engineer that the equipment was installed according to its specifications. Where multiple manufacturers have supplied components for a piece of equipment, the manufacturer that assembled the components shall supply the certification.

GC-13.06. OPERATING INSTRUCTIONS AND MANUALS

The Contractor shall furnish the services of qualified manufacturers' technicians to instruct designated employees of the Owner in the operation and care of all equipment. The Contractor shall also furnish and deliver to the Engineer three complete sets of instructions, bulletins; diagrams, and other data and information required for the proper operation and maintenance of the equipment, including spare parts lists and ordering of spare parts. These operating manuals shall be furnished to the Engineer at such time as the equipment is delivered and shall include references to models and serial numbers of equipment furnished, assembly drawings, lubrication instructions, and service recommendations. Such data shall be bound in booklet form for easy reference and shall be accompanied by a transmittal sheet listing an inventory of items included.

GC-13.07. STORAGE AND MAINTENANCE OF EQUIPMENT

Equipment containing moving parts or bearings which is subject to damage by exposure or improper storage shall be protected as set forth herein:

The Contractor shall require that the manufacturers of all equipment to be incorporated into the Work of this Contract supply detailed instructions concerning storage and maintenance required to maintain the equipment in good condition until it is placed in operation. These instructions shall be acceptable to the Engineer and shall be strictly enforced. Such acceptance shall not relieve the Contractor of its obligation to properly store and maintain the equipment.

Equipment which is intended for outdoor installation may be stored outside subject to and in accordance with the manufacturer's instructions. Equipment intended for indoor installation shall be stored in heated and ventilated warehouses or in heated and ventilated enclosures on the Site of the Work.

Equipment which is installed more than seven days prior to being placed in operation shall be protected in strict accordance with the manufacturers' recommendations and in a manner acceptable to the Engineer. Such protection, where dictated, shall consist of complete air-tight encapsulation with desiccants.

Equipment improperly stored or improperly protected after installation shall, at the Owner's option, be replaced by the Contractor at no cost to the Owner.

GC-13.08. LUBRICATION CHART AND LUBRICATION

The Contractor shall furnish the Owner a lubrication chart(s) for all equipment furnished or installed by the Contractor. The chart(s) shall include the following for each item of equipment:

- name of the item;
- location of the item;
- each point of lubrication on the item;
- for each point of lubrication, the identification of the lubricant recommended and the recommended frequency of lubrication.

The information on the chart(s) shall be developed from manufacturers' printed data or from manufacturers' specific recommendations.

The identification of the lubricant by manufacturer's name and product identification number (such as Mobil X421) shall be furnished. Unless otherwise stated the name of the manufacturer to be used will be furnished to the Owner by the Contractor.

Following the initial operation of the equipment the Contractor shall relubricate, changing and adding lubricants, at the intervals or frequency as recommended by the manufacturer until acceptance.

SECTION 14

SHOP DRAWINGS AND SAMPLES

GC-14.01. LISTING OF ITEMS

Following execution of the Contract by the Contractor, the Engineer will submit to the Contractor a list of equipment, materials, and other items for which shop drawings, layouts, or samples will be required. This listing shall not be construed to be all-inclusive and may be added to, or deleted from, as may be required in the opinion of the Engineer.

GC-14.02. ACCEPTANCE OF MANUFACTURERS OR VENDORS

The Contractor, with such promptness and in such sequence as to cause no delay in the Work, shall submit to the Engineer the name of the manufacturer or vendor for each item on the list or addition to the list submitted. The Contractor shall make no awards, and no work under any item shall proceed, until acceptance of the manufacturer or the Engineer has given vendor. Such acceptance will be only on the basis of the manufacturer's or vendor's experience and reputation and will not imply that the shop drawings or samples for the item will be acceptable. Review of shop drawings for an item will depend upon full compliance with the Contract Documents as demonstrated by material submitted.

GC-14.03. ELECTRICAL INTERCONNECTIONS

Where the Project includes electrical equipment and electrical control systems and where the Work of the Project involves more than one Contractor, it shall be the responsibility of the Electrical Contractor to coordinate and complete power, control, and electrical signal interconnections for all equipment included in the Project.

GC-14.04. SHOP DRAWING SUBMITTAL REQUIREMENTS

Shop drawings and data shall be submitted to the Engineer for each item on the latest revised list determined from Section GC-14.01 above. Submittals shall be made sufficiently in advance of the time when items included therein are to be incorporated into the Work to permit proper review, necessary revisions, and resubmittals without causing a delay in the performance of the Work.

Shop drawings shall present complete and accurate information relative to all working dimensions, equipment weights, assembly, and section views, and all necessary details pertaining to coordinating the Work of the Contract, lists of materials and finishes, parts lists and the description thereof, lists of spare parts and tools where such parts or tools are required, and any other items of information that are required to demonstrate detailed compliance with the Contract Documents. Drawings for electrical equipment shall include elementary and interconnection diagrams.

Except as otherwise provided in Section 13.02, Contractor’s submittal of Shop Drawings shall constitute Contractor’s representation that submitted Shop Drawings and the specifications pertaining thereto have been thoroughly reviewed by Contractor for consistency with the Specifications and that submitted Shop Drawings strictly comply with the requirements of the Contract Documents; that the Contractor has determined and verified all quantities, dimensions, field construction criteria, materials catalog numbers, and similar data, and that Contractor has reviewed or coordinated each shop drawing with the requirements of the Work and the Contract Documents. The return to Contractor of Shop Drawings stamped “Reviewed” shall in no way relieve Contractor from sole responsibility for strictly complying with the specifications in the Contract Documents. Contractor shall reimburse Owner for the costs (including labor costs) and expenses of Engineer incurred in the review of Shop Drawings which have been twice before returned marked as “Rejected” or “Resubmit”.

Unless otherwise permitted in specific cases, all data shall be transmitted to the Engineer by the Prime Contractor.

Each shop drawing submitted shall indicate the following:

(a) Project name and contract number

(b) Manufacturer of the equipment

(c) Notation as to whether original submittal or re-submittal

(d) Date received by Contractor from manufacturer or vendor

(e) Date submitted to Engineer

Each shop drawing submittal shall be accompanied by a transmittal letter indicating the item or items submitted, with particular reference to latest revised list of equipment, materials, and other items described in GC-14.01 above and the appropriate section of the Contract Documents to which the items apply. The transmittal letter shall also indicate whether the submittal constitutes a complete set of drawings for the item, a partial set of drawings for which additional submittals are to be expected by the Engineer, or a partial set of drawings to complete a previous submittal. In any case, the Contractor shall indicate by the transmittal letters when the submittals for an item are intended to be complete.

Unless otherwise stated in the Special Conditions, the Contractor shall submit at least five copies of drawings, catalog data, and similar items for review. This number includes one for return to the Contractor noted as "Reviewed" or request for amendment. If the Contractor desires more than one copy returned to it, it shall submit with the initial and any subsequent transmittals the additional number desired up to a maximum of three copies.

If the Engineer requires additional copies, it will so inform the Contractor upon return of the material noted as "Reviewed". Additional copies of "Reviewed" shop drawings will be requested in the cases where the subject matter shown thereon requires coordination of two or more prime Contracts. Copies of such drawings, when received, will be retransmitted by the Engineer.

A current file of "Reviewed" shop drawings will be maintained by the Engineer and, where so stated in the Special Conditions, said current file of "Reviewed" shop drawings will be at the job site. Any Contractor may have access to said "Reviewed" shop drawing file during normal office hours. It shall be the responsibility of each prime Contractor to avail itself of information in said "Reviewed" shop drawing file and to be aware of coordination requirements involving its work in the event it does not receive appropriate shop drawings from the Engineer.

GC-14.05. ENGINEER'S REVIEW OF SHOP DRAWINGS

The Engineer’s review of shop drawings is for general compliance with the Contract Documents only and is not a complete check of the method of assembly, erection, construction or detailed review of the specifications. Such review shall in no way be construed as permitting any departure whatsoever from the Contract Documents, except where the Contractor has previously requested and received written approval of the Engineer for such departure. When requested by Contractor, proposed departures from the Contract Documents will be considered by Engineer at Contractor’s expense, whether or not accepted. The cost of Engineer’s conflict review and any revisions made as a result of Contractor’s requested departure shall be at the expense of Contractor. Contractor shall reimburse Owner for the referenced costs and expenses of Engineer upon demand.

Review of shop drawings by the Engineer will be limited to complete submittals except where review of a partial submittal is specifically requested by the Contractor and where such review of a partial submittal

is necessary for timely completion of the Work of the Contract. Where shop drawings of related items are necessary for review of a particular submittal, the Engineer will so inform the Contractor, who will promptly submit such shop drawing of said related items.

Drawings and similar data will be reviewed and stamped by the Engineer as follows:

(a) "Reviewed," if no change or rejection is made. All but four copies of the submitted data will be returned.

(b) "Reviewed and Noted," if minor changes or additions are made but re-submittal is not considered necessary. All but four copies of the submitted data will be returned and all copies will bear the corrective marks.

(c) "Resubmit," if the changes requested are extensive or if re-transmittal of the submittal to another Contractor is required. In this case, the Contractor shall resubmit the items after correction, and the same number of copies shall be included in the re-submittal as in the first submittal. One copy of the first submittal will be retained by the Engineer and two copies will be returned to the Contractor.

(d) "Rejected," if it is considered that the data submitted cannot, with reasonable revision, meet the requirements of the Contract Drawings and Specifications.

GC-14.06. RESUBMITTALS

Any changes, other than those indicated as requested, made in drawings or other data shall be specifically brought to the attention of the Engineer upon re-submittal. Changes or additions shall not be made in, or to, "Reviewed" data without specific notice to the Engineer.

If, after reasonable correction and re-submittal of the shop drawings for an item of equipment, acceptance is not given, the Contractor shall submit the name of another manufacturer or vendor to supply the item required in accordance with GC-14.02. Should progress of the Work be delayed by the changing of the manufacturer or vendor, such a cause will not be considered an extenuating circumstance beyond the control of the Contractor, and charges for delay if otherwise applicable, will be levied and shall be born solely by the Contractor.

GC-14.07. SAMPLES

Samples shall be submitted to the Engineer as required on the latest revised list determined from Section GC-14.01. The samples shall be properly identified by tags and shall be submitted sufficiently in advance of the time when they are to be incorporated into the Work, so that rejections thereof will not cause delay. A letter of transmittal from the Contractor requesting review shall accompany such samples.

The procedures set forth in Section GC-14.05 and GC-14.06 above for shop drawings shall be used for processing samples.

SECTION 15

TEMPORARY SERVICES

GC-15.01. TEMPORARY HEAT

It is the obligation and responsibility of the Contractor to provide and maintain temporary heat by means of portable electric, oil or gas-fired units. The Contractor shall provide and pay for all fuel and electricity used in the temporary facilities and shall provide proper smoke pipes or other means to prevent smoke or smudge from marking up walls, ceilings, or other parts of equipment.

Should the temporary heating facilities require electric service, the Contractor shall provide the necessary wiring and power.

After their installation and testing of the permanent heating system facilities, they may be used for temporary heating purposes with concurrence of the Owner. Any temporary wiring or piping required and all power consumed shall be the obligation and responsibility of the Contractor.

If the Contractor elects to utilize the permanent heating facilities included in the Project for temporary heat, it shall be the responsibility of the Contractor to guarantee the heating system for a period of one year following final acceptance of the Contract or Beneficial Occupancy, whichever comes first. It shall be the responsibility of the Contractor to replace all filters before the final acceptance of the Contract.

It shall be the responsibility of the Contractor to repair any damage to heating and ventilating equipment suffered as the result of use by the Contractor.

After the buildings are enclosed excepting windows, doors and similar apertures, temporary enclosures for all apertures shall be provided and temperatures in the entire building shall be continuously maintained at not less than 40 degrees Fahrenheit unless specific permission is granted in writing by the Engineer. The Contractor shall install on each floor, near the center of the building, a suitable, securely fastened, and properly protected thermometer.

The Owner will supply all heat after final acceptance of the Contract or upon Beneficial Occupancy of a structure by the Owner.

GC-15.02. TEMPORARY ELECTRIC LIGHT AND POWER

It is the obligation and responsibility of the Contractor to provide and maintain temporary facilities for furnishing light and power necessary for operations under the Contract, and to make all necessary arrangements therefor, including all required connections, ordering the meter, and paying all fees and inspection charges.

The Contractor shall make the temporary light and power facilities available to any and all subcontractors, for their use in connection with their contracts, and may charge each subcontractor for such service an amount not to exceed a fraction of the cost of the services, as billed by the utility, proportional to the value of the Project. Removal of temporary facilities shall be by the Contractor. The installation and meters shall remain until need for same has ceased or until completion of the Contract.

GC-15.03. POWER, FUEL AND WATER FOR TESTING

The permanent electrical service, or any part thereof, shall not be connected until the tests on wiring and grounding systems have been successfully completed and test data reviewed by the Engineer.

Where tests on equipment require electric power for testing, such power shall be supplied through the permanent electrical service and through the permanent electrical distribution and control equipment. All power for testing will be provided by the Owner. The use by the Owner of the permanent electrical service, electrical distribution system, and/or control equipment for the purpose of testing shall not constitute acceptance of the Work.

Where tests are specified on fuel-burning equipment, or where tests are specified on other equipment, and require simultaneous operation of the fuel burning equipment, all fuel for such tests will be provided by the Owner.

Unless otherwise specified, water of acceptable quality for testing shall be furnished by the Contractor.

GC-15.04. TEMPORARY WATER FACILITIES

Where the public water supply is available and under control of the Owner, water will be furnished to Contractor. Such water supply shall be subject at all times to the control and supervision of the superintendent or manager of the water utility, and at a cost determined by the schedule of wholesale charges on a file at the office of the utility. Prior to making use of any municipal water, permission in writing to use the water for any particular purpose shall be obtained from the superintendent or manager. The cost, if any, of connection to the water supply shall be paid by the Contractor.

Where the public water supply is owned or controlled by a private company, corporation or individual or municipality other than the Owner, the Contractor shall make such arrangements at its cost for service with the owners thereof as he requires.

The Contractor shall make the temporary water service available to all subcontractors, for their reasonable use in connection with their Contracts. Removal of temporary facilities shall be the responsibility of the Contractor. The installation and meters shall remain until need for same has ceased or until completion of the Contract.

- END OF SECTION -

SECTION 00800

SPECIAL CONDITIONS

SPECIAL CONDITIONS

SPECIAL CONDITIONS

SC-1 LINES, GRADES AND ELEVATIONS

From the information provided by the Engineer, the Contractor shall verify bench marks and develop and make all detail surveys needed for construction.

The Contractor shall set and maintain all necessary intermediate points, lines, grades and elevations, and provide slope stakes, offset stakes, batter boards, stakes for pipe locations, and other such items at his own expense. Where the Contractor uses the laser for control, the Contractor shall periodically check the grade and alignment during each day's operation.

The accuracy of the Contractor's survey and other required data is the sole responsibility of the Contractor, and the furnishing of data to the Engineer does not constitute a transferal of responsibility for checking.

SC-2 MOBILIZATION AND DEMOBILIZATION

Mobilization shall include the purchase of Contract bonds and all necessary permits; transportation of all personnel, equipment and operating supplies to the site; establishment of offices, buildings, sanitary facilities, telephone service, construction identification signs and other necessary facilities at the site; construction and maintenance of temporary access roads, bridges, and maintenance and protection of traffic during construction, and other preparatory work at the site. Mobilization shall also include the installation of barriers or fencing to limit public access to the site.

Demobilization shall include removal of all unused material and equipment including field offices, construction barriers, and soil and erosion control materials. All work and work areas shall be neatly cleaned upon completion according to the Engineer’s direction and shall be left in a neat and orderly condition. Access roads constructed solely for the Contractor’s use shall be graded to conform with adjacent ground. Any salvaged material not specified to be disposed of otherwise shall become the property of the Contractor and removed from the site. All trash shall be removed as directed by the Engineer and disposed of according to local regulations.

SC-3 WORKING HOURS AND HOLIDAYS

The Contractor shall perform all work Monday through Friday during which period the Owner’s or Engineer's representative will be on-site to inspect the work. The Contractor may seek permission to perform work outside this period that will require inspection by the Owner’s or Engineer’s representative. Overtime work performed by the Contractor shall be at no additional cost to the contract.

The Contractor shall recognize in the work schedule that normal holidays are observed each calendar year. Work may be allowed during holidays, whenever holiday work is scheduled, the Contractor shall give prior notice to the Owner.

SC-4 PRE-WORK CONFERENCE

Prior to the start of construction by the successful bidder, a general information meeting shall be held with the Owner, Engineer, Contractor and other interested parties in attendance. The meeting shall cover the general features of the project and the various requirements in the Contract. The Contractor shall submit a draft work schedule prior to the meeting in accordance with the Work Schedule and Construction Activity requirements in the Special Provisions.

SC-5 PROGRESS AND COORDINATION MEETINGS

Progress and coordination meetings will be held biweekly or as directed by the Engineer, with the Contractor's supervisory representatives, having decision-making authority, in attendance.

The Contractor shall conduct the following meetings between:

- Contractor's project manager
- Contractor's project superintendent
- Engineer's designated Representative
- Owner's designated Representative
- Subcontractors

Meetings shall be held at approximately biweekly intervals or more frequently as called by the Engineer. The Engineer shall schedule the meetings. The Engineer shall take minutes at the meeting, review minutes with participants at the meeting and forward copies of the meeting minutes to the participants within fourteen days after the meeting date.

Agenda for the meeting shall consist of, but not be limited to, the following:

- Construction progress for the past month
- Construction schedule for upcoming month
- Pay request and materials stored lists
- Test results for tests performed during the month
- Problems with construction
- Pending or upcoming change orders
- Other items as deemed necessary by attendees

Contractor shall submit a work schedule update and submittal schedule update at each meeting if either is behind schedule.

SC-6 PRE-WORK ON-SITE VIDEO RECORDING

Prior to start of work, the Contractor, at their expense, shall in the presence of the Owner and Engineer, conduct video recording of all areas of the existing plant facilities which will be affected by the work under this Contract. Two copies (DVD format) of the recording shall be submitted to the Owner for record keeping before any work can proceed.

SC-7 PHOTOGRAPHY DURING CONSTRUCTION

The Contractor shall snap color photos on a periodic basis as specified in the Contract Documents.

SC-8 PROGRESS PAYMENTS AND RETAINAGE

All progress payments will be on the basis of progress of the Work. Owner will retain a portion of each Progress Payment otherwise due the Contractor. The following retention policy shall apply:

- Retainage of five (5) percent of the payment claimed until the work is complete.
- When the work is substantially complete, the retainage shall be two hundred (200) percent of the amount necessary as determined by the Owner to assure completion of the remaining work.
- The Owner may increase the retainage up to ten (10) percent, if the Owner determines, at its discretion, that the Contractor is not making satisfactory progress or there is other specific cause for such withholding.

Final payment shall include the interest earned on the withholding provided the work was completed within the time limits specified for the prices specified in the Contract or approved Change Orders.

SC-9 PERMITS

With reference to the General Conditions, Section 2, the following permits and associated fees are being obtained and paid by the Owner:

Kentucky Division of Water

The Contractor shall be responsible for obtaining any additional Local, County, State or Federal issued permits necessary for the Work. This includes all Building Permits and local inspection permits. Contractor shall pay all fees associated with obtaining such permits.

SC-10 WORK SCHEDULE AND CONSTRUCTION ACTIVITIES

The work schedule prepared by the Contractor (reference Section GC-3.02) shall be prepared in such detail as to enable regular monitoring and updating throughout construction. The work schedule shall demonstrate compliance with all milestones, durations and constraints stipulated in the Contract Documents. The work schedule shall include tasks for shop drawing submittal, shop drawing review, manufacture and delivery, start-up and testing. No separate payment will be made for developing or updating the work schedule.

The work schedule shall be developed utilizing computerized integrated Critical Path Method (CPM) planning software such as Primavera, Microsoft Project, or Suretrak and shall be resource-loaded. Tasks shall be indicated in the form of a legible bar and shall show proposed start and end dates and duration of all major components and activities included in the Contract. The schedule shall include tasks for shop drawing submittal, shop drawing review, manufacture and delivery, start-up and testing. The schedule shall indicate a baseline bar for each task and a bar indicating the actual progress of the task. The General Contractor shall integrate and take into account the work of the other Contractors, and the other Contractors shall provide input to the General Contractor's schedule and shall review the compiled work schedule for acceptance.

The General Contractor shall update the work schedule on a monthly basis throughout construction. A copy of the updated work schedule shall be submitted to the Engineer along with each payment application, along with copies of certified payrolls and required MBE/WBE documentation. Payment applications will not be reviewed by the Engineer until an acceptable updated work schedule has been received.

SC-11 CONSTRUCTION ACCESS

Construction access directly to the site shall be via Jay Lane. This street will routinely carry traffic to and from the existing treatment plant, including, chemical trucks, and personnel and maintenance vehicles and the local residents. The Contractor shall maintain a means for access to the plant and for the local residents site at all times.

The Contractor shall also recognize that a portion of the access roadways to the work site are public roadways that will carry local, public traffic. Public traffic to and from this area may occur at all hours. The Contractor shall provide and install all necessary construction traffic signage, including, but not limited to signs for speed limit; temporary construction indication; stop signs. Temporary signs shall be in accordance with KY DOT.

The Contractor shall make no claim against the Owner due to redirection of construction access location.

SC-12 MAINTENANCE OF EXISTING ACCESS ROAD

The Contractor shall include in the lump sum Bid costs to maintain the existing access road for construction traffic in acceptable condition during the construction period. Acceptable conditions shall mean that potholes and excessive deterioration of the existing road due to heavy construction traffic shall be repaired

promptly by the Contractor. Potholes deeper than 6-inches and/or greater than 12-inches in any plan direction shall be filled and compacted with subbase aggregate. Where deterioration in a specific area is greater than 10 square feet, the area shall be paved in accordance with the Section, entitled "Restoration of Surfaces".

Regardless of the above criteria, if, in the sole opinion of the Owner or Engineer, it is deemed that the safety of public traffic is compromised due to road deterioration from the Contractor's construction traffic, the Engineer may direct the Contractor to repair the deteriorated portions in accordance with the Section, entitled "Restoration of Surfaces" at no additional costs to the Contract.

The Contractor shall apply water sprinkling, or other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

SC-13 DUST AND DEBRIS CONTROL

The Contractor shall provide means for controlling dust at the site throughout the duration of the project. The Contractor shall promptly remove any mud tracked onto adjacent roadways from vehicles leaving or entering the project site. The Contractor shall also provide necessary measures to prevent dust and debris from construction activities from entering or falling into the water being processed in the existing treatment plant.

SC-14 MATERIAL STORAGE

The Contractor shall be responsible to provide material storage (either on- or off-site) as required to complete construction. The Contractor shall not cut or remove any trees on the site for purposes of material storage. The Contractor shall identify the proposed storage location for approval by the Engineer. Any relocation of the storage area during the project shall require approval of the Engineer.

SC-15 ON-SITE AND/OR OFF-SITE SOIL BORROW MATERIAL

A. The Contractor is permitted to use on-site soil borrow material as embankment material, as accepted by the Engineer, provided it meets all the requirements as specified for the type of earthwork being performed. If the Contractor elects to use this material, the Contractor is solely responsible for assessing and insuring that the material meets the requirements of the Contract Documents. The Contractor is solely responsible for costs associated with using on-site borrow material including but no limited to, permitting costs, borrow source development, excavation, transportation, laboratory testing, placement, and restoration of the borrow source.

B. On-site and/or off-site soil borrow material to be used as fill to meet subgrades beneath structures shall meet the requirements of the Section, entitled "Embankment", with the following exceptions:

Particle-Size Distribution

1. Soil material shall be run-of-bank gravel with the following gradation by weight, in accordance with ASTM D422:

% Passing	Sieve
100%	1-1/2 inch
30% to 65%	¼ inch
0% to 10%	No. 200

2. Soil material shall be tested for grain size at a frequency of one (1) test per 500 cubic yards of material, or as otherwise requested by the Engineer. A minimum of one (1) grain size test shall be performed for the soil material used beneath each structure, or as otherwise requested by the Engineer.

3. The results of all testing specified herein shall be submitted to the Engineer for review.

Density Control

1. Soil material shall be compacted to 95% of maximum dry density as determined by the density tests designated in ASTM D1557.

    a. Compaction curves for the full range of soil materials to be used shall be developed by an approved independent testing laboratory.

2. Field control samples shall be taken and tested by an independent testing laboratory as required to assure that adequate compaction of the soil material is being achieved.

3. A minimum of one (1) in-place density test shall be made for every 1,000 square feet of compacted area per lift, or as otherwise requested by the Engineer. A minimum of two (2) in-place density tests per lift shall be performed for the compacted area beneath each structure, or as otherwise requested by the Engineer.

    a. In-place density of soil material shall be determined by the methods described in ASTM D1556 or ASTM D2922 and expressed as a percentage of the maximum dry density.

4. The results of all testing specified herein shall be submitted to the Engineer for review.

C. On-site and/or off-site soil borrow material to be used as elsewhere shall meet the requirements of the Section titled "Embankment".

SC-16 EMERGENCY CALLS

The Contractor shall provide the Owner with the phone numbers of at least three responsible persons, to be used during non-working hours and weekends, who shall be in a position to dispatch labor and equipment to the project in the event of an emergency.

SC-17 EXISTING UTILITIES

Prior to the start of construction, the Contractor shall contact Utilities Protection Center at (800) 282-7411 to determine the location of all existing underground utilities in accordance with the General Provisions. The location of the existing underground utilities shown on the Contract Drawings are approximate and shall be verified by the Contractor.

SC-18 OWNER'S RIGHT TO EXISTING MATERIALS AND EQUIPMENT

All existing material and equipment required to be removed, replaced, or demolished under this contract shall become the property and responsibility of the Contractor and may be salvaged at their discretion, with the exception of items listed in the Section, entitled "Demolition" which shall remain in the Owner's property and at no additional cost to the contract.

SC-19 QUALIFICATIONS OF BIDDER

In addition to requirements described in the Information for Bidders, Contractors will be required to show evidence of a suitable license to perform work in the Commonwealth of Kentucky before their bids will be considered. The Owner will consider, in determining the qualifications of a bidder, their record in the performance of any contracts for the construction work into which they may have entered with any public bodies or corporations; the Owner expressly reserves the right to reject the bid of such bidder if such record discloses that

such bidder, in the opinion of the Owner, has not properly performed such contracts or has habitually and without just cause neglected the payment of bills, or has otherwise discarded his obligations to subcontractors, vendors, or employees.

The apparent low bidders will be required to submit a qualification statement providing suitable evidence indicating that the bidder has the capabilities to perform classes of work contemplated, that the bidder has satisfactorily performed similar work elsewhere, and that the bidder has the necessary plant and sufficient capital to execute the work properly.

The Owner may make such additional investigation as it deems necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish to the Owner all such additional information and data for this purpose as it may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of such bidder, fails to satisfy the Owner that such bidder is properly qualified by experience and financial status to carry out the obligations of the Contract and to complete the work contemplated herein an expeditious manner. Conditional bids will not be accepted.

Within ten days of Bid opening date, the three lowest bidders shall provide the following information (additional information may be requested):

- Financial data
- Experience
- Equipment and personnel available
- List of previous, similar projects
- References

SC-20 SITE CONDITIONS AND CONDITIONS OF WORK

The Contractor must acquaint themselves thoroughly as to the character and nature of the work to be done. The Contractor furthermore must make a careful examination of the site of the work and inform themselves fully as to the difficulties to be encountered in the performance of the work, the facilities for delivering, storing and placing materials and equipment, and other conditions relating to construction labor.

The Contractor assumes all risk as to the nature and behavior of the soil or subsurface conditions which underlie the work or is adjacent thereto, or difficulties that may be due to any unfavorable conditions that may be encountered in the work, whether apparent on surface inspection or disclosed after construction begins.

No plea of ignorance of conditions that exist or may hereafter exist on the site of the work, or difficulties that may be encountered in the execution of the work as a result of failure to make necessary investigations and examinations, will be accepted as an excuse for any failure or omission on the part of the Contractor to fulfill, in every detail, all the requirements of the Contract Documents and to complete the work for the consideration set forth therein, or as a basis for any claim whatsoever.

Insofar as possible, the Contractor, in carrying out his work must employ such methods or means as will not cause interruption of or interference with the work of the Owner or any separate Contractor.

This Contract includes excavation of the unclassified basis. The cost of all excavation required under this Contract will be merged into the base bid. No distinction will be made insofar as payment is concerned between earth and rock.

SC-21 CONDITIONS AFFECTING THE WORK

The Contractor shall be responsible for having taken steps reasonably necessary to ascertain the nature and location of the work, and the general and local conditions which can affect the work or the cost thereof. Any failure by the Contractor to do so will not relieve them from responsibility for successfully performing the work without additional expense. The Owner and Engineer assume no responsibility for any understanding or

representations concerning conditions made by any of its officers or agents prior to the execution of this Contract, unless such understanding or representations by the Owner or Engineer are expressly stated in the Contract.

SC-22 LEAD-BASED PAINT

The possibility exists for surfaces encountered during the work to contain lead-based paint. For the purpose of this bid the Contractor shall assume all efforts to comply and to perform work in accordance with applicable state and federal laws, rules and regulations related to worker safety, including but not limited to OSHA and Health Standard for Occupational Exposure to Lead in Construction Work.

SC-23 EXAMINATION OF RECORDS

The Contractor agrees that the Owner, or any duly authorized representative, shall, until the expiration of three (3) years after final payment hereunder, have access to and the right to examine and copy any directly pertinent books, documents, papers and records of the Contractor involving transactions related to this Contract.

The Contractor further agrees to include in any subcontract for more than $10,000 entered into as a result of this Contract, a provision to the effect that subcontractor agreed that the Owner or any duly authorized representative shall, until the expiration of three (3) years after final payment under the subcontract, have access to and the right to examine and copy any directly pertinent books, documents, papers and records of such Contractor involving transactions related to such subcontractor, or this Contract. The term subcontract as used herein shall exclude subcontracts or purchase orders for public utility services at rates established for uniform applicability to the general public.

The period of access provided in subparagraphs above for records, books, documents and papers which may relate to any arbitration, litigation or the settlement of claims arising out of the performance of this Contract or any subcontract shall continue until any appeals, arbitration, litigation, or claims shall have been finally disposed of.

SC-24 RODENT AND PEST CONTROL

The Contractor shall at all times keep the work area, including the storage areas, free from rodents, noxious pests, and other vermin.

The Owner or the Engineer shall notify the Contractor on any non-compliance with this requirement and of the corrective action required. This notice, when delivered to the Contractor or the Contractor's representative at the site of the work, shall be deemed sufficient notice of the non-compliance and the corrective action required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to eliminate the rodents, pests or vermin and the causes thereof promptly, the Owner may have the necessary extermination work performed and charge the cost to the Contractor.

SC-25 ACCURACY OF DRAWINGS

The Contractor shall have sole responsibility for field verifying existing equipment, piping, appurtenances and structure locations and dimensions prior to ordering, fabrication and installation of equipment, piping, appurtenance sand materials. The Contractor shall conform to the Drawings as closely as possible and exercise care to secure approved headroom and space conditions, neat arrangements of equipment, piping, valves, hangers and like items to overcome interferences with the existing conditions.

SC-26 DISSEMINATION OF CONTRACT INFORMATION

The Contractor shall not publish, permit to be published, or distribute for public consumption, any information, or written, concerning the results or conclusions made pursuant to performance of this Contract without the prior written consent of the Engineer. (Two copies of any material proposed to be published or distributed shall be submitted to the Engineer).

SC-27 MODEL NUMBERS FOR EQUIPMENT, MATERIALS OR SYSTEMS

Model or series numbers listed for a particular piece of equipment, material or system establishes minimum standards for operation and quality. Additional requirements and standards maybe defined by the Specifications, and furnishing the listed model or series does not relieve the Contractor or Manufacturer from the responsibility of satisfying all requirements and standards set forth in the Specifications.

SC-28 EQUIPMENT OPERATION AND MAINTENANCE MANUALS

The Contractor shall submit equipment O&M manuals in accordance with the General Provisions. Where O&M Manuals are specified to be submitted, six (6) copies shall be provided. At least one copy of the O&M Manual shall be an original. Retainage on Pay Requests will not be reduced until the Engineer has approved the O&M Manuals required for the work. O&M Manuals shall be clearly marked to indicate the applicable components related to the WWTF. The content of each manual shall provided in accordance with the following checklist:

1. General
    a. Three-ring binder (8 ½" x 11") with cover sheet including:
        (1) Functional Name
        (2) Manufacturer
        (3) Specific Location Installed
        (4) Model & Serial Numbers
    b. Table of Contents with sections in the O&M tabbed
    c. Sheet with Name, Address, Phone Number and E-mail Address of:
        (1) Local Supplier
        (2) Factory
        (3) Contractor
    d. All Purchase Order Numbers
    e. Bill of Materials
    f. Drawings larger than 11" x 17" (blueprints, shop drawings) neatly folded in clear plastic vinyl pockets

2. Operation Portion
    a. Brief description of equipment/system/controls
    b. Principle components identified
    c. Normal starting procedure
    d. Normal stop procedure
    e. Emergency stop procedure
    f. Equipment test procedures
    g. Alarm silence procedure/overload reset procedure
    h. Programming procedure/recommended settings
    i. Assistance telephone number

3. Maintenance Portion
    a. Detailed assembly drawings
    b. Detailed parts list with unique part numbers
    c. Spare parts list
    d. Lubrication schedules/requirements

4. Complete set of previously "Reviewed" Shop Drawings

5. The Contractor (Manufacturers) shall supply complete equipment O&M information in electronic format (DOC or PDF, in rich text format (searchable)) for equipment specified in Divisions 11 and 14.

SC-29 VIDEO RECORDING DURING EQUIPMENT OPERATIONS TRAINING

The Owner reserves the right to video record all training sessions involving the Owner's operations staff during the training periods conducted by the equipment manufacturer as specified in the Contract Documents. Videotapes of these training sessions will be used for the sole purpose of training and educating the Owners' operations staff.

SC-30 REQUIREMENTS FOR PROFESSIONAL ENGINEER'S LICENSE

Where the Contract Documents include requirements for certain shop drawing submittals to be prepared by a professional engineer licensed in the Commonwealth of Kentucky, the Engineer may consider a waiver of the licensing requirements specifically for the Commonwealth of Kentucky provided that said professional engineer is licensed and in good standing with the licensing board in a U.S. state outside the Commonwealth of Kentucky. Such waiver shall not relieve the professional engineer from complying with applicable design codes and standards specific to the Commonwealth of Kentucky.

SC-31 FIELD TESTING AND FACILITY STARTUP

I. GENERAL

A. This Special Provision includes:

1. Requirements for sequencing of the various field testing described in the Contract Specifications, including sequencing of testing described in this Special Provision.
2. Requirements for documentation prior to performance of system testing.
3. Requirements for developing a detailed plan for and conducting clean water system testing and/or dry system testing.
4. Requirements for startup performance period.
5. Requirements for scheduling of training

B. Requests for deviations from the test sequencing and testing described herein may be provided by the Contractor to the Engineer. Such requests shall be made in writing, and shall be accepted by the Engineer prior to implementation.

C. Prior to startup activity the contractor shall verify that: systems are tested hydraulically, mechanically, and electrically; systems which require calibration, commissioning, and balancing are fully certified as complete and perform in accordance with the Contract Documents; and that the required tagging and identification is complete.

D. Contractor shall verify to the Engineer in writing that the potable water components have been disinfected in accordance with AWWA Specifications C651, C652 and C653. These requirements apply equally to new facilities and components and to existing components into which connections have been made.

E. The Contractor shall schedule the start-up a minimum of 30 days prior to the start-up date with a written notice issued to, but not necessarily limited to Owner and Engineer and sub-contractors.

II. TEST SEQUENCING

A. Field testing shall be performed in accordance with the Contract Documents. Testing shall be performed in the sequence described herein. Each test shall be clearly identified on the Contractor's work schedule. Work schedule shall include line items for each piece of equipment and system that will be tested, and each type of test to be performed.

B. Testing shall be performed within the phasing and sequencing listed herein. Tests specified in the Contract Documents that are not listed in one of the phases described herein are not required to be performed in any particular order or phase, but shall be performed in accordance with the requirements of the individual specification section. Tests associated with equipment required for operation of equipment or systems listed herein shall be performed as prerequisites regardless of whether or not such tests are listed in the testing sequence specified herein. Tests listed in the same phase may be performed concurrently where approved by the Engineer. No testing in a particular phase may be performed until all testing in prior phases have been completed and approved by the Engineer. Before proceeding to testing in the next phase, all discrepancies and deficiencies observed during the tests in the previous phase shall be noted and corrected, and, if directed by the Engineer, the test of equipment and systems previously found deficient shall be rescheduled and repeated at no additional cost to the Owner. The Contractor shall provide written notification to the Engineer a minimum of seven (7) calendar days prior to beginning the next phase of testing. Tests shall be performed by phase in the following sequence:

SC-32 PAYMENTS TO CONTRACTOR

Owner shall pay Contractor as set forth in the General Provisions of the Contract Documents, Section 11, as amended by these Special Conditions.

At least ten (10) days before each progress payment falls due (but not more often than once a month) the CONTRACTOR will submit to the ENGINEER a partial payment estimate filled out and signed by the CONTRACTOR covering the WORK performed during the period covered by the partial payment estimate and supported by such data as the ENGINEER may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the WORK but delivered and suitably stored at or near the site, the partial payment estimate shall also be accompanied by such supporting data, satisfactory to the OWNER, as will establish the Owner's title to the material and equipment and protect his interest therein including applicable insurance. The ENGINEER will, within ten (10) days after receipt of each partial payment estimate, either indicate in writing his approval of payment and present the partial payment estimate to the OWNER, or return the partial payment estimate to the CONTRACTOR indicating in writing his reasons for refusing to approve payment. In the latter case, the CONTRACTOR may make the necessary corrections and resubmit the partial payment estimate. The OWNER within ten (10) days of presentation to him of an approved partial payment estimate, pay the CONTRACTOR a progress payment on the basis of the approved partial payment estimate.

SC-33 AS-BUILT DRAWINGS

As-built drawings shall be delivered to the Engineer and approved prior to submittal of final request for payment.

SC-34 PERFORMANCE AND PAYMENT BONDS

100% performance and 100% payment bonds are required and they must be valid for one year beyond the date of acceptance of the completed project.

SC-35 SUBMITTALS

Submittals must bear the approval stamp of the Contractor prior to submittal.

SC-36 SPECIAL PRECAUTIONS

The area of the proposed construction is the site of the existing water treatment plant for the City of Louisa. Contractor shall proceed with extreme caution during construction operations to ensure that the facilities of the existing plant are not damaged and the plant shall remain in operations at all times. Particular care shall be taken during excavation to ensure that all utilities, water mains, electrical services, and appurtenances are not

damaged. Particular care shall be taken during backfill and compaction to ensure that the mains are properly supported and protected so that leaks will not develop due to settling of the backfill.

Contractor shall maintain on site sufficient safety equipment, leak detection equipment, pipe location equipment and personnel to ensure safety of the Contractor's workmen, the Owner's representatives, and the general public.

Contractor shall be responsible for his own safety programs and plans.

SC-37 BLASTING

Blasting is not permitted.

SC-38 SUBSURFACE CONDITIONS

Rock may be encountered during construction of this project. The cost of rock excavation is to be included in the price for other items of construction and no additional payment for rock excavation will be made. The Contractor shall be responsible for inspecting the site and must satisfy himself as to the existing subsurface conditions.

The presence of rock shall be considered a usual physical condition, ordinarily encountered and generally recognized as inherent in the work described in the Contract Documents.

SC-39 SEWER AND POTABLE WATER LINES

All sewer and potable water lines will maintain a horizontal separation of 10 feet and a vertical separation of 18 inches.

SC-40 EROSION AND SEDIMENT CONTROL

The contractor shall take positive steps to minimize siltation and erosion during the project as per the Erosion and Sedimentation Control Plan. All erosion and sedimentation control measures musts be installed prior to initiation of construction activity. In addition, all erosion and sedimentation control measures must comply with the applicable regulations in the Commonwealth of Kentucky. Erosion and sediment control measures shown on the Plans are minimum requirements. Contractor shall provide additional measures as may be required to be in compliance at all times with local and state laws.

SC-41 QUALITY CONTROL TESTING

Contractor will perform his own quality control testing at his own expense. The Owner may perform testing to check the Contractor's work but such tests shall not be used by the Contractor for quality control and such tests shall not relieve the Contractor from obligations to perform the work in accordance with the Specifications and Contract Documents.

In the event that any test is performed by the Owner which in the opinion of the Engineer indicates failure of the work to meet the specifications, the Contractor shall promptly correct the work and reimburse the Owner for the costs of all subsequent tests until the work has been corrected.

The Contractor will be responsible for taking all samples and concrete cylinders requested by the Engineer and delivery of same to a testing laboratory selected by the Owner.

Unless specifically stated otherwise in individual Sections of the Specifications or Drawings, the Contractor shall provide test results within 48 hours of test completion.

SC-42 OWNER'S MINIMUM INSURANCE REQUIREMENTS

The Contractor at its expense shall procure and shall maintain the insurance required in this Contract and to be provided by the Contractor. The Contractor shall require each subcontractor to procure and maintain the insurance required by this Contract and to be provided by subcontractors. At a minimum, the following insurance Limits shall be procured:

General Liability – Commercial General Liability
Limits of Insurance - $2,000,000 general aggregate
$2,000,000 products & completed operations aggregate
$1,000,000 personal & advertising
$1,000,000 each occurrence

Automobile Liability – All Owned, Non-owned & Hired vehicles
Limits of Liability - $1,000,000 per accident

Excess or Umbrella Liability
Limits of Liability - $2,000,000

Workmen's Compensation – Statutory Coverage in each state of operations or "all states" coverage
Limits of Liability - $100,000 each accident bodily injury
$500,000 policy limit bodily injury by disease
$100,000 each employee bodily injury by disease

Description of Operations
Georgetown Municipal Water and Sewer Service must be added to the Commercial General Liability policy as an additional insured by Standard Endorsements CG 2010(11-85) and CG 2037 or their equivalents.

All policies, except workers compensation, shall include a waiver of subrogation.

Certificate Holder
Must list: Georgetown Municipal Water & Sewer Service
125 W. Clinton St.
Georgetown, KY 40324

Cancellation
Thirty (30) days prior written notice is required.

Builders Risk/Installation Floater
May be required in an amount equal to the contract. If above ground structures are involved in the Contract, this is required.

- END OF SECTION -

DIVISION 1

GENERAL REQUIREMENTS

SECTION 01010

SUMMARY

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:
1. Work covered by the Contract Documents.
2. Sequence of Operations.
3. Utility Shutdowns
4. Tie-ins and Disconnections
5. Temporary Systems
6. Use of premises.
7. Specification formats and conventions.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. The Contractor shall provide all material, services, labor, tools, and equipment, necessary to construct this project. The following is a brief description of the major work items included in the contract, but not limited to, and as described in these specifications:

1. Installation of new force main, modifications to one existing pump station and the installation one new pump stations for the Georgetown Municipal Water and Sewer Services.

2. The following major Work items are included in the Contract:

a. New Wrights Lane pump station
b. Modifications to Harbor Village pump station
c. Installation of new 8-inch Force Main.
d. All related appurtenances as shown on the Drawings and described in the Specifications.

B. All work shall include all related appurtenances as shown on the Drawings and described in the Specifications.

C. All excavation is bid unclassified.

1.03 SEQUENCE OF OPERATIONS

Not used

1.04 UTILITY SHUTDOWNS

A. One-week advance notice to the Owner is required prior to performing any utility shutdown unless of an emergency in nature.
B. Contractor shall know where all existing valves are located on the utility lines and shall be able to shut down expeditiously in case of line breaks.
C. The existing utility lines are shown as an approximate location on the plans. The contractor shall use extreme caution while laying other utility lines as not to break existing lines and interrupt service to owner's existing facilities.

D. Length of shutdowns on the existing system should be pre-determined before construction by owner, engineer, and contractor.

1.05 TIE-INS AND DISCONNECTIONS

A. Contractor shall furnish all materials and shall provide excavation, de-watering, scaffolding and support operations to support tie-ins.

1.06 TEMPORARY SYSTEM (S)

A. All temporary utility lines and hoses shall be depressurized and all temporary electrical lines and equipment de-energized when not in use and at the end of each workday.

1.07 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Division and Sections using the 17-division format.

1.08 PRE-BID SUBMITTAL PACKAGE

A. All bidders must recognize that, if any alternate equipment or material is used and does not meet or exceed the physical and dimensional standards nor perform as specified in the judgment of the project Engineer or Owner, the Contractor shall be required to modify or replace the alternate equipment with the original equipment or material at no additional cost to the Owner or Engineer.

B. Alternate manufacturers are eligible to offer equipment proposals for this work provided any exceptions or deviations taken to the plan design and product specifications shall be approved by the Engineer prior to bidding.

C. In order for alternate equipment to the considered an "approved equal," prospective suppliers must make a pre-bid submittal as detailed in the following paragraphs and make it available to the design engineer fourteen (14) calendar days prior to the time of bidding. All differences shall be clearly marked between the specifications and proposed substitute equipment.

D. The pre-bid submittals for qualification to bid must contain an installation list of ten (10) similar in size and construction completed and in operation within the past five (5) years. The installation list will be complete with the date of installation, the name and telephone number of the equipment operator and the name and telephone number of the design engineer.

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

Not used

END OF SECTION

SECTION 01015

WORK SEQUENCE

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall submit to the Engineer for review and acceptance a complete schedule of his proposed sequence of construction operations prior to commencement of work. However, the Engineer shall not accept a construction schedule that fails to utilize the entire time allocated for the new force main, new pump station and pump station modifications. This schedule requirement in no way prevents the Contractor from completing the project in a shorter time frame than scheduled. The construction schedule shall be submitted and approved by the Owner prior to the submittal of the first partial payment request. A revised construction schedule shall be submitted with every subsequent partial payment request. This revised schedule must be approved by the Owner prior to payment

B. The Contractor shall complete all work for the rehabilitation of the Harbor Village Pump Station and place the pump station back in service prior to making the wet tap to the existing 8-inch force main near Wrights Lane.

C. All existing force mains at the Mallard Point Disposal WWTP for Mallard Point Subdivision (6-inch) and Northern Elementary School (1-1/2-inch) shall be re-routed to the existing 8-inch force main from Harbor Village Pump Station after the new Wrights Lane Pump Station has been placed in service.

1.02 RELATED WORK

A. Section 01010 - Summary of Work.

B. Section 01040 - Coordination.

- END OF SECTION -

SECTION 01016

OCCUPANCY

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall be aware that after each section of the project is completed, the Contractor shall notify the Engineer that those specific operations are complete and prior to placing that portion of the work into service shall request an interim inspection of the work to be returned to or placed into service.

B. The interim inspection requested by the Contractor shall not preclude or supersede the final inspection of the project or reduce the Contractor's responsibility for the completed portion prior to final acceptance of the work by the Owner.

C. The Contractor shall be aware that after all of the gravity sewers have been completed, the Contractor shall notify the Engineer that all lines are complete and ready for final inspection. After the gravity sewers have passed the final inspection, approval will be given to begin the service connections to the existing sanitary sewer services lines at each residence.

- 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, equipment, 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 prices for the following items.

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 five (5) 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 five percent (5%) 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 form the supplier is attached to the pay request. Further, no item whose value is less than $1,000 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, then shall be limited to ninety percent (90%) of the bid price until clean-up and restoration.

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%) 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.

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 topographical maps issued.

C. Any discrepancies which may be discovered between actual conditions and those represented by the topographical maps and 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 conditions there existing 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% for added work or a minimum 15% for deleted work which shall cover the Contractor's general supervision, overhead and profit. In case of subcontracts, the 15% (maximum for added work and minimum for deleted work) is interpreted to mean the subcontractor's supervision, overhead and profit, and an additional 5% (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 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 FORCE MAIN & GRAVITY SEWER

A. Payment for installing the force main and gravity sewer will be made at the contract unit price per linear foot, complete in place, which shall include compensation for furnishing pipe, fittings, trenching (including rock excavation), earth, sand or Class I material bedding, thrustblocking, earth backfill, fittings, crushed stone pavement replacement, boring without casing under bituminous and concrete drives, sidewalk repair or replacement, disinfection, copper tracing wire and identification tape, testing and all appurtenances required. The quantity of force main to be paid for shall be the length of the completed line as measured along its centerline without any deduction for lengths of fittings, valves or other appurtenances. This includes both the PVC pipe, Ductile Iron and the HDPE pipe as described in the construction drawings.

B. Payment for crushed stone or bituminous pavement replacement and concrete surface replacement is included in this pay item and considered incidental to the construction and shall include furnishing and laying same in accordance with the specifications including concrete sub-slab and gravel backfill under pavement.

2.02 BORED HIGHWAY/RAILROAD CROSSING

Payment for the steel casing pipe bored under the railroad, highway, roadway, driveway or other areas shown on

the plans shall include the respective encasement pipe and will be paid for at the contract unit price per linear foot of pipe for the various sizes. This work shall include the encasement pipe, complete in place with fittings, spacers, skids, blocking, and all items necessary for its construction and installation. Carrier pipe is paid separately under item 2.01.

2.03 CONNECTION TO EXISTING FORCE MAIN

Payment for connecting to an existing force main at the location as shown on the construction plans shall include all materials and labor necessary for making a connection to the existing force main. This shall include tapping sleeves and valves, boxes, and testing of sleeves prior to tap. Different sizes will be paid as one. Payment will be made per connection and will include a maximum of 10 LF of pipe, fittings, and excavation.

2.04 AIR RELEASE, AIR/VACUUM RELEASE, AND COMBINATION AIR VALVES

Provide all labor, materials, equipment and services required to furnish and install all air release, air/vacuum release, and combination air valves (collectively "air valves"), manholes, and boxes shown on the drawings and/or specified herein. Air valves and manholes or curb boxes shall be installed at high points of force mains at locations shown on the plans or otherwise determined in the field by the ENGINEER. Payment will be on a per unit basis.

2.05 TYPE B and C CREEK CROSSING

Payment for forces main crossing major creeks or streams shall include excavation, concrete, rip rap, crushed stone, gravel backfill , anchors and PVC casing pipe when called for on the contract drawings will be paid for at the contract unit price per linear foot of creek crossing. This work shall include the excavation, concrete, gravel backfill material and anchors complete in place with fittings, blocking, and all items necessary for its construction. The length of the creek crossing to be paid for shall be measured from end to end of the encasement pipe. Carrier pipe is paid separately.

2.06 STEEL CASING - OPEN CUT

Payment for steel casing crossing the highway, roadway, driveway, water lines or other areas shown on the plans shall include the respective encasement pipe open cut and will be paid for at the contract unit price per linear foot of encasement pipe for the various sizes and types. This work shall include all the fittings, spacers, end seals and all items necessary for its construction and installation. Asphalt replacement and stone backfill will be paid for in the unit price of the pipe.

2.07 GATE VALVE AND BOX

Payment for furnishing and installing gate valves and valve boxes with covers in force mains will be made at the contract unit price each, complete in place, which shall include compensation for furnishing, hauling, trenching (including rock excavation), bedding, laying, jointing, backfilling, concrete supports and concrete collars.

2,08 REMOVE EXISTING AIR RELEASE VALVE VAULT

Payment for removing the existing air release valve vault shall be made on a per unit basis as shown on the construction drawings. This shall include all labor, excavation, hauling, blocking, and restoration to complete the removal. This vault is the property of GMWSS and they shall be notified upon its removal and shall be delivered to a location of their choice.

2.09 STANDARD MANHOLE

Payment is for furnishing and installing manholes of the types shown at a depth as shown on the Drawings. This is to be paid at the contract unit price each, complete in place, which shall include compensation for materials, furnishing, setting new manholes, and connecting inlet/outlet lines, hauling, excavation (including

rock excavation), bedding, backfilling, cleanup, grouting, seals, frames, covers and all other items necessary for a complete installation on a new sewer lines.

2.10 ADDITIONAL MANHOLE DEPTH

Payment for the additional manhole depth over and above the depth paid for in standard and drop manholes will be paid at the contract unit price per each additional vertical foot, rounded to the nearest foot, as measured to the invert at the centerline of the manhole as shown on the plans. This is to be paid at the contract unit price, complete in place, which shall include compensation for materials, backfilling, clean-up and all other items necessary for a complete installation.

2.11 CONNECT NEW FORCE MAIN TO EXISTING AIR RELEASE VALVE

Payment is for labor, and excavation to connect the new force main to an existing air release valve as shown on the construction drawings and shall be paid on a per unit each basis. This shall also include any other work required to make a complete and workable installation.

2.12 HARBOR VILLAGE PUMP STATION MODIFICATIONS

Payment for modifications to the existing pump station will be made at the contract lump sum price, complete in place, which shall include compensation for furnishing and installation of new 8-foot diameter manhole, discharge piping and valves, new submersible pumps and control panel, concrete repairs and coating sytem to existing wet well, and associated electrical work, replacement or modification to existing vavle vault and wet well for a complete operating system as shown on the drawings.

2.13 WRIGHTS LANE LANDFILL PUMP STATION

Payment for installing a new above ground suction lift pump station will be made at the contract lump sum price, complete in place, which shall include compensation for furnishing and installation including pumps, motors, electrical, piping, fiberglass enclosure, valves, grading, fencing, access road, crushed stone over filter fabric, backfilling, seeding, cleanup, and all other items necessary for a complete installation as shown on the contract drawings and specifications.

Payment for this item shall also include, but not limited to the following:

1. 500 Gallon Underground LPG Tank
2. 1" Water Service & Yard Hydrant Assembly , which shall include hydrant, gate valve and valve box and cover, concrete blocking and supporting pad, drainage bed, wrenches, saddle, corporation stop, service line and meter, setter, meter box and lid, excavation, and all items necessary for a complete installation.
3. Odor Control System

2.14 SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM (SCADA)

Payment for providing and installing the Supervisory Control and Data Acquisition System (SCADA) will be made at the contract unit price per each site installed, complete in place, which shall include compensation for furnishing equipment, materials, labor and all appurtenances required for a complete operating system.

PART 3 – EXECUTION

3.01 PAY ITEMS

A. The pay items listed hereinbefore refer to the items listed in the Bid Schedule and cover all of the pay items under the base bid for this contract.

B. Any and all other items of work listed in the specifications or shown on the Contract Drawings for this contract shall be considered incidental to and included in those pay items.

3.02 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 pipeline 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 Contractors responsibility to field verify the length and quantities of pipeline 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 pipe or overrun of pipe ordered for the pipeline 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 01030

LABOR PROVISIONS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall conform to all provisions of the Kentucky Department of Labor, Wage Decisions (latest revisions), relative to minimum wages and hours as they may apply to the work to be accomplished under these specifications.

B. In addition to the above, certain Federal laws and regulations shall govern the work and shall supplement or supplant the Kentucky Department of Labor Wage Decisions cited above, as the case may be.

1.02 WAGE RATES

The schedules of prevailing wage rates were determined for the project and are attached to this section. Classifications and minimum hourly wage rates are based on the Department of Labor's decisions. The said classifications and wage rates are hereby made a part of these Contract Documents. The Contractor shall post at appropriate, conspicuous points at the site of the project schedules of the aforementioned minimum wage rates. The Contractor will utilize, when feasible, local labor and will pay them wages commensurate with the wages prevailing in the Community.

1.03 LABOR PREFERENCE

Where feasible, the Contractor will utilize local labor.

1.04 HOURS OF WORK

A. Hours of work shall be as set out in Kentucky Department of Labor Wage Decisions (latest revisions); that is, not more than eight (8) hours in one calendar day, nor more than forty (40) hours in one week, except in case of emergency caused by fire, flood or damage to life and property.

B. Any laborer, workman, mechanic, helper, assistant or apprentice working in excess of forty (40) hours per week, except in case of emergency, shall be paid not less than 1-1/2 times the wage rate. Whenever overtime work is scheduled, the Contractor shall give prior notice to the Owner.

- END OF SECTION -

STATE WAGE RATES

KENTUCKY ENGINEERING GROUP, PLLC

Steven L. Beshear
Governor

KENTUCKY LABOR CABINET
DEPARTMENT OF WORKPLACE STANDARDS
DIVISION OF EMPLOYMENT STANDARDS,
APPRENTICESHIP & MEDIATION
1047 US Hwy 127 S - Suite 4
Frankfort, Kentucky 40601
Phone: (502) 564-3534
Fax (502) 696-1897
www.labor.ky.gov

Larry Roberts
Secretary

Anthony Russell
Commissioner

September 16, 2013

Bryan Lovan
KY Engineering Group
PO Box 1034
Versailles KY 40383

Re: City of Georgetown, US 25-Wrights Lane Pump Station & Force Main

Advertising Date as Shown on Notification: September 14, 2013

Dear Bryan Lovan:

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 8-019, dated June 25, 2013 for SCOTT 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: 105-H-00130-13-8, Heavy/Highway

Sincerely,

Anthony Russell
Commissioner

KENTUCKY LABOR CABINET

ERRATUM

Refer to the Locality Number and Determination Number listed below published by the Kentucky Labor Cabinet, Division of Employment Standards, Apprenticeship and Mediation dated June 25, 2013.

Locality Number 019 – Grant, Owen & Scott Counties

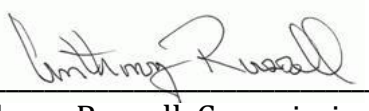
Determination Number CR 8-019

DELETE:

Carpenter	BASE RATE	$21.23
	FRINGE BENEFITS	12.40
Piledriver	BASE RATE	$21.73
	FRINGE BENEFITS	12.40

INSERT:

Carpenter	BASE RATE	$21.98
	FRINGE BENEFITS	12.70
Piledriver	BASE RATE	$22.48
	FRINGE BENEFITS	12.70



Anthony Russell, Commissioner
Department of Workplace Standards
Kentucky Labor Cabinet
Frankfort, KY 40601

This 27TH day of June, 2013

PREVAILING WAGE DETERMINATION
CURRENT REVISION
LOCALITY NO. 019

Project No. 105-H-00130-13-8

____ Bldg ___x__ HH

Determination No. CR 8-019
Date of Determination: June 25, 2013

This schedule of the prevailing rate of wages for Locality No. 019, which includes Grant, Owen & Scott 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 8-019 .

Apprentices shall be permitted to work as such subject to Administrative Regulation 803 KAR 1:010. Copies of this regulation 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, and/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
KENTUCKY LABOR CABINET

ASBESTOS/INSULATION WORKERS/HEAT & FROST INSULATORS		BASE RATE	$28.50
		FRINGE BENEFITS	13.22
BOILERMAKERS:		BASE RATE	$24.65
		FRINGE BENEFITS	12.94
BRICKLAYERS:			
Bricklayers:		BASE RATE	$26.11
		FRINGE BENEFITS	9.84
Refractory:		BASE RATE	$26.61
		FRINGE BENEFITS	9.84
CARPENTERS:			
Carpenters:	BUILDING	BASE RATE	~~$21.23~~
		FRINGE BENEFITS	~~12.40~~
Piledrivermen	BUILDING	BASE RATE	~~$21.73~~
		FRINGE BENEFITS	~~12.40~~
Carpenters:	HEAVY & HIGHWAY	BASE RATE	$26.90
		FRINGE BENEFITS	14.50
Pildrivermen:	HEAVY & HIGHWAY	BASE RATE	$27.15
		FRINGE BENEFITS	14.50
Divers:	HEAVY & HIGHWAY	BASE RATE	$40.73
		FRINGE BENEFITS	14.50
CEMENT MASONS:		BASE RATE	$ 17.50
		FRINGE BENEFITS	4.95
ELECTRICIANS:		BASE RATE	$29.48
		FRINGE BENEFITS	14.36
LINEMAN:	HEAVY & HIGHWAY	BASE RATE	$31.86
		FRINGE BENEFITS	11.63
GROUNDSMAN:	HEAVY & HIGHWAY	BASE RATE	$28.48
		FRINGE BENEFITS	10.94
EQUIPMENT OPERATOR:	HEAVY & HIGHWAY	BASE RATE	$18.87
		FRINGE BENEFITS	9.03
ELEVATOR CONSTRUCTORS:		BASE RATE	$29.75
		FRINGE BENEFITS	10.95

GLAZIERS:

OWEN COUNTY:	BASE RATE	$18.01
	FRINGE BENEFITS	3.88
GRANT & SCOTT COUNTIES:	BASE RATE	$15.45

IRONWORKERS:	BASE RATE	$26.47
	FRINGE BENEFITS	19.56

LABORERS:

BUILDING GROUP 1: General laborers, asbestos abatement laborer, toxic waste removal laborer, water boys, tool room checker, carpenter tenders, (civil engineer helper, rodman, grade checkers excluding all field work performed by engineering firms), concrete pouring and curing, concrete form stripping and wrecking, hand digging and backfilling of ditches, clearing of right of ways and building sites, wood sheeting and shoring, signalman for concrete bucket and general cleaning, and environmental laborer - nuclear, radiation, toxic and hazardous waste - Level D:

BUILDING	*BASE RATE	$20.41
	FRINGE BENEFITS	10.69

BUILDING GROUP 2: All air tool operators, air track drills, asphalt rakers, tampers, batchers plant and scale man, chain saw, concrete saw, electric hand grinder, all electric bush and chipping hammers, flagmen, forklift operators, form setter (street or highway), metal form setters, heaters, mesh handlers on walkways, streets and roadways outside building, gunnite laborers, hand spiker, introflax burning rod, joint makers, mason tenders, multi-trade tender, pipe layers, plaster tenders, powderman helpers, power driven Georgia buggies, power posthole diggers, railroad laborers, sandblaster laborers, scow man and deck hand, signal man, sweeper and cleaner machines, vibrator operators, walk behind trenching machines, mortar mixer machines, water pumpmen, and environmental laborers-nuclear, radiation, toxic and hazardous waste - Level C:

BUILDING	*BASE RATE	$20.81
	FRINGE BENEFITS	10.69

BUILDING GROUP 3: Asphalt Paver Screwman, gunnite nozzleman and gunnite nozzle machine operator, sand blaster nozzleman, concrete or grout pumpman, plaster pumpman:

BUILDING	*BASE RATE	$21.01
	FRINGE BENEFITS	10.69

BUILDING GROUP 4: Powderman and blaster, and environmental laborer - nuclear, radiation, toxic and hazardous waste - Level B:

BUILDING	*BASE RATE	$21.11
	FRINGE BENEFITS	10.69

BUILDING GROUP 5: Caisson holes (6 ft. and over) pressure and free air including tools, construction specialist, and environmental laborer-nuclear, radiation, toxic and hazardous waste - Level A:

BUILDING	*BASE RATE	$21.61
	FRINGE BENEFITS	10.69

BUILDING GROUP 6: Tunnel man and tunnel sand miner, cofferdam (pressure and free air), sand hog or mucker (pressure or free air):

BUILDING	*BASE RATE	$21.91
	FRINGE BENEFITS	10.69

LABORERS ON BUILDING: *Employees handling chemically treated materials which are harmful to the skin shall receive an additional $.25 above base rate. Any employee working on high work such as towers or smoke stacks or any type of work putting the employee 50 feet above the ground or a solid floor shall receive an additional $.50 per hour above the base rate. Any employee working on boilers, kilns, melting tanks, furnaces, or when refractory is done using live fire, drying fires, heatups or any hot work shall receive an additional 25% premium above the base rate.

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 & hazardous waste-Level D; flagmen; grade checkers; all hand digging and hand back filling; highway marker placers; landscaping laborers; mesh handlers & placers; puddler; railroad laborers; rip-rap & grouters; right of way laborers; sign, guard rail & fence installers (all types); signal men, sound barrier installer; storm and sanitary sewer laborers; swampers; truck spotters & dumpers; wrecking of concrete forms; general cleanup.

	HEAVY & HIGHWAY	*BASE RATE	$21.15
		FRINGE BENEFITS	11.41

HEAVY HIGHWAY GROUP 2: Batter board men (sanitary & storm sewer); brickmason tenders; mortar mixer operator; scaffold builders; burner and welder; bushammers; chain saw operator; concrete saw operators; deckhand scow man; dry cement handlers; environmental laborers-nuclear, radiation, toxic & 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 & wheel barrow; 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	$21.40
		FRINGE BENEFITS	11.41

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	$21.45
		FRINGE BENEFITS	11.41

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

	HEAVY & HIGHWAY	*BASE RATE	$22.05
		FRINGE BENEFITS	11.41

***Signal Person will receive the rate equal to the rate paid the laborer classification for which he or she is signaling.**

MARBLE, TILE & TERRAZZO:

Finishers:	BASE RATE	$15.42
	FRINGE BENEFITS	5.42
Setters:	BASE RATE	$22.64
	FRINGE BENEFITS	6.10

MILLWRIGHTS:	BASE RATE	$28.21
	FRINGE BENEFITS	15.99

OPERATING ENGINEERS / BUILDING:

BUILDING CLASS A-1:
NCCCO or OECP Certified:
Cableway, Carry Deck Crane, Cherry Picker, Clamshell, Crane, Derrick, Derrick Boat, Dragline, Hoist Engine (2 or more drums), Hydraulic Boom Truck, Hydrocrane, Orangepeel Bucket, Overhead Crane, Piledriver, Rough Terrain Crane, Tower Cranes (French, German and other types), Truck Crane:

	BUILDING	BASE RATE	$27.90
		FRINGE BENEFITS	13.90

OPERATING ENGINEERS / BUILDING: CONTINUED

BUILDING CLASS A: Auto Patrol, Batcher Plant, Bituminous Paver, Cableway, Central Compressor Plant, Clamshell, Concrete Mixer (21 cu. ft. or over), Concrete Pump, Crane, Crusher Plant, Derrick, Derrick Boat, Ditching and Trenching Machine, Dragline, Dredge Operator, Dredge Engineer, Elevating Grader and all types of Loaders, Forklift (regardless of lift height), Hoe-Type Machine, Hoist (1 drum when used for stack or chimney construction or repair), Hoisting Engine (2 or more drums), Locomotive, Motor Scraper, 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, Hopto, Tow or Push Boat, A-Frame Winch Truck, Concrete Paver, Gradeall, Hoist, Hyster, Pumpcrete, Ross Carrier, Boom, Tail Boom, Rotary Drill, Hydro Hammer, Mucking Machine, Rock Spreader attached to equipment, Scoopmobile, KeCal Loader, Tower Cranes (French, German and other types), Hydrocrane, Backfiller, Gurries, Sub-Grader, Tunnel Mining Machines including Moles, Shields, or similar types of Tunnel Mining Equipment:

BUILDING	BASE RATE	$26.84
	FRINGE BENEFITS	13.90

***Operators on cranes with boom one-hundred fifty feet (150') and over including jib, shall receive seventy-five cents ($.75) above base rate. All cranes with piling leads will receive $.50 above base rate regardless of boom length**

BUILDING 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, Fireman, 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 materials), Hoisting Engineer (1 drum or buck hoist), Forklift (when used for masonry construction, Firebrick Masonry Excluded), Well Points, Grout Pump, Throttle-Valve Man, Tugger, Electric Vibrator Compactor and Caisson Drill Helper:

BUILDING	BASE RATE	$23.94
	FRINGE BENEFITS	13.90

BUILDING CLASS C: Bituminous Distributor, Cement Gun, Conveyor, 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	$23.13
	FRINGE BENEFITS	13.90

OPERATING ENGINEERS / HEAVY & HIGHWAY:

HEAVY & HIGHWAY CLASS A-1:
NCCCO or OECP Certified:
Crane, dragline, hoist (1 drum when used for stack or chimney construction repair), hoisting engineer (2 or more drums), orangepeel bucket, overhead crane, piledriver, truck crane, tower crane, hydraulic crane:

HEAVY & HIGHWAY	BASE RATE	$28.40
	FRINGE BENEFITS	13.40

OPERATING ENGINEERS / HEAVY & HIGHWAY: CONTINUED

HEAVY & HIGHWAY CLASS A: A-frame Winch Truck, Auto Patrol, Backfiller, Batcher Plant, Bituminous Paver, Bituminous Transfer Machine, all types of Boom Cats, Bulldozer, Cableway, Carry-All Scoop, Carry Deck Crane, Central Compressor Plant Operator, Clamshell, Concrete Mixer (21 cu. Ft. or over), Concert Paver, Truck-mounted Concrete Pump, Core Drills, Crane, Crusher Plant, Derrick, Derrick Boat, Ditching and Trenching Machine, Dragline, Dredge Operator, Dredge Engineer, Earth Movers, Elevating Grader and all types of Loaders, Grade-all, Gurries, Heavy Equipment Robotics Operator/Mechanic, High Lift, Hoe-type machine, Hoist (two or more drums), Hoisting Engine, (two or more drums), Horizontal directional Drill Operator, Hydraulic Boom Truck, Hydrocrane, Hyster, KeCal Loader, Letourneau, Locomotive, Mechanic, Mechanically Operated Laser Screed, Mechanic Welder, Mucking Machine, Motor Scraper, Orangepeel Bucket, Piledriver, Power Blade, Pumpcrete, Push Dozer, Rock Spreader attached to equipment, All rotary Drills, Roller (Bituminous), Scarifier, Scoopmobile, Shovel, Side Boom, Subgrader, Tailboom, Telescoping Type Forklift, Tow or Push Boat, Tower Cranes (French, German, and other types), Tractor Shovel and Truck Crane, Tunnel Mining Machines including Moles, Shields, or similar types of Tunnel Mining Equipment:

HEAVY & HIGHWAY		BASE RATE	$27.35
		FRINGE BENEFITS	13.40

Operators on cranes with booms one hundred fifty feet (150) and over (including job) shall receive one dollar ($1.00) above Class A 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 one hundred fifty (150) feet, shall receive one dollar ($1.00) above the Class A rate. Where remote, laser, or CPS controlled equipment is utilized to operate the equipment listed in the wage classifications of this agreement, such work for operating purposes shall be the jurisdiction of the Operating Engineers.

HEAVY & HIGHWAY CLASS B: All Air Compressors (over 900 cu. Ft. per min), Bituminous Mixer, Boom Type Tamping Machine, Bull Float, Concrete Mixer (under 21 cu. Ft.), Dredge Engineer, Electric Vibrator Compactor/Self-propelled Compactor, Elevator (on drum or back hoist), Elevator (regardless of lift height), Form Grader, Hoist (one drum), Joint Sealing Machine, Mechanic Helper, Outboard Motor Boat, Power Sweeper (riding type), Roller (rock), Ross Carrier, Skid Mounted or Trailer mounted Concrete Pumps, Skid Steer Machine with all attachments, Switchman or Brakeman, Throttle Valve Man, Tract air and Road Widening Trencher, Tractor (50 H.P. or over), Truck Crane Oiler, Tugger, Welding Machine, Well Points, and Whirley Oiler:

HEAVY & HIGHWAY		BASE RATE	$24.87
		FRINGE BENEFITS	13.40

HEAVY & HIGHWAY CLASS B2: Greaser on Grease Facilities servicing Heavy Equipment, all off road material handling equipment, including articulating dump trucks:

HEAVY & HIGHWAY		BASE RATE	$25.26
		FRINGE BENEFITS	13.40

HEAVY & HIGHWAY CLASS C: Bituminous Distributor, Burlap and Curing Machine, Caison Drill and Core Drill Helper (track or skid mounted), Cement Gun, Concrete Saw, Conveyor, deckhand Oiler, Grout Pump, Hydraulic Post Driver, Hydro Seeder, Mud Jack, Oiler, Paving Joint Machine, Power form handling equipment, Pump, roller (earth), Steerman, Tamping machine, Tractors (under 50 H.P.) and Vibrator:

HEAVY & HIGHWAY		BASE RATE	$24.60
		FRINGE BENEFITS	13.40

PAINTERS:

Painters:	BUILDING	BASE RATE	$22.85
		FRINGE BENEFITS	7.10
Brush & Roller:	HEAVY & HIGHWAY	BASE RATE	$18.20
		FRINGE BENEFITS	5.08
Drywall Finishers & Plasterers:	HEAVY & HIGHWAY	BASE RATE	$18.45
		FRINGE BENEFITS	5.08

PAINTERS: CONTINUED

Spray, Sandblast, Power Tools, Waterblast, Steam Cleaning; Brush & Roller of Mastics, Creosotes, Kwinch Koate and Coal Tar Epoxy:	HEAVY & HIGHWAY	BASE RATE	$19.20
		FRINGE BENEFITS	5.08
Spray of Mastics, Creosotes, Kwinch Koate and Coal Tar Epoxy:	HEAVY & HIGHWAY	BASE RATE	$20.20
		FRINGE BENEFITS	5.08

PLUMBERS & PIPEFITTERS:	BASE RATE	$16.65
	FRINGE BENEFITS	1.02

ROOFERS: (Excluding Metal Roofs)	BASE RATE	$18.90
	FRINGE BENEFITS	6.79

SHEETMETAL WORKERS: (Including Metal Roofs)	BASE RATE	$26.35
	FRINGE BENEFITS	11.07

SPRINKLER FITTERS:	BASE RATE	$29.55
	FRINGE BENEFITS	17.22

TRUCK DRIVERS / BUILDING:	BASE RATE	$18.31
	FRINGE BENEFITS	*9.24

Truck Drivers performing work on or hauling from a hazardous or toxic waste site, add $4.00 to base.

*TRUCK DRIVER Fringe benefits - Apply to each employee (whose name appears on the payroll that week) who has been employed a minimum of twenty (20) work days within any ninety (90) consecutive day period for that employer.

TRUCK DRIVERS / HEAVY HIGHWAY:

Four-wheel service trucks, four-wheel dump trucks, Batch Trucks, Oil Distributors, Asphalt Distributors:	HEAVY & HIGHWAY	BASE RATE	$19.34
		FRINGE BENEFITS	7.02
Tandems:	HEAVY & HIGHWAY	BASE RATE	$19.39
		FRINGE BENEFITS	7.02
Tractor-Trailer; including semi-tractors, pole-trailers, ready-mix trucks; fuel trucks, asphalt-oil spraybar men (see also next line):	HEAVY & HIGHWAY	BASE RATE	$19.44
		FRINGE BENEFITS	7.02
Asphalt-Oil spraybar men when operated from cab, Five-Axle trucks & over:	HEAVY & HIGHWAY	BASE RATE	$19.54
		FRINGE BENEFITS	7.02

TRUCK DRIVERS / HEAVY HIGHWAY: CONTINUED

Belly Dumps, End Dumps, Articulated Dumps, Low-boys & Heavy Duty Equipment,Truck Mechanics:			
	HEAVY & HIGHWAY	BASE RATE	$19.81
		FRINGE BENEFITS	7.02

END OF DOCUMENT
CR 8-019
June 25, 2013

SECTION 01040

COORDINATION

PART 1 - GENERAL

1.01 COORDINATION OF THE WORK

The Contractor shall coordinate the work of all the crafts, trades and subcontractors engaged on the Work, and he shall have final responsibility as regards the schedule, workmanship and completeness of each and all parts of the Work.

All crafts, trades and subcontractors shall be made to cooperate with each other and with others as they may be involved in the installation of work which adjoins, incorporates, precedes or follows the work of another. It shall be the Contractor's responsibility to point out areas of cooperation prior to the execution of subcontract agreements and the assignment of the parts of the Work. Each craft, trade and subcontractor shall be made responsible to the Owner, for furnishing embedded items, giving directions for doing all cutting and fitting, making all provisions for accommodating the Work, and for protecting, patching, repairing and cleaning as required to satisfactorily perform the Work.

The Contractor shall be responsible for all cutting, digging and other action of his subcontractors and workmen. Where such action impairs the safety or function of any structure or component of the Project, the Contractor shall make such repairs, alterations and additions as will, in the opinion of the Engineer, bring said structure or component back to its original design condition at no additional cost to the Owner.

Each subcontractor is expected to be familiar with the General Requirements and all sections of the Detailed Specifications for all other trades and to study all Drawings applicable to his work to the end that complete coordination between trades will be affected. Each Contractor shall consult with the Engineer if conflicts exist on the Drawings.

- END OF SECTION -

SECTION 01200

SUBSTITUTIONS

PART 1 - GENERAL

A. If the CONTRACTOR wishes to furnish or use a substitute item of material or equipment or construction method he shall make written application to the Contracting Officer within thirty (30) days after execution of the Contractor, certifying that the proposed substitute will perform adequately the functions called for by the general design, be similar and of equal substance to that specified and be suited to the same use and capable of performing the same functions as that specified. Requests for review of substitute items of material and equipment will not be accepted by the ENGINEER from anyone other than CONTRACTOR.

B. In making request for substitution, CONTRACTOR represents:

1. He has personally investigated proposed product or method, and determined that it is equal or superior in all respects to that specified.

2. He will provide the same or better guarantee for substitution as for product or method specified.

3. He will coordinate installation of accepted substitution into work, making such changes as required in all respects.

4. He waives all claims for additional costs related to substitution that consequently become apparent.

5. Cost data is complete and includes all related costs under this Contract.

1.01 SUBMITTALS

A. The CONTRACTOR shall submit six (6) copies of requests for substitution. Include in request the following:

1. Complete data substantiating compliance of proposed substitution with Contract Documents.

2. Indication whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty.

3. For Products:

a. Product identification, including manufacturer's name and address.

b. Manufacturer's literature with product description, performance and test data, and reference standards.

c. Samples.

d. Name and address of similar projects on which product was used, data of installation, and product performance and maintenance records.

4. For Construction Methods:

a. Detailed description of proposed method.

b. Drawings illustrating methods.

5. Itemized comparison of proposed substitution with product or method specified.

6. Data relating to changes in construction schedule.

7. Relation to separate contracts, if any.

8. Accurate cost data on proposed substitution in comparison with product or method specified.

D. Substitutions will not be accepted if:

1. They are only shown or implied on Shop Drawings.

2. Acceptance will require substantial revision of Contract Documents.

3. Substitutions would change design concepts or Specifications.

4. Substitutions would delay completion of the Work.

5. Substitutions involve items for which a manufacturer was declared at time of bidding.

E. The ENGINEER will determine whether substitute brands or products are equal to those specified in the Contract Documents. No substitute will be ordered or installed without the ENGINEER's prior written acceptance.

F. The OWNER may require CONTRACTOR to furnish at CONTRACTOR'S expense a special performance guarantee or other surety with respect to any substitute.

G. If the ENGINEER determines that a substitute is not equal to that named in the Specifications, the CONTRACTOR shall furnish one of the brands or products specified, at no additional cost to the OWNER.

H. The time required by the ENGINEER to evaluate and either accept or reject proposed substitutes is included in the Contract Time and no extension of the Contract Time shall be allowed therefore.

1.02 ENGINEERING COSTS

A. The ENGINEER will record all time required in evaluating substitutions proposed by CONTRACTOR and in making any change in the Drawings or Specifications occasioned thereby. Whether or not the ENGINEER accepts a proposed substitute, the CONTRACTOR will reimburse the OWNER for the actual costs of the ENGINEER for evaluating any proposed substitute which either does not meet the requirements of the Drawings and Specifications, or the acceptance of which would require changes to other portions of the work.

B. CONTRACTOR shall reimburse OWNER for all associated engineering costs, including redesign, additional shop drawing reviews, investigations, consultant fees and revision of the Contract Documents required because of the substitution.

- END OF SECTION -

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 WORK INCLUDED

Shop drawings, descriptive literature, project data and samples (when samples are specifically requested) for all manufactured or fabricated items shall be submitted by the Contractor to the Engineer for examination and review in the form and in the manner required by the Engineer. All submittals shall be furnished in at least six (6) copies and shall be checked and reviewed by the Contractor before submission to the Engineer. The review of the Drawings by the Engineer shall not be construed as a complete check but only for conformance with the design concept of the Project and for compliance with information given in the Contract Documents. Review of such drawings will not relieve the Contractor of the responsibility for any errors which may exist as the Contractor shall be responsible for the dimensions and design of adequate connections, details, and satisfactory construction of all work.

1.02 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. General Conditions.

B. Section 01720 - Project Record Documents (As-Builts).

1.03 DEFINITIONS

The term "submittals" shall mean shop drawings, manufacturer's drawings, catalog sheets, brochures, descriptive literature, diagrams, schedules, calculations, material lists, performance charts, test reports, office and field samples, and items of similar nature which are normally submitted for the Engineer's review for conformance with the design concept and compliance with the Contract Documents.

1.04 GENERAL CONDITIONS

A. Review by the Engineer of shop drawings or submittals of material and equipment shall not relieve the Contractor from the responsibilities of furnishing same of proper dimension, size, quality, quantity, materials and all performance characteristics to efficiently perform the requirements and intent of the Contract Documents. Review shall not relieve the Contractor from responsibility for errors of any kind on the shop drawings. Review is intended only to assure conformance with the design concept of the Project and compliance with the information given in the Contract Documents.

B. Review of shop drawings shall not be construed as releasing the Contractor from the responsibility of complying with the Specifications.

1.05 GENERAL REQUIREMENTS FOR SUBMITTALS

A. Shop Drawings:

1. Shop drawings shall be prepared by a qualified detailer. Details shall be identified by reference to sheet and detail numbers shown on Contract Drawings. Where applicable, show fabrication, layout, setting and erection details.

2. Shop drawings are defined as original drawings prepared by the Contractor, subcontractors, suppliers, or distributors performing work under this Contract. Shop drawings illustrate some portion of the work and show fabrication, layout, setting or

erection details of equipment, materials and components. The Contractor shall, except as otherwise noted, have prepared the number of reviewed copies required for his distribution plus two (2) which will be retained by the Engineer. Shop drawings shall be folded to an approximate size of 8-1/2" x 11" and in such manner that the title block will be located in the lower righthand corner of the exposed surface.

B. Project data shall include manufacturer's standard schematic drawings modified to delete information which is not applicable to the Project, and shall be supplemented to provide additional information applicable to the Project. Each copy of descriptive literature shall be clearly marked to identify pertinent information as it applies to the Project.

C. Where samples are required, they shall be adequate to illustrate materials, equipment or workmanship, and to establish standards by which completed work is judged. Provide sufficient size and quantity to clearly illustrate functional characteristics of product and material, with integrally related parts and attachment devices, along with a full range of color samples.

D. All submittals shall be referenced to the applicable item, section and division of the Specifications, and to the applicable Drawing(s) or Drawing schedule(s).

E. The Contractor shall review and check submittals, and shall indicate his review by initials and date.

F. If the submittals deviate from the Contract Drawings and/or Specifications, the Contractor shall advise the Engineer, in letter of transmittal of the deviation and the reasons therefor. All changes shall be clearly marked on the submittal with a bold red mark. Any additional costs for modifications shall be borne by the Contractor.

G. In the event the Engineer does not specifically reject the use of material or equipment at variance to that which is shown on the Drawings or specified, the Contractor shall, at no additional expense to the Owner, and using methods reviewed by the Engineer, make any changes to structures, piping, controls, electrical work, mechanical work, etc., that may be necessary to accommodate this equipment or material. Should equipment other than that on which design drawings are based be accepted by the Engineer, shop drawings shall be submitted detailing all modification work and equipment changes made necessary by the substituted item.

H. Additional information on particular items, such as special drawings, schedules, calculations, performance curves, and material details, shall be provided when specifically requested in the technical Specifications.

I. Submittals for all electrically operated items (including instrumentation and controls) shall include complete wiring diagrams showing leads, runs, number of wires, wire size, color coding, all terminations and connections, and coordination with related equipment.

J. Equipment shop drawings shall indicate all factory or shop paint coatings applied by suppliers, manufacturers and fabricators; the Contractor shall be responsible for insuring the compatibility of such coatings with the field-applied paint products and systems.

K. Fastener specifications of manufacturer shall be indicated on equipment shop drawings.

L. Where manufacturers' brand names are given in the Specifications for building and construction materials and products, such as grout, bonding compounds, curing compounds, masonry cleaners, waterproofing solutions and similar products, the Contractor shall submit names and descriptive literature of such materials and products he proposes to use in this Contract.

M. No material shall be fabricated or shipped unless the applicable drawings or submittals have been reviewed by the Engineer and returned to the Contractor.

N. All bulletins, brochures, instructions, parts lists, and warranties packaged with and accompanying materials and products delivered to and installed in the Project shall be saved and transmitted to the Owner through the Engineer.

1.06 CONTRACTOR RESPONSIBILITIES

A. Verify field measurements, field construction criteria, catalog numbers and similar data.

B. Coordinate each submittal with requirements of Work and of Contract Documents.

C. Notify Engineer, in writing at time of submission, of deviations in submittals from requirements of Contract Documents.

D. Begin no work, and have no material or products fabricated or shipped which required submittals until return of submittals with Engineer's stamp and initials or signature indicating review.

- END OF SECTION -

SECTION 01380

CONSTRUCTION PHOTOGRAPHY

PART 1 - GENERAL

1.01 WORK INCLUDED

The Contractor shall be responsible for video taping the entire project site both prior to construction and immediately after completion and acceptance of all work. Video tapes shall be produced by a videographer acceptable to the Engineer and of a professional quality.

1.02 VIDEO TAPE

The video tape shall be of a high quality VHS or DVD format. Video tapes shall show the time, date, and project location on screen during playback.

1.03 SUBMITTALS

The Contractor shall provide two copies of the project video tape or DVD with jackets. Both the video tapes or DVD's and jackets shall be clearly labeled with project name start date and completion date as shown below.

Project Name and Contract No.
Owner Name
Start Date: _____
Completion Date: _____

-END OF SECTION-

SECTION 01450

QUALITY CONTROL

PART 1 - GENERAL

1.01 QUALITY CONTROL

A. Work of all crafts and trades shall be laid out to lines and elevations as established by the Contractor from the Drawings or from instructions by the Engineer.

B. Unless otherwise shown, all work shall be plumb and level, in straight lines and true planes, parallel or square to the established lines and levels. The Work shall be accurately measured and fitted to tolerance as established by the best practices of the crafts and trades involved, and shall be as required to fit all parts of the Work carefully and neatly together.

C. All equipment, materials and articles incorporated into the Work shall be new and of comparable quality as specified. All workmanship shall be first-class and shall be performed by mechanics skilled and regularly employed in their respective trades.

1.02 TESTS, INSPECTIONS, AND CERTIFICATIONS OF MATERIALS

A. Tests, inspections and certifications of materials, equipment, subcontractors or completed work, as required by the various sections of the Specifications shall be obtained by the Contractor and all costs shall be included in the Contract Price.

B. The Contractor shall submit to the Engineer the name of testing laboratory to be used.

C. Contractor shall deliver written notice to the Engineer at least 24 hours in advance of any inspections or tests to be made at the Project site. All inspections or tests to be conducted in the field shall be done in the presence of the Engineer or his representative.

D. Certifications by independent testing laboratories may be by copy of the attestation(s) and shall give scientific procedures and results of tests. Certifications by persons having interest in the matter shall be by original attest properly sworn to and notarized.

- END OF SECTION -

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION

The Contractor shall make his own provisions for temporary electricity and water and maintain strict supervision of use of temporary utility services as follows:

A. Enforce compliance with applicable standards.
B. Enforce safety practices
C. Prevent abuse of services.
D. Pay all utility charges required.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

A. The Contractor shall obtain and pay for all permits as required by governing authorities.

B. Obtain and pay for temporary easements required across property other than that of Owner or that is shown on the Contract Drawings.

C. The Contractor shall comply with applicable codes.

1.03 REMOVAL

A. The Contractor shall completely remove temporary materials, equipment, and offices upon completion of construction.

B. The Contractor shall repair damage caused by installation and restore to specified or original condition.

1.04 TEMPORARY ELECTRICITY

Electrical service for construction needs and for lighting and heating the work area will be provided by the Contractor.

1.05 TEMPORARY LIGHTING

A. The Contractor shall furnish and install temporary lighting required for:

1. Construction needs.
2. Safe and adequate working conditions.
3. Public Safety.
4. Security lighting.
5. Temporary office and storage area lighting.

B. Service periods for safety lighting shall be as follows:

1. Within construction area: All times that authorized personnel are present.
2. Public areas: At all times.

C. Costs of Installation and Preparation: Contractor shall pay all installation, maintenance and removal costs of temporary lighting.

D. Maintenance of temporary lighting service (replacement of bulbs, etc.) shall be the sole responsibility of the General Contractor.

1.06 TEMPORARY WATER

The Contractor shall provide the water necessary for testing and shall supply his own hoses.

1.07 SANITARY FACILITIES

Contractor shall provide sanitary facilities as directed in Article 42 of the General Conditions.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.01 DUST CONTROL

Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

3.02 EROSION AND SEDIMENT CONTROL

A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

B. Minimize amount of bare soil exposed at one time.

C. Provide temporary measures such as berms, dikes, drains, hay bales, gabions, etc., as directed by the Engineer so as to minimize siltation due to runoff.

D. Construct fill and waste areas by selective placement to avoid erosive exposed surface of silts or clays.

E. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

- END OF SECTION -

SECTION 01530

BARRIERS

PART 1 - GENERAL

1.01 WORK INCLUDED

Temporary Railing: Temporary railing shall be provided around open pits and other locations where needed, to prevent accidents or injury to persons.

1.02 COST

The Contractor shall pay all costs for barriers used for traffic control purposes.

- END OF SECTION -

SECTION 01540

SECURITY

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide barricades, lanterns and other such signs and signals as may be necessary to warn of the dangers in connection with open excavation and obstructions.

B. Provide an adequate and approved system to secure the Project area at all times, especially during non-construction periods; the Contractor shall be solely responsible for taking proper security measures.

1.02 COSTS

Contractor shall pay all costs for protection and security systems.

- END OF SECTION -

SECTION 01570

TRAFFIC REGULATION

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Construction parking control.

B. Flagmen.

C. Flares and lights.

D. Haul routes.

E. Traffic signs and signals.

F. Removal.

1.02 RELATED REQUIREMENTS

Section 01530 - Barriers.

PART 2 - PRODUCTS

2.01 SIGNS, SIGNALS AND DEVICES

A. Post-mounted and wall-mounted traffic control and informational signs as specified and required by local jurisdictions.

B. Automatic Traffic Control Signals: As approved by local jurisdictions.

C. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.

D. Flagman Equipment: As required by local jurisdictions.

PART 3 - EXECUTION

3.01 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and Owner's operations.

B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.

C. Prevent parking on or adjacent to access roads or in nondesignated areas.

3.02 TRAFFIC CONTROL

A. Whenever and wherever, in the Engineer's opinion, traffic is sufficiently congested or public safety is endangered, Contractor shall furnish uniformed officers to direct traffic and to keep traffic off the highway area affected by construction operations.

B. Contractor shall abide by City regulations governing utility construction work.

C. Traffic control shall be provided according to the Kentucky Department of Highways Manual on Uniform Traffic Control Devices for Streets and Highways.

3.03 FLAGMEN

Provide trained and equipped flagmen to regulate traffic when construction operations or traffic encroach on public traffic lanes.

3.04 FLARES AND LIGHTS

Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

3.05 HAUL ROUTES

A. Consult with authorities, establish public thoroughfares to be used for haul routes and site access.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

3.06 TRAFFIC SIGNS AND SIGNALS

A. At approaches to site and on site, install appropriate signs at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.

B. Install and operate traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control, and areas affected by Contractor's operations.

C. Relocate as work progresses, to maintain effective traffic control.

3.07 REMOVAL

Remove equipment and devices when no longer required. Repair damage caused by installation. Remove post settings to a depth of 2 feet.

- END OF SECTION -

SECTION 01580

PROJECT IDENTIFICATION AND SIGNS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall provide all signs required by these specifications near the site of the work. The sign shall set forth the description of the work and the names of the Owner, Engineer and Contractor as shown on the Plans or in these Specifications.

B. The Contractor shall furnish and install two (2) signs on the Project. The signs shall be constructed in accordance with Figure 1 on the following page. The locations shall be determined by the Owner and Engineer.

PART 2 - PRODUCT

2.01 SIGN

The signs shall be constructed of 3/4" thick APA A-B exterior grade or marine plywood. Posts shall be 4" x 4" of fencing type material. Prime all wood with white primer. Sign shall be as shown in Figure 1.

PART 3 - EXECUTION

3.01 MAINTENANCE

The signs shall be maintained in good condition until completion of the Project.

3.02 LOCATION

The location of the project signs are shown on the project location map. Exact location shall be determined at the pre-construction conference after the contract has been awarded.

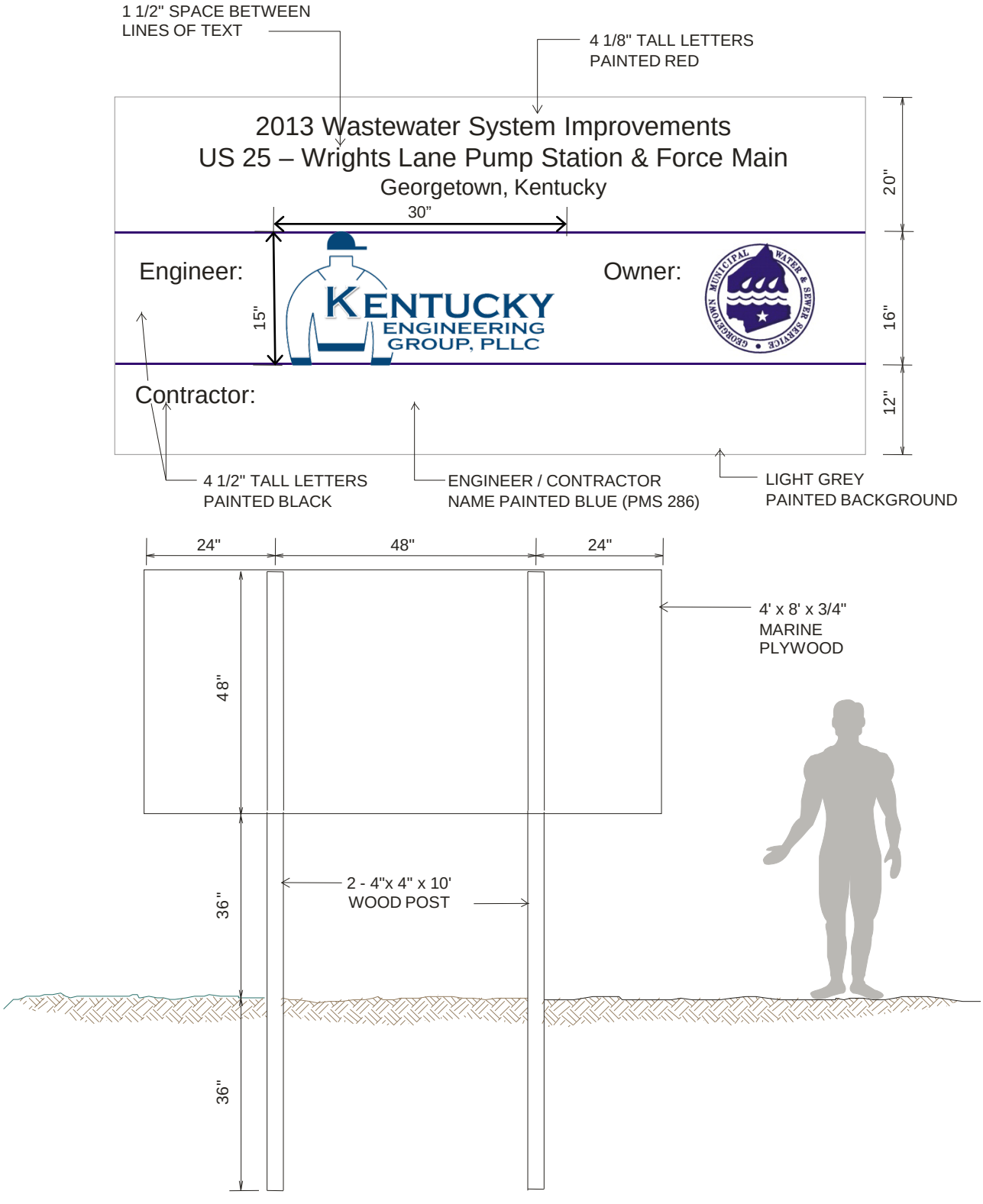


FIGURE 1

01580-2

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 COMPLIANCE WITH SAFETY REGULATIONS

The equipment items furnished shall comply with all governing Federal and State laws regarding safety, including all requirements of the Occupational Safety and Health Act of 1970 (OSHA).

PART 2 - PRODUCTS

2.01 REFERENCES

A. General Provisions: Section 10 Correction and Guarantee of Work, Section 13 Materials and Equipment.

B. Divisions 2, 5, 11, 13, 15, and 16

C. All material shall meet applicable American Water Works Association (AWWA), American Standard Testing Methods (ASTM), Underwriters Laboratories (UL), Factory Mutual (FM), National Sanitation Foundation (NSF) standards.

2.02 SERVICES OF MANUFACTURERS' REPRESENTATIVE AND OPERATING MANUALS

A. Bid prices for equipment furnished under Divisions 2, 5, 11, 13, 15 and 16, shall include the cost of written operation and maintenance instructions and the cost of a competent representative of the manufacturers of all equipment to supervise the installation, adjustment, and testing of the equipment and to instruct the Owner's operating personnel on operation and maintenance. This supervision and instruction may be divided into two or more time periods as required by the installation program, and shall be scheduled at the convenience of the Owner.

B. Unless otherwise specified with the equipment, equipment manufacturers shall provide a minimum of two (2) separate repeated training sessions for the Owner's staff for a total of eight (8) hours of training. Each session shall be at least two (2) hours in length, but not more than four (4) hours. Manufacturer's agenda and schedule for the training shall be submitted to and approved by the Owner and Engineer prior to conducting the training. No training will be scheduled until the equipment has been installed, satisfactorily tested, and is ready for operation.

C. The manufacturer's representative shall have complete knowledge of the proper installation, lubrication, operation and maintenance of the equipment provided and shall be capable of instructing the representatives of the Owner on proper start-up, shut-down, on-line operations, lubrication and preventive maintenance of the equipment. Outlines of lesson plans and proposed training schedule shall be submitted to the Owner and Engineer for review thirty (30) days prior to the desired instructional period. Specific requirements for furnishing the services of manufacturer's representatives are indicated under detailed specifications. This work may be conducted in conjunction with Inspection and Testing, whenever possible, as provided under Part 3 of EXECUTION of the appropriate detailed specification. Should difficulties in operation of the equipment arise due to the manufacturer's design or fabrication, additional services shall be provided at no cost to the Owner.

D. A certificate from the manufacturer stating that the installation of the equipment is satisfactory, that the unit has been satisfactorily tested, is ready for operation, and that the operating

personnel have been suitably instructed in the operation, lubrication, and care of the unit shall be submitted to the Engineer.

E. For equipment furnished under other Divisions, the Contractor, unless otherwise specified, shall furnish the services of accredited representatives of the manufacturer only when some evident malfunction or over-heating makes such services necessary. Additional services, when needed, shall be provided at no additional cost to the Owner.

2.03 INSTALLATION OF EQUIPMENT

A. Special care shall be taken to ensure proper alignment of all equipment with particular reference to pumps, blowers, and electric drives. The units shall be carefully aligned on their foundations by qualified millwrights after their sole plates have been shimmied to true alignment at the anchor bolts. The anchor bolts shall be set in place and the nuts tightened against the shims. After the foundation alignments have been reviewed by the Engineer, the bedplates or wing feet of the equipment shall be securely bolted in place. The alignment of equipment shall be further checked after securing to the foundations, and after conformation of all alignments, the sole plates shall be finally grouted in place. The Contractor shall be responsible for the exact alignment of equipment with associated piping, and under no circumstances, will "pipe springing" be allowed.

B. All wedges, shims, filling pieces, keys, packing, red or white lead grout, or other materials necessary to properly align, level, and secure apparatus in place shall be furnished by the Contractor. All parts intended to be plumb or level must be proven exactly so. Any grinding necessary to bring parts to proper bearing after erection shall be done at the expense of the Contractor.

2.04 SUBSTITUTION OF MANUFACTURE AND/OR EQUIPMENT

A. All bidders must recognize that, if any alternate equipment or system is used and does not meet or exceed the physical and dimensional standards nor perform as specified in the judgement of the project Engineer or Owner, the Contractor shall be required to modify or replace the alternate equipment with the original specified at no additional cost to the Owner or Engineer.

E. In order for alternate manufacturer or equipment to the considered an "approved equal," prospective suppliers must make a pre-bid submittal as detailed in the following paragraphs and make it available to the design engineer fourteen (14) calendar days prior to the time of bidding. All differences shall be clearly marked between the specifications and proposed substitute equipment.

F. The pre-bid submittals for qualification to bid must contain an installation list of ten (10) similar in size and capacity equipment completed and in operation within the past five (5) years. The installation list will be complete with the date of installation, the name and telephone number of the equipment operator and the name and telephone number of the design engineer.

2.05 GREASE, OIL, AND FUEL

A. All grease, oil, and fuel required for testing of equipment shall be furnished with the respective equipment. The Contractor shall furnish the Owner with a supply of required lubricants adequate for startup, including grease and oil of the type recommended by the manufacturer with each item of equipment supplied under Division 11, 13, 15 and 16.

B. All lubricants and fuels shall be properly labeled, using an indelible marker and writing on the lubricant container or drum, specifying the type and brand name of the lubricant supplied. A Master Lubrication list must be submitted to the Engineer for approval clearly stating which lubricants are to be used in the various pieces of plant equipment and the quantity supplied for one years' use by each unit. The Master Lubrication list shall be submitted in the following format:

-EXAMPLE-
MASTER LUBRICATION SCHEDULE
(for format and content example ONLY)

EQUIPMENT	LUBRICANT	QUANTITY (ONE YEAR'S SUPPLY
Clarifier Drive	50 weight oil, Shell XY2, or equal	25 Quarts per unit
Plunger Pump Auto Oiler	30 weight lube oil, Exxon, Shell, or equal	6 Quarts per unit
Grit Pump Drive	90 weight lubricant, Chevron Products G666, Shell, or equal	4 Gallons per unit

2.06 TOOLS AND SPARE PARTS

A. Any special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation, and maintenance of any equipment shall be furnished with the respective equipment.

B. All spare parts shall be properly protected for long periods of storage (contained in plastic bags or cardboard containers) and labeled for easy identification without opening. The labels shall be written with an indelible marker, in the following example format:

1. Item: shaft sleeve
2. No. of units: 1
3. Re-order No.: ACD2614
4. Supplier: K&S
5. Supplied for: Torque Flow Pumps

2.07 MAINTENANCE AND LUBRICATION SCHEDULES

The Contractor’s attention is directed to the General Provisions and Section 01300 for requirements relative to the submission of shop and working drawings for the mechanical equipment. For all mechanical and electrical equipment furnished, the Contractor shall provide a list including the equipment name, and address and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained. In addition, a maintenance and lubrication schedule for each piece of equipment shall be submitted along with shop drawings. Submission shall be in seven (7) copies. This schedule shall be in the form indicated hereinafter:

-EXAMPLE-
TYPICAL MAINTENANCE SCHEDULE
(for format and content example ONLY)

ITEM	ACTION	FREQUENCY	REMARKS
CLARIFIERS			
Equipment	Check removal of scum washdown, if required; remove any debris, etc.	Daily	
	Dewater, examine structure, scrape and paint all exposed metals, examine scraping shoes.	6 months	Scrape and clean walls of suitable repair any damage to scraping shoes.
Sludge Collector Drive Unit	Remove shear pin, clean off rust, grease and replace.	6 months	
Overflow Weir	Check serviceability	Daily	

-EXAMPLE-
TYPICAL LUBRICATION SCHEDULE
(for format and content example ONLY)

ITEM	MANUFACTURER'S RECOMMENDATIONS	TYPE LUBRICANT	FREQUENCY
Spur and Worm Gearing	Check oil level	See below; same as for oil change	Weekly
	Change oil	75-80 NSMP Oil (Winter 80-90 NSMP Gem Oil (Summer)	Gem 6 months
	Flush out drives before oil.	Kendall Flushing change Oil	Prior to oil change
Gear Motors*	Change oil	Kenoil 053 R&O (Winter) Kenoil 072 R&O	2,000 hours or 6 months

*See manufacturer's instructional manual for initial operation instructions. (IMPORTANT)

2.08 STORAGE AND HANDLING OF EQUIPMENT

A. Special attention shall be given to the storage and handling of equipment. As a minimum, the procedure outlined below shall be followed:

1. Equipment shall not be shipped until all pertinent shop drawings are reviewed by the Engineer.

2. All equipment having moving parts such as gears, electric motors, etc. and/or instruments shall be stored in a temperature and humidity controlled building approved by the Engineer, until such time as the equipment is to be installed.

3. All equipment shall be stored fully lubricated with oil, grease, etc. unless otherwise instructed by the manufacturer.

4. Manufacturer's storage instructions shall be carefully studied by the Contractor and reviewed with the Engineer. These instructions shall be carefully followed and a written record of this kept by the Contractor.

5. Moving parts shall be rotated a minimum of once weekly or less frequently if acceptable to the Engineer to ensure proper lubrication and to avoid metal-to-metal "welding." Upon installation of the equipment, the Contractor shall start the equipment, at least half load, once weekly or less frequently if acceptable to the Engineer, an adequate period of time to ensure that the equipment does not deteriorate from lack of use.

6. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants shall be put into the equipment at the time of acceptance.

7. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested, and accepted in a minimum time period. As such, the manufacturer will guarantee the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor’s expense.

B. The Owner reserves the right to withhold payment for any materials improperly stored and maintained.

2.09 PARTIAL UTILIZATION

A. During the course of construction partial occupation and utilization of completed portion of the work may be required so that the existing structure can be demolished and the new structure constructed.

B. When deemed necessary, the Owner or the Contractor may request use of completed work.

C. Partial utilization shall be practiced in accordance with the General Provisions.

2.10 EQUIPMENT WARRANTY

The Contractor shall provide the Owner a one (1) year warranty on all equipment, in accordance with the General Provisions. The warranty period for each item of equipment shall be one (1) year from the date of the Owner's acceptance of the equipment item.

2.11 ADJUSTMENTS AND CORRECTIONS OF EQUIPMENT AND APPURTENANCES DURING OPERATION

A. Some items of functional nature included in this Contract cannot be tested as to performance and quality at the time of completion of their installation. They must wait for necessary testing and proper performance until such functions are possible during later portions of this Contract. Such testing, specified performance and proper instructions to the Owner's operators (as to their maintenance and operation) is deemed a portion of this Contract, and payment shall be retained by the Owner for equipment delivered to the site and for Work completed to cover such service. Such service replacements and performance shall take precedence over expiration of the one (1) year guarantee period.

B. The Contractor shall expedite the completion of such service by his Suppliers and Subcontractors and shall render competent supervision of such service. He shall also expedite the replacement of defective and unaccepted parts and equipment. Unnecessary delay in delivery and installation of corrective parts and equipment may constitute damage to the Owner for which the Contractor can be held liable.

2.12 INSTALLING NEW EQUIPMENT IN EXISTING STRUCTURES

Where new equipment is planned and/or specified as being installed in existing structures, the Contractor shall verify all dimensions and locations of existing facilities prior to ordering the new equipment. Existing anchor bolts shall be used when possible, and new equipment shall be fabricated to conform to the existing dimensions, shapes, and locations as required.

- END OF SECTION -

SECTION 01610

TRANSPORTATION AND HANDLING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Handling and Distribution:

1. The Contractor shall handle, haul, and distribute all materials and all surplus materials on the different portions of the work, as necessary or required; shall provide suitable and adequate storage room for materials and equipment during the progress of the work, and be responsible for the protection, loss of, or damage to materials and equipment furnished by him, until the final completion and acceptance of the work.

2. Storage and demurrage charges by transportation companies and vendors shall be borne by the Contractor.

B. Storage of Materials and Equipment: All excavated materials and equipment to be incorporated in the work shall be placed so as not to injure any part of the work or the existing facilities and so that free access can be had at all times to all parts of the work and to all public utility installations in the vicinity of the work. Materials and equipment shall be kept neatly piled and compactly stored in such locations as will cause a minimum of inconvenience to public travel and adjoining owners, tenants and occupants.

- END OF SECTION -

SECTION 01700

PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Liquidated Damages: PROPOSAL, GENERAL CONDITIONS: Article 13.

B. Cleaning: Section 01710.

C. Project Record Documents: Section 01720.

1.02 SUBSTANTIAL COMPLETION

A. Contractor:

1. Submit written certification to Engineer that project is substantially complete.

2. Submit list of major items to be completed or corrected.

B. Engineer will make an inspection within seven days after receipt of certification, together with Owner's Representative.

C. Should Engineer consider that work is substantially complete:

1. Contractor shall prepare, and submit to Engineer, a list of items to be completed or corrected, as determined by the inspection.

2. Engineer will prepare and issue a Certificate of Substantial Completion, containing:

a. Date of Substantial Completion.

b. Contractor's list of items to be completed or corrected, verified and amended by Engineer.

c. The time within which Contractor shall complete or correct work of listed items.

d. Time and date Owner will assume possession of work or designated portion thereof.

e. Responsibilities of Owner and Contractor for:

(1) Insurance
(2) Utilities
(3) Operation of mechanical, electrical and other systems.
(4) Maintenance and cleaning.
(5) Security

f. Signatures of:
(1) Engineer
(2) Contractor

(3) Owner

3. Owner occupancy of Project or Designated Portion of Project:

a. Contractor shall:

(1) Obtain certificate of occupancy.
(2) Perform final cleaning in accordance with Section 01710.

b. Owner will occupy Project, under provisions stated in Certificate of Substantial Completion.

4. Contractor shall complete work listed for completion or correction, within designated time.

D. Should Engineer consider that work is not substantially complete.

1. He shall immediately notify Contractor, in writing, stating reasons.

2. Contractor shall complete work, and send second written notice to Engineer, certifying that Project, or designated portion of Project is substantially complete.

3. Engineer will reinspect work.

1.03 FINAL INSPECTION

A. Contractor shall submit written certification that:

1. Contract Documents have been reviewed.

2. Project has been inspected for compliance with Contract Documents.

3. Work has been completed in accordance with Contract Documents.

4. Equipment and systems have been tested in presence of Owner's Representative and are operational.

5. Project is completed and ready for final inspection.

B. Engineer will make final inspection within seven (7) days after receipt of certification.

C. Should Engineer consider that work is finally complete in accordance with requirements of Contract Documents, he shall request Contractor to make Project Closeout submittals.

D. Should Engineer consider that work is not finally complete:

1. He shall notify Contractor, in writing, stating reasons.

2. Contractor shall take immediate steps to remedy the stated deficiencies, and send second written notice to Engineer certifying that work is complete.

3. Engineer will reinspect work.

1.04 FINAL CLEAN UP

The Work will not be considered as completed and final payment made until all final clean up has been done by the Contractor in a manner satisfactory to the Engineer. See Section 01710 for detailed requirements.

1.05 CLOSEOUT SUBMITTALS

A. Project Record Documents: To requirements of Section 01720.

B. Guarantees, Warranties and Bonds: To requirements of particular technical specifications and Section 01740.

1.06 INSTRUCTION

Instruct Owner's personnel in operation of all systems, mechanical, electrical and other equipment.

1.07 FINAL APPLICATION FOR PAYMENT

Contractor shall submit final applications in accordance with requirements of GENERAL CONDITIONS.

1.08 FINAL CERTIFICATE FOR PAYMENT

A. Engineer will issue final certificate in accordance with provisions of GENERAL CONDITIONS.

B. Should final completion be materially delayed through no fault of Contractor, Engineer may issue a Semi-Final Certificate for Payment.

- END OF SECTION -

SECTION 01710

CLEANING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. During its progress the work and the adjacent areas affected thereby shall be kept cleaned up and all rubbish, surplus materials, and unneeded construction equipment shall be removed on a daily basis and all damage repaired so that the public and property owners will be inconvenienced as little as possible.

B. Where material or debris has washed or flowed into or been placed in existing watercourses, ditches, gutters, drains, pipes, structures, by work done under this contract, or elsewhere during the course of the Contractor's operations, such material or debris shall be entirely removed and satisfactorily disposed of during the progress of the work, and the ditches, channels, drains, pipes, structures, and work, etc., shall, upon completion of the work, be left in a clean and neat condition.

C. On or before the completion of the work, the Contractor shall, unless otherwise especially directed or permitted in writing, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools, and machinery or other construction equipment furnished by him; shall remove, acceptably disinfect, and cover all organic matter and material containing organics in, under, and around privies, houses, and other buildings used by him; shall remove all rubbish from any grounds which he has occupied; and shall leave the roads and all parts of the premises and adjacent property affected by his operations in a neat and satisfactory condition.

D. The Contractor shall thoroughly clean all materials and equipment installed by him and his subcontractors, and on completion of the work shall deliver it undamaged and in fresh and new appearing condition.

E. The Contractor shall restore or replace, when and as directed, any public or private property damaged by his work, equipment, or employees, to a condition equal or better than that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary highway or driveway, walk, and landscaping work. Suitable materials, equipment, and methods shall be used for such restoration. The restoration of existing property or structures shall be done as promptly as practicable as work progresses and shall not be left until the end of the contract period.

1.02 DESCRIPTION

A. Related Requirements Specified Elsewhere:

1. Project Closeout: Section 01700.

2. Cleaning for Specific Products or Work: Specification Section for that work.

B. On a continuous basis, maintain premises free from accumulations of waste, debris, and rubbish, caused by operations.

C. At completion of Work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all sight-exposed surfaces; leave Project clean and ready for occupancy.

1.03 SAFETY REQUIREMENTS

A. Hazards Control:

1. Store volatile wastes in covered metal containers, and remove from premises daily.

2. Prevent accumulation of wastes which create hazardous conditions.

3. Provide adequate ventilation during use of volatile or noxious substances.

B. Conduct cleaning and disposal operations in compliance with local ordinances and anti-pollution laws.

1. Do not burn or bury rubbish and waste materials on Project site without written permission from the Owner.

2. Do not dispose of volatile wastes such as mineral spirits, oil, or fuel in open drainage ditches or storm or sanitary drains.

3. Do not dispose of wastes into streams or waterways.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.01 DURING CONSTRUCTION

A. Execute cleaning to ensure that grounds and public properties are maintained free from accumulations of waste materials and rubbish.

B. Wet down dry materials and rubbish to minimize blowing dust.

C. At reasonable intervals during progress of Work, clean site and public properties, and dispose of waste materials, debris and rubbish.

D. Provide on-site containers for collection of waste materials, debris and rubbish.

E. Remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off construction site.

F. The Contractor shall thoroughly clean all materials and equipment installed.

3.02 FINAL CLEANING

A. Employ experienced workmen, or professional cleaners, for final cleaning.

B. In preparation for substantial completion, conduct final inspection of project area(s).

C. Broom clean paved surfaces; rake clean other surfaces of grounds.

D. Maintain cleaning until Project, or portion thereof, is accepted by Owner.

- END OF SECTION -

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 WORK INCLUDED

The Contractor shall obtain from the Engineer, one (1) set of blueline prints of the Contract Drawings. These prints shall be kept and maintained in good condition at the project site and a qualified representative of the Contractor shall enter upon these prints, from day-to-day, the actual "as-built" record of the construction progress. Entries and notations shall be made in a neat and legible manner and these prints shall be delivered to the Engineer upon completion of the construction. APPROVAL FOR FINAL PAYMENT WILL BE CONTINGENT UPON COMPLIANCE WITH THIS PROVISION.

1.02 RELATED REQUIREMENTS SPECIFIED ELSEWHERE:

A. Section 01300 - Submittals.

B. General Conditions: PDR

1.03 MAINTENANCE OF DOCUMENTS

A. Maintain at job site, one copy of:

1. Contract Drawings
2. Specifications
3. Addenda
4. Reviewed Shop Drawings
5. Change Orders
6. Other Modifications to Contract

B. Store documents in approved location, apart from documents used for construction.

C. Provide files and racks for storage of documents.

D. Maintain documents in clean, dry legible condition.

E. Do not use record documents for construction purposes.

F. Make documents available at all times for inspection by Engineer and Owner.

1.04 MARKING DEVICES

Provide colored pencil or felt-tip marking pen for all marking.

1.05 RECORDING

A. Label each document "PROJECT RECORD" in 2-inch high printed letters.

B. Keep record documents current.

C. Do not permanently conceal any work until required information has been recorded.

D. Contract Drawings: Legibly mark to record actual construction:

1. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
2. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
3. Field changes of dimension and detail.
4. Changes made by Change Order or Field Order.
5. Details not on original Contract Drawings.

E. Specifications and Addenda: Legibly mark up each Section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
2. Changes made by Change Order or Field Order.
3. Other matters not originally specified.

F. Shop Drawings: Maintain as record documents; legibly annotate Shop Drawings to record changes made after review.

1.06 SUBMITTAL

A. At completion of project, deliver record documents to Engineer.

B. Accompany submittal with transmittal letter, in duplicate, containing:

1. Date
2. Project Title and Number
3. Contractor's Name and Address
4. Title and Number of each Record Document
5. Certification that each Document as Submitted is Complete and Accurate
6. Signature of Contractor, or his authorized Representative

- END OF SECTION -

SECTION 01730

OPERATING AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Compile product data and related information appropriate for Owner's maintenance and operation of equipment furnished under the contract. Prepare operating and maintenance data as specified.

B. Instruct Owner's personnel in the maintenance and operation of equipment and systems as outlined herein and/or in other Divisions.

C. In addition to maintenance and operations data, the manufacturer's printed recommended installation practice shall also be included. If not part of the operations and maintenance manual, separate written installation instructions shall be provided, serving to assist the Contractor in equipment installation.

D. Related Requirements Specified Elsewhere:

1. Section 01300 - Submittals.

2. Section 01700 - Project Closeout.

3. Section 01720 - Project Record Documents.

4. Section 01740 - Warranties and Bonds.

5. General Conditions

1.02 MAINTENANCE AND OPERATIONS MANUAL

Every piece of equipment furnished and installed shall be provided with complete maintenance and operations manuals. These shall be detailed in instructions to the Owner's personnel. They shall be attractively bound for the Owner's records.

The manuals shall be submitted to the Engineer for review as to adequacy and completeness. Provide three (3) copies each.

1.03 FORM OF SUBMITTALS

A. Prepare data in the form of an instructional manual for use by Owner's personnel.

B. Format:

1. Size: 8-1/2 x 11 in.

2. Paper: 20 pound minimum, white, for typed pages.

3. Text: Manufacturer's printed data, or neatly typewritten.

4. Drawings:

   a. Provide reinforced punched binder tab, bind with text.

   b. Fold large drawings to the size of the text pages where feasible.

   c. For all drawings included within manuals, furnish a 3 mil mylar copy in standard size drawings 36" x 24", 8" x 16" or 8-1/2" x 11".

   d. For flow or piping diagrams that cannot be detailed on the standard size drawings, a larger, appropriate size drawing may be submitted.

5. Provide fly-leaf for each separate product, or each piece of operating equipment.

   a. Provide typed description of product, and major component parts of equipment.

   b. Provide indexed tabs.

6. Cover: Identify each volume with types or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:

   a. Title of Project.

   b. Identity of separate structure as applicable.

   c. Identity of general subject matter covered in the manual.

C. Binders:

1. Commercial quality, durable and cleanable, 3-hole, 3" or 4" post type binders, with oil and moisture resistant hard covers.

2. When multiple binders are used, correlate the data into related consistent grouping.

3. Labeled on the front cover and side of each binder shall be the name of the Project, the Contract Number and Volume Number.

1.04 CONTENT OF MANUAL

A. Neatly typewritten table of contents for each volume, arranged in systematic order.

1. Contractor, name of responsible principal, address and telephone number.

2. A list of each product required to be included, indexed to the content of the volume.

3. List, with each product, the name, address and telephone number of:

   a. Subcontractor or installer.

   b. Maintenance contractor, as appropriate.

   c. Identify the area of responsibility of each.
   d. Local source of supply for parts and replacement.

4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.

B. Product Data:

1. Include only those sheets which are pertinent to the specific product. References to other sizes and types or models of similar equipment shall be deleted or lined out.

2. Annotate each sheet to:

a. Clearly identify the specific product or part installed.

b. Clearly identify the data applicable to the installation.

c. Provide a parts list for all new equipment items, with catalog numbers and other data necessary for ordering replacement parts.

d. Delete references to inapplicable information.

3. Clear and concise instructions for the operation, adjustment, lubrication, and other maintenance of the equipment including a lubrication chart.

C. Drawings:

1. Supplement product data with drawings as necessary to clearly illustrate:

a. Relations of component parts of equipment and systems.

b. Control and flow diagrams.

2. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.

3. Do not use Project Record Documents as maintenance drawings.

D. Written text, as required to supplement product data for the particular installation:

1. Organize in a consistent format under separate headings for different procedures.

2. Provide a logical sequence of instructions for each procedure.

E. Copy of each warranty, bond and service contract issued: Provide information sheet for Owner's personnel.

1. Proper procedures in the event of failure.

2. Instances which might affect the validity of warranties or bonds.

F. These manuals shall be delivered to the Engineer at the time designated by the Engineer. The manuals must be approved by the Engineer before final payment on the equipment is made.

- END OF SECTION -

SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Compile specified warranties and bonds.

B. Compile specified service and maintenance contracts.

C. Co-execute submittals when so specified.

D. Review submittals to verify compliance with Contract Documents.

E. Related requirements specified elsewhere:

1. Bid Bond: Instructions to Bidders.

2. Performance and Payment Bonds: General Conditions.

3. Guaranty: General Conditions.

4. General Warranty of Construction: General Conditions.

5. Project Closeout: Section 01700.

6. Warranties and Bonds required for specific products: As listed herein.

7. Provisions of Warranties and Bonds, Duration: Respective specification sections for particular products.

8. Operating and Maintenance Data: Section 01730.

1.02 SUBMITTALS REQUIREMENTS

A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.

B. Furnish two (2) original signed copies.

C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

1. Product, equipment or work item.

2. Firm name, address and telephone number.

3. Scope

4. Date of beginning of warranty, bond or service and maintenance contract.
5. Duration of warranty, bond or service and maintenance contract.

6. Provide information for Owner's personnel:

   a. Proper procedure in case of failure.

   b. Instances which might affect the validity of warranty or bond.

7. Contractor name, address and telephone number.

1.03 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:

1. Size 8-1/2 in. x 11 in., punch sheets for 3-ring binder: Fold larger sheets to fit into binders.

2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS". List:

   a. Title of Project

   b. Name of Contractor

C. Binders: Commercial quality, three-ring, with durable and cleanable plastic covers.

1.04 TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during progress of construction: Submit documents within 10 days after inspection and acceptance.

B. Otherwise, make submittals within 10 days after date of substantial completion, prior to final request for payment.

C. For items of work, where acceptance is delayed materially beyond the Date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing the date of acceptance as the start of the warranty period.

1.05 SUBMITTALS REQUIRED

Submit warranties, bonds, service and maintenance contracts as specified in the respective sections of the Specifications.

- END OF SECTION -

DIVISION 2

SITE WORK

KENTUCKY ENGINEERING GROUP, PLLC

SECTION 02131

STRIPPING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This Section includes the requirements for stripping designated area(s) as shown on the Contract Drawings. The work shall consist of the excavation and removal of all topsoil, organic and other unsuitable matter at the location(s) and to the stripping limits required by the work shown on the Contract Drawings.

1.2 REFERENCES

Not Used.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

A. The area(s) designated for stripping shall be stripped to a depth of six (6) inches.

B. Stripped material shall be stockpiled at designated areas for later use or removed from the site. Stripped material stockpiles shall be enclosed by silt fence.

C. Objectionable materials encountered during the stripping operation shall be removed from the site and be legally disposed of.

D. The Contractor shall be responsible for compliance with all Federal, State and local laws and regulations relative to disposal by removal, and for obtaining all necessary permits and payment of fees for removal or disposal.

-- END OF SECTION --

SECTION 02200

SITE CLEARING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Clear site within construction limits of plant life and grass.

B. Remove root system of trees and shrubs.

C. Remove surface debris

1.02 REGULATORY REQUIREMENTS

Conform to applicable local codes and ordinances for disposal of debris.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.01 EXISTING TREES AND OTHER VEGETATION

A. The Contractor shall not cut or injure any trees or other vegetation outside right-of-way or easement lines and outside areas to be cleared, as indicated on the Drawings, without written permission from the Engineer. The Contractor shall be responsible for all damage done outside these lines.

B. The Engineer shall designate which trees are to be removed within permanent and temporary easement lines or right-of-way lines.

3.02 CLEARING

A. From areas to be cleared, the Contractor shall cut or otherwise remove all trees, brush, and other vegetable matter such as snags, bark and refuse. The ground shall be cleared to the width of the permanent easement or right-of-way unless otherwise directed by the Engineer.

B. Except where clearing is done by uprooting with machinery, trees, stumps, and stubs to be cleared shall be cut as close to the ground surface as practicable, but no more than 6" above the ground surface for small trees and 12" for larger trees.

C. Elm bark shall be either buried at least 1 foot deep or burned in suitable incinerators off site with satisfactory antipollution controls and fire prevention controls, to prevent the spread of Dutch Elm disease and as required by applicable laws.

3.03 GRUBBING

From areas to be grubbed, the Contractor shall remove completely all stumps, remove to a depth of 12" all roots larger than 3" in diameter, and remove to a depth of 6" all roots larger than 1/2" in diameter. Such depths shall be measured form the existing ground surface or the proposed finished grade, whichever is lower.

3.04 STRIPPING OF TOPSOIL

Prior to starting general excavation, strip topsoil to a depth of 6" or to depths required by the Engineer. Do not strip topsoil in a muddy condition and avoid admixture of subsoil. Stockpile the stripped topsoil within easement or right-of-way lines for use in finish grading and site restoration. Topsoil stockpiled, shall be free from trash, brush, stones over 2" in diameter and other extraneous material.

3.05 PROTECTION

A. Protect plant growth and features remaining as final landscaping.

B. Protect bench marks and existing work from damage or displacement.

C. Maintain designated site access for vehicle and pedestrian traffic.

3.06 REMOVAL

A. All material resulting from clearing and grubbing and not scheduled for reuse shall become the property of the Contractor and shall be suitable disposed of off-site, unless otherwise directed by the Engineer, in accordance with all applicable laws, ordinances, rules and regulations.

B. Such disposal shall be performed as soon as possible after removal of material and shall not be left until the final period of cleaning up.

- END OF SECTION -

SECTION 02202

ROCK REMOVAL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Removal of discovered rock during excavation.

B. Rock removal is part of and incidental to unclassified excavation. No separate payment shall be made for rock removal.

1.02 RELATED WORK

A. Section 01450 - Quality Control

B. Section 02070 - Selective Demolition

C. Section 02220 - Excavation

1.03 REFERENCES

A. NFPA 495 - Code for Manufacture, Transportation, Storage and Use of Explosive Materials.

B. Commonwealth of Kentucky Department of Mines and Minerals, Laws and Regulations Governing Explosives and Blasting.

1.04 QUALITY ASSURANCE

A. Seismic Survey Firm: Company specializing in seismic surveys with five years documented experience.

B. Explosives Firm: Company specializing in explosives for disintegration of subsurface rock with five years documented experience.

1.05 REGULATORY REQUIREMENTS

A. All blasting work done shall conform to Kentucky Department of Mines and Minerals code for explosive disintegration of rock.

B. The Contractor shall obtain permits from local authorities having jurisdiction before explosives are brought to site or drilling is started.

C. The Contractor shall conform to all State, Federal, and City laws, ordinances and regulations in regard to transportation, use and handling of explosives.

1.06 SHOP DRAWINGS

A. Submit shop drawings under provisions of Section 01300.

B. Indicate proposed method of blasting, delay pattern, explosive types, type of blasting mat or cover, and intended rock recovery method.

1.07 DEFINITIONS

A. Rock

1. All pieces of ledge or bedrock, boulders or masonry larger than one-half cubic yard in volume.

2. Any material requiring blasting, barring, or wedging for removal from its original bed.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Rock Definition: Solid mineral material that cannot be removed with a power shovel.

B. Explosives: Type recommended by explosives firm and required by authorities having jurisdiction.

C. Delay Devices: Type recommended by explosives firm and conforming to State regulations.

D. Blasting Mat Materials: Type recommended by explosives firm and conforming to State regulations.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify site conditions and note irregularities affecting work of this Section.

B. Beginning work of this Section means acceptance of existing condition.

C. All excavation is Bid Unclassified - No additional payment will be made for rock excavation.

3.02 ROCK REMOVAL

A. Excavate for and remove rock by a mechanical method.

B. Cut away rock at excavation bottom to form even surface.

C. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.

D. Rock shall be disposed of in an approved manner acceptable to the Engineer. No payment will be made for hauling of rock.

E. Correct unauthorized rock removal in accordance with backfilling and compaction requirements of Section 02610, Article 3.07.

3.03 ROCK REMOVAL - EXPLOSIVES METHODS

A. If rock is uncovered requiring the explosives method for rock disintegration, notify the Engineer.

B. Advise owners of adjacent buildings or structures in writing prior to setting up seismographs. Describe blasting and seismic operations.

C. Peak particle velocity will be limited to 4.0 in/sec.

D. Provide seismographic monitoring during progress of all blasting operations, or as required by State regulations.

E. Disintegrate rock and remove from excavation in accordance with Article 3.02.

F. The Contractor shall be solely responsible for his blasting operations.

1. Handling of explosives and blasting shall be done only by trained and experienced persons in such procedures.

2. Handling and blasting shall be in accordance with all Federal, State and local laws, rules and regulations relating to the possession, handling, storage and transportation and use of explosives.

3. All blasts in open cut shall be properly covered and protected with approved blasting mats.

4. Charges shall be of such size that the excavation will not be unduly large and shall be so arranged and timed that adjacent rock, upon or against which pipelines or structures are to be built, will not be shattered.

5. Blasting will not be permitted within 25 feet of pipelines or structures.

6. All existing pipes or structures exposed during excavation shall be adequately protected from damage before proceeding with the blasting.

G. Repair of Damages Due to Blasting

1. Any injury or damage to the work or to existing pipes or structures shall be repaired or rebuilt by the Contractor at his expense.

2. Whenever blasting may damage adjacent rock, pipes or structures, blasting shall be discontinued and the rock removed by drilling, barring, wedging or other methods.

H. Explosives

1. At no time shall an excessive amount of explosives be kept at the site of the work. Such explosives shall be stored, handled, and used in conformity with all applicable laws and regulations.

2. Accurate daily records shall be kept showing the amounts of explosives on hand, both at the site and at any storage magazine, the quantities received and issued, and the purpose for which issued.

3. The Contractor shall be responsible for any damage or injury to any persons, property, or structures as a result of his handling, storage, or use of explosives.

I. Rock Clearance in Trenches

1. Ledge rock, boulders and large stones shall be removed from the sides and bottom of the trench to provide clearance for the specified embedment of each pipe section, joint or appurtenance; but in no instance shall the clearance be less than 6 inches. Additional clearance at the pipe bell or joint shall be provided to allow for the proper make-up of the joint.

2. At the transition from an earth bottom to a rock bottom the minimum bottom clearance shall be 12 inches for a distance of not less than 5 feet.

J. Rock Clearance at Structures

1. Concrete for structures shall be placed directly on the rock and the excavation shall be only to the elevations and grades shown on the Contract Drawings.

3.04 FIELD QUALITY CONTROL

Engineer or his representative shall approve the depth of final rock.

3.05 EXCAVATION AND BACKFILL

A. Rock removal and backfilling shall be performed in accordance with the applicable provisions of the Specifications.

B. The rock excavated which cannot be incorporated into the backfill material, as specified, shall be disposed of as spoil, and shall be replaced with the quantity of acceptable material required for backfilling.

3.06 HAUL

No payment will be made separately or directly for haul on any part of the work for removed rock. All haul will be considered a necessary and incidental part of the work and the cost thereof shall be considered by the Contractor in the contract unit price for the pay items of work involved.

- END OF SECTION -

SECTION 02220

EXCAVATION

PART 1 - GENERAL

1.01 WORK INCLUDED

All excavation for the project is unclassified excavation. No separate payment shall be made for rock excavation.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.01 EXCAVATION FOR TRENCHES

A. If the foundation is good firm earth and the machine excavation has been accomplished, the remainder of the material shall be excavated by hand and the earth pared or molded to give full support to the lower quadrant of the barrel of each pipe. Where bell and spigot pipe are involved, bell holes shall be excavated during this latter operation to prevent the bells from being supported on undistributed earth. If for any reason the machine excavation in earth is carried below an elevation that will permit the type of bedding in undistributed earth, then a layer of granular material shall be placed so that the lower quadrant of the pipe will be securely bedded in the granular fill as described in Section 02610, Part 3.

B. If the foundation is rock and the excavation has been undercut as set out hereinbefore, a bed of No. 9 crushed stone aggregate shall be placed to provide continuous support for the lower quadrant of the pipe.

C. Trenches shall be of sufficient width to provide free working space on each side of the pipe and to permit proper backfilling around the pipe, but unless specifically authorized by the Engineer, trenches shall in no case be excavated or permitted to become wider than 2'-6" plus the nominal diameters of the pipe at the level of or below the top of pipe. Trenches cut in roads and streets shall not exceed a maximum width of 3'-6" plus the nominal diameters of the pipe at the level of the road or street surface.

D. All excavated materials shall be placed a minimum of 2 feet back from the edge of the trench.

E. Unless specifically directed otherwise by the Engineer, not more than 500 feet of trench shall be opened ahead of the pipe laying work of any one crew, and not more than 500 feet of open ditch shall be left behind the pipe laying work of any one crew. Watchmen or barricades, lanterns and other such signs and signals as may be necessary to warn the public of the dangers in connection with open trenches, excavations and other obstructions, shall be provided by and at the expense of the Contractor.

F. When so required, or when directed by the Engineer, only one-half of street crossings and road crossings shall be excavated before placing temporary bridges over the side excavated, for the convenience of the traveling public. All backfilled ditches shall be maintained in such manner that they will offer no hazard to the passage of traffic. The convenience of the traveling public and the property owners abutting the improvements shall be taken into consideration. All public or private drives shall be promptly backfilled at the direction of the Engineer.

G. Where existing drainage ditches coincide with the proposed water main alignment, the Contractor shall re-establish the drainage ditch after the water main has been laid and properly backfilled. The

drainage ditch shall be of equal size as the previously existing one and free of any restrictions which might impede flow.

3.02 SHORING, SHEETING, AND BRACING OF EXCAVATION

A. Where unstable material is encountered or where the depth of excavation in earth exceeds five (5) feet, the sides of the trench or excavation shall be supported by substantial sheeting, bracing, and shoring, or the sides sloped to the angle of repose. Sloping the sides of the ditch to the angle will not be permitted in streets, roads, narrow rights-of-way or other constricted areas unless otherwise specified. The design and installation of all sheeting, sheet piling, bracing and shoring shall be based on computations of pressure exerted by the materials to be retained under obtaining conditions. Adequate and proper shoring of all excavations shall be the entire responsibility of the Contractor; however, the Engineer may require the submission of shoring plans (accompanied by supporting computations) for approval prior to the Contractor undertaking any portion of the work. The standards of the Federal Occupational Safety and Health Act and the Kentucky Labor Cabinet shall be followed.

B. Foundations, adjacent to where the excavation is to be made below the depth of the existing foundation, shall be supported by shoring, bracing or underpinning as long as the excavation shall remain open, or thereafter if required to insure the stability of the structure supported by the foundation, and the Contractor shall be held strictly responsible for any damage to said foundations.

C. Solid sheeting will be required for wet or unstable material. It shall consist of continuous vertical sheet piling of timber or steel with suitable wales and braces.

D. Care shall be taken to avoid excessive backfill loads on the completed pipelines and the trench width requirements at the level of the crown of the pipe and at the level of a road or street be strictly observed.

E. Trench sheeting shall not be removed until sufficient backfill has been placed to protect the pipe.

F. All sheeting, planking, timbering, bracing and bridging shall be placed, renewed and maintained as long as is necessary.

3.03 REMOVAL OF WATER

A. The Contractor, at his own expense, shall provide adequate facilities for promptly and continuously removing water from all excavation.

B. To ensure proper conditions at all times during construction, the Contractor shall provide and maintain ample means and devices (including spare units kept ready for immediate use in case of breakdowns) with which to remove promptly and dispose properly of all water entering trenches and other excavations. Such excavation shall be kept dry until the structures, pipes, and appurtenances to be built therein have been completed to such extent that they will not be floated or otherwise damaged.

C. All water pumped or drained from the work shall be disposed of in s suitable manner without undue interference with other work, damage to pavements, other surfaces, or property. Suitable temporary pipes, flumes, or channels shall be provided for water that may flow along or across the site of the work.

D. If necessary, the Contractor shall dewater the excavations by means of an efficient drainage wellpoint system which will drain the soil and prevent saturated soil from flowing into the excavation. The wellpoints shall be designed especially for this type of service. The pumping unit shall be designed for use with the wellpoints, and shall be capable of maintaining a high vacuum and of handling large volumes of air and water at the same time.

E. The installation of the wellpoints and pump shall be done under the supervision of a competent representative of the manufacturer. The Contractor shall do all special work such as surrounding the wellpoints with sand or gravel or other work which is necessary for the wellpoint system to operate for the successful

dewatering of the excavation.

F. The Contractor shall at all times during construction provide and maintain means and devices with which to promptly dispose of all water entering the excavations or other parts of the work and shall keep said excavations dry until the structures to be built therein are complete. No concrete shall be placed in water nor shall water be allowed to rise over structures if there is danger of floatation or of setting up unequal pressures in the concrete, until the concrete has set at least twenty four (24) hours and any danger of floatation has been removed.

G. The Contractor shall dispose of water from the work in a suitable manner without damage to adjacent property or sewers. No water shall be drained into work built or under construction. No sanitary sewer shall be used for the disposal of trench water.

3.04 DISPOSITION OF EXCAVATED MATERIAL

Material excavated for pipe lines and structures not suitable or needed for backfilling purposes, shall be disposed of by the Contractor at his own expense in a manner satisfactory to the Engineer.

3.05 UNAUTHORIZED EXCAVATION

Whenever the excavation is carried beyond or below the required lines and grades, the Contractor, at his own expense, shall refill said excavated space with suitable material in a manner approved by the Engineer.

3.06 EXISTING UTILITIES AND OTHER OBSTRUCTIONS

Prior to the commencement of construction on the project, the Contractor shall contact the utility companies whose lines, above and below ground, may be affected during construction and verify the locations of the utilities as shown on the Contract Drawings. The Contractor shall ascertain from said companies if he will be allowed to displace or alter, by necessity, those lines encountered or replace those lines disturbed by accident during construction, or if the companies themselves are only permitted by policy to perform such work. If the Contractor is permitted to perform such work, he shall leave the lines in as good condition as were originally encountered and complete the work as quickly as possible. All such lines or underground structures damaged or molested in the construction shall be replaced at the Contractor's expense, unless, in the opinion of the Engineer, such damage was caused through no fault of the Contractor.

3.07 FINAL CLEANUP AND RESTORATION

Unless specifically approved by the Owner and Engineer, **cleanup of disturbed areas shall be kept current with construction** and restoration efforts by the contractor initiated **immediately** and areas not remain **unprotected** for more than **seven 7days.** Any large rocks, stones or debris shall be removed from the site, and shall not be a burden to the property owner(s) and/or adjacent properties. The contractor may windrow or track-in the excavated material over the trench prior to final cleanup to allow for and to assist in the initial settlement of the trench. All disturbed areas must be seeded at least with a temporary seed mix if for some reason the area cannot be permanently seeded within two (2) weeks.

- END OF SECTION -

SECTION 02230

TRENCH BEDDING AND BACKFILLING

PART 1 - GENERAL

1.01 WORK INCLUDED

The Contractor shall furnish, place and compact all bedding and backfill materials specified herein or denoted on the Drawings. The materials, equipment, labor, etc. required herein are to be considered as part of the requirements and costs for installing the various pipes, structures and other items they are incidental to.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Crushed stone material shall conform with the requirements of applicable sections of the Kentucky Bureau of Highways Standard Specifications and shall consist of clean, hard, and durable particles or fragments, free from dirt, vegetation or objectional materials.

B. Two classes of crushed stone material are used in this Section for pipe bedding and backfill. The type of material in each class is as follows:

1. Class I - No. 9 Aggregate.

2. Class II - Dense Graded Aggregate (DGA).

C. Subbase material for structures shall be naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed stone.

D. Backfill materials at structures shall be satisfactory soil materials free of debris, waste, frozen materials, vegetable, and other deleterious matter.

PART 3 - EXECUTION

3.01 EXCAVATION

A. The trench excavation shall be located as shown on the Contract Drawings or as specified. Under ordinary conditions, excavation shall be by open cut from the ground surface. Where the depth of trench and soil conditions permit, tunneling may be required beneath cross walks, curbs, gutters, pavements, trees, driveways, railroad tracks and other surface structures. No additional compensation will be allowed for such tunneling over the price bid for open cut excavation of equivalent depths below the ground surface unless such tunnel excavation is specifically provided for in the Contract Documents.

B. Trenches shall be excavated to maintain the depths as shown on the Contract Drawings or as specified for the type of pipe to be installed.

C. The alignment and depth shall be determined and maintained by the use of a string line installed on batter boards above the trench, a double string line installed along side of the trench or a laser beam system.

D. The minimum width of trench excavation shall be 6-inches on each side of the pipe hub for 21-inch diameter pipe and smaller and 12-inches on each side of the pipe hub for 24-inch diameter pipe and larger.

E. Trenches shall not be opened for more than 300 feet in advance of pipe installation nor left unfilled for more than 100 feet in the rear of the installed pipe when work is in progress without the consent of the Engineer. Open trenches shall be protected and barricaded as required.

F. Bridging across open trenches shall be constructed and maintained where required.

3.02 PIPE BEDDING

A. Piping for gravity sewers and force mains shall be supported as follows:

1. All gravity sewer piping shall be laid on a bed of granular material except when a concrete encasement situation occurs. All pipe bedding material shall be Class I (No. 9 crushed stone aggregate) and shall be placed to a depth of 4" in an earth trench and 6" in a rock trench. Aggregate bedding shall be graded to provide for a uniform and continuous support beneath the pipe at all points.

2. The trench bottom for force main piping shall be stable, continuous, relatively smooth and free of frozen material, clodded dirt, foreign material larger than 1/2-inch in diameter. The foundation for force main piping shall be prepared so that the entire load of the backfill on top of the pipe will be carried uniformly on the barrel of the pipe. Any uneven areas in the trench bottom shall be shaved off or filled in with Class I granular bedding. When the trench is made through rock, the bottom shall be lowered to provide 6 inches of clearance around the pipe. Class I granular bedding shall be used to bring the trench bottom to grade.

B. After each pipe has been brought to grade, aligned, and placed in final position, Class I material for gravity sewer piping and earth material for force main piping shall be deposited and densified under the pipe haunches and on each side of the pipe up to the spring line of the pipe to prevent lateral displacement and hold the pipe in proper position during subsequent pipe jointing, bedding, and backfilling operations.

C. In wet, yielding and mucky locations where pipe is in danger of sinking below grade or floating out of grade or line, or where backfill materials are of such a fluid nature that such movements of pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective.

D. Where an unstable (i.e., water, mud, etc.) trench bottom is encountered, stabilization of the trench bottom is required. This is to be accomplished by undercutting the trench depth and replacing to grade with a foundation of crushed stone aggregate.

E. The depth of the foundation is dependent upon the severity of the trench bottom. The size of stone aggregate used in the foundation will be determined by the condition of the unstable material. Once the trench bottom has been stabilized, the required Class I bedding material can be placed.

F. It should be noted that no pipe shall be laid on solid or blasted rock.

G. Pipe bedding as required in Paragraphs A, B and D of this article is <u>not</u> considered a separate pay item.

3.03 SUBGRADE PREPARATION FOR PIPE

A. Where pipe is to be laid on undisturbed bottom of excavated trench, mechanical excavation shall not extend lower than the finished subgrade elevation at any point.

B. Where pipe is to be laid on special granular material the excavation below subgrade shall be to the depth specified or directed. The excavation below subgrade shall be refilled with special granular material as specified or directed, shall be deposited in layers not to exceed 6 inches and shall be thoroughly compacted prior to the preparation of pipe subgrade.

C. The subgrade shall be prepared by shaping with hand tools to the contour of the pipe barrel to allow for uniform and continuous bearing and support on solid undisturbed ground or embedment for the entire length of the pipe.

D. Pipe subgrade preparation shall be performed immediately prior to installing the pipe in the trench. Where bell holes are required they shall be made after the subgrade preparation is complete and shall be only of sufficient length to prevent any part of the bell from becoming in contact with the trench bottom and allowing space for joint assembly.

3.04 BACKFILL FOR PIPING

A. Initial Backfill

1. This backfill is defined as that material which is placed over the pipe from the spring line to a point 6 inches above the top of the pipe. For gravity sewer piping the material shall be Class I (No. 9 crushed stone aggregate) and may be machine placed without compaction. Uneven places in the backfill shall be leveled by hand. For force main piping, initial backfill material shall be earth material free of rocks, acceptable to the Engineer or with Class I material when a condition exists mentioned in Paragraph A, 3. below.

2. Material used, whether earth or Class I, in the initial backfilling is NOT a separate pay item. Payment for the material is included in the unit price per linear foot of gravity sewer or force main.

3. In areas where large quantities of rock are excavated and the available excavated earth in the immediate vicinity is insufficient for placing the required amount of backfill over the top of the pipe as set forth in Paragraph A.1., the Contractor shall either haul in earth or order Class I material for backfilling over the pipe. Neither the hauling and placement of earth nor the ordering and placement of Class I material to fulfill the backfill requirements set forth herein is considered a separate pay item.

B. Final Backfill

1. There are two cases where the method of final backfilling varies. The various cases and their trench situations are as follows:

   a. Case I - Areas not subject to vehicular traffic.

   b. Case II - Paved areas including streets, drives and walks.

2. In all cases, walking or working on the completed pipelines, except as may be necessary in backfilling, will not be permitted until the trench has been backfilled to a point six (6) inches above the top of the pipe. The method of final backfilling for each of the above cases is as follows:

   a. Case I - The trench shall be backfilled from a point 6 inches above the top of the pipe to a point 8 inches below the surface of the ground with earth material free from large rock (over one-half cubic foot in volume), acceptable to the

Engineer. The remainder of the trench shall be backfilled with earth material free of any rocks.

b. Case II - The trench shall be backfilled from a point 6 inches above the top of the pipe to a point 12 inches below the existing pavement surface with Class I (No. 9 crushed stone aggregate) material. The backfill shall be mechanically tamped in approximately 6-inch layers to obtain the maximum possible compaction. The remaining backfill shall be Class II (dense graded aggregate) material mechanically tamped to maximum possible compaction. The trench may be left with a slight mound if permitted by the Engineer.

3. Earth and Class I material used in final backfill is not a separate pay item. Payment shall be included in the unit price per linear foot of gravity sewer and force main.

4. Class II material used in final backfill shall be included in the unit price per linear foot of bituminous pavement replacement.

C. A sufficient amount of Class II material shall be stockpiled to insure immediate replacement by the Contractor of any settled areas. No extra payment will be made for the filling in of settled or washed areas by the Contractor.

D. Excavated materials from trenches, in excess of quantity required for trench backfill, shall be disposed of by the Contractor. It shall be the responsibility of the Contractor to obtain location or permits for its disposal, unless specific waste areas have been designated on the Drawings or noted in these specifications. Unit prices for the various pipe sizes shall include the cost of disposal of excess excavated materials, as set forth herein, not additional compensation being allowed for hauling or overhaul.

3.05 BACKFILL AND FILL AT STRUCTURES

A. Place No. 57 stone fill material in maximum 6" lifts (loose thickness to required subgrade elevations).

B. With the exception of the organic debris, existing fill material, and topsoil, the on-site soil removed from the excavations could be used as fill or backfill material provided the moisture content of the soil is adjusted.

C. 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 points where elevations are indicated, or between such points and existing grades.

D. 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 the 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 symmetrically.

E. Grade areas adjacent to building lines to drain away from structures to prevent ponding.

F. Control soil compaction during construction providing minimum compaction to 95% of Standard Proctor density at a moisture content of ± 2% of optimum.

G. All excess excavated material shall become the property of the Contractor and shall be disposed of by him outside the project limits. It is the Contractor's responsibility to locate a suitable waste area off-site, obtain necessary permits for use of the waste area and be in compliance with applicable laws and regulations. The Contractor shall place and compact all excess excavated material at the waste area, with the cost of hauling, placing, compacting, and grading included in the Contractor's bid. Acceptable excavated material includes suitable demolition materials.

3.06 MAINTENANCE

A. Protection of Graded Areas: 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: 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: 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.

3.07 SHORING, SHEETING, AND BRACING OF EXCAVATION

A. Where unstable material is encountered or where the depth of excavation in earth exceeds five (5) feet, the sides of the trench or excavation shall be supported by substantial sheeting, bracing, and shoring, or the sides sloped to the angle of repose. Sloping the sides of the ditch to the angle will not be permitted in streets, roads, narrow rights-of-way or other constricted areas unless otherwise specified. The design and installation of all sheeting, sheet piling, bracing, and shoring shall be based on computations of pressure exerted by the materials to be retained under obtaining conditions. Adequate and proper shoring of all excavations shall be the entire responsibility of the Contractor; however, the Engineer may require the submission of shoring plans (accompanied by supporting computations) for approval prior to the Contractor undertaking any portion of the work. The standards of the Federal Occupational Safety and Health Act and the Kentucky Labor Cabinet shall be followed.

B. Foundations, adjacent to where the excavation is to be made below the depth of the existing foundation, shall be supported by shoring, bracing or underpinning as long as the excavation shall remain open, or thereafter if required to insure the stability of the structure supported by the foundation, and the Contractor shall be held strictly responsible for any damage to said foundations.

C. Solid sheeting will be required for wet or unstable material. It shall consist of continuous vertical sheet piling of timber or steel with suitable wales and braces.

D. Care shall be taken to avoid excessive backfill loads on the completed pipelines and the trench width requirements at the level of the crown of the pipe and at the level of a road or street be strictly observed.

E. Trench sheeting shall not be removed until sufficient backfill has been placed to protect the pipe.

F. All sheeting, planking, timbering, bracing and bridging shall be placed, renewed and maintained as long as is necessary.

3.08 STORAGE OF MATERIALS

A. Traffic shall be maintained at all times in accordance with the applicable Highway Permits. Where no Highway Permit is required, at least one-half of the street must be kept open for traffic.

B. Where conditions do not permit storage of materials adjacent to the trench, the material excavated from a length as may be required, shall be removed by the Contractor, at his cost and expense, as soon as excavated. The material subsequently excavated shall be used to refill the trench where the pipe had been built, provided it be of suitable character. The excess material shall be removed to locations selected and obtained by the Contractor.

1. The Contractor shall, at his cost and expense, bring back adequate amounts of satisfactory excavated materials as may be required to properly refill the trenches.

C. If directed by the Engineer, the Contractor shall refill trenches with select fill or other suitable materials and excess excavated materials shall be disposed of as spoil.

3.09 REMOVAL OF WATER AND DRAINAGE

A. The Contractor, at his own expense, shall provide adequate facilities for promptly and continuously removing water from all excavation.

B. To ensure proper conditions at all times during construction, the Contractor shall provide and maintain ample means and devices (including spare units kept ready for immediate use in case of breakdowns) with which to remove promptly and dispose properly of all water entering trenches and other excavations. Such excavation shall be kept dry until the structures, pipes, and appurtenances to be built therein have been completed to such extent that they will not be floated or otherwise damaged.

C. All water pumped or drained from the work shall be disposed of in s suitable manner without undue interference with other work, damage to pavements, other surfaces, or property. Suitable temporary pipes, flumes, or channels shall be provided for water that may flow along or across the site of the work.

D. If necessary, the Contractor shall dewater the excavations by means of an efficient drainage wellpoint system which will drain the soil and prevent saturated soil from flowing into the excavation. The wellpoints shall be designed especially for this type of service. The pumping unit shall be designed for use with the wellpoints, and shall be capable of maintaining a high vacuum and of handling large volumes of air and water at the same time.

E. The installation of the wellpoints and pump shall be done under the supervision of a competent representative of the manufacturer. The Contractor shall do all special work such as surrounding the wellpoints with sand or gravel or other work which is necessary for the wellpoint system to operate for the successful dewatering of the excavation.

3.10 UNAUTHORIZED EXCAVATION

Whenever the excavation is carried beyond or below the required lines and grades, the Contractor, at his own expense, shall refill said excavated space with suitable material in a manner approved by the Engineer.

3.11 EXISTING UTILITIES AND OTHER OBSTRUCTIONS

Prior to the commencement of construction on the project, the Contractor shall contact the utility companies whose lines, above and below ground, may be affected during construction and verify the locations of the utilities as shown on the Contract Drawings. The Contractor shall ascertain from said companies if he will be allowed to displace or alter, by necessity, those lines encountered or replace those lines disturbed by accident during construction, or if the companies themselves are only permitted by policy to perform such work. If the Contractor is permitted to perform such work, he shall leave the lines in as good condition as were originally encountered and complete the work as quickly as possible. All such lines or underground structures damaged or molested in the construction shall be replaced at the Contractor's expense, unless, in the opinion of the Engineer, such damage was caused through no fault of the Contractor.

3.12 FINAL CLEANUP AND RESTORATION

Unless specifically approved by the Owner and Engineer, **cleanup of disturbed areas shall be kept current with construction** and restoration efforts by the contractor initiated no longer than seven (7) days after the trench excavation work has started. All excavated material not required for backfilling of the trench and any large rocks, stones or debris shall be removed from the site, and shall not be a burden to the property owner(s) and/or adjacent properties. The contractor may windrow or track-in the excavated material over the trench prior to final cleanup to allow for and to assist in the initial settlement of the trench. All disturbed areas must be seeded at least with a temporary seed mix if for some reason the area cannot be permanently seeded within two (2) weeks.

3.13 MEASURMENT

A. All trench excavation, backfill and compaction are not considered pay items. Payment for these items shall be included in the unit price laid for each size of pipe at their respective depths. This unit price shall be full remuneration for performing the trench and backfill complete including grading, bell holes, sheeting, dewatering, and tamping; and including the furnishing of sewer pipe, all equipment, labor, materials, power, tools, and transportation necessary or incidental thereto.

- 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.

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. Payment for same will be subject to negotiation.

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 Department of Highways, Standard Specifications, latest edition, unless otherwise noted.

B. When referred to in these Specifications, dense graded aggregate (DGA) shall be crushed stone classified by the Kentucky Department of Highways, Standard Specifications, latest edition, and conforming to the following requirements:

Sieve Size	Percent Passing
1 Inch	100
3/4 Inch	70 - 100
1/2 Inch	50 - 80
#4	30 - 65
#10	17 - 50
#40	8 - 30
#200	2 - 10

PART 3 - EXECUTION

3.01 INSTALLATION

A. Crushed stone shall be placed and compacted in accordance with the Kentucky Department of Highways, Standard Specifications.

B. Crushed stone shall be placed in those areas as shown on the Drawings.

-- 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 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 fences, 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 shown on the Drawings and 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. Permits:

1. The Contractor shall apply for a permit (if applicable) for stormwater runoff from the construction site for the project. It shall be the Contractor's responsibility to determine if the proposed construction activities will require a permit from the federal, state, and local regulatory agencies.

2. For this project, the stormwater permitting process falls under the Kentucky Pollutant Discharge Elimination System (KPDES) permit program administered by the Kentucky Division of Water, Frankfort, Kentucky.

PART 2 - PRODUCTS

2.01 GENERAL

A. Mulch and fertilizer are specified in this Division.

B. Erosion control blanket where called for in this Section or on the Drawings shall be AMXCO Hi-Velocity type Curlex Blanket as manufactured by American Excelsior Company, Arlington, TX 76011, or equal.

C. Silt fence fabric where called for in this Section or on the Drawings shall be Mirafi 100X as manufactured by Celanese Corporation, New York, NY 10036, or equal.

D. Bales may be hay or straw, and shall be reasonably clean and free of noxious weeds and deleterious materials. Filter fabric for sediment traps shall be of suitable materials acceptable to the Engineer.

PART 3 - EXECUTION

3.01 GENERAL

A. Erosion control practices shall be adequate to prevent erosion of disturbed and/or regraded areas.

B. Earthwork procedures shall be as specified in this Division.

C. Silt fences shall be located and staked as shown on the Drawings and/or as designated by the ENGINEER.

1.02 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 ½ bushels and ryegrass 25 pounds per acre; or tall fescue 30 pounds and ryegrass 20 pounds per acre.

2. Time of Seeding June 2 to August 15

   Tall fescue 30 pounds and ryegrass 20 pounds per acre; or, spring oats 2 bushels and ryegrass 30 pounds per acre.

3. Time of Seeding August 16 to February 14

   Rye 2 bushels and ryegrass 20 pounds per acre; or, tall fescue 30 pounds and ryegrass 20 pounds per acre.

4. Lime will not be required for temporary seeding.

5. Fertilize 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 cultipacked 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, too steep to hold the seed without protective cover.

3.03 MAINTENANCE OF CONTROLS AND PERFORMANCE

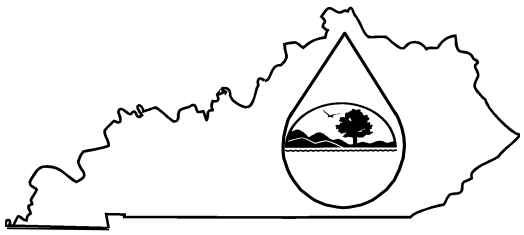
A. Erosion and sedimentation controls shall be inspected weekly and after significant rain storms. Replace silt fencing, which is damaged, filter stone, which is dislodged, erosion control blanket which is damaged, and make other necessary repairs.

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.

- END OF SECTION -

KPDES FORM NOI-SW



Kentucky 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** ☐ **If Yes, submit with this form.** **No** ☐						
SIC or Designated Activity Code Primary		**2nd**		**3rd**		**4th**	
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** ☐ **No** ☐		

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

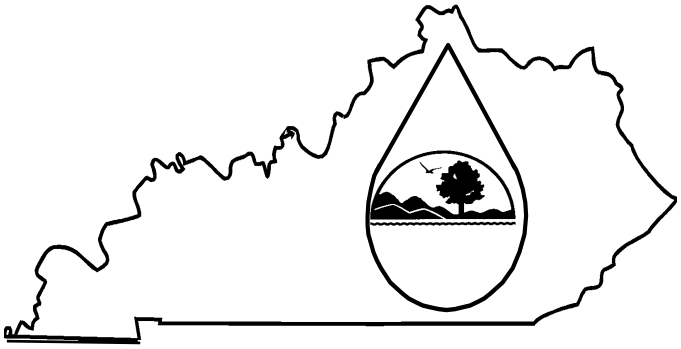
Federal statutes provide for severe penalties for submitting false information on this application form. Federal regulations require this application to be signed as follows:

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 authroity 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



Kentucky Pollutant Discharge Elimination System (KPDES)

NOTICE OF TERMINATION (NOT)
of Coverage Under the KPDES General Permit for Storm Water Discharges Associated with Industrial Activity

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: ☐
Check here if the Storm Water Discharge is Being Terminated: ☐
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 quater, 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 02310

PIPE AND FITTINGS FOR SANITARY SEWERS

PART 1 - GENERAL

1.01 WORK INCLUDED

The Contractor shall furnish all labor, material, and equipment necessary to install gravity sewer piping together with all appurtenances as shown and detailed on the Drawings and specified herein.

1.02 RELATED WORK

A. Section 02222 - Excavation.

B. Section 02226 - Trench Bedding and Backfilling.

C. Section 02330 - Manholes, Frames and Covers.

D. Section 02340 - Encasement Pipe.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

A. Ductile Iron (DI) Pipe:

1. Ductile iron pipe shall conform to ANSI A21.50 (AWWA C150) and ANSI A21.51 (AWWA C151). The pipe shall be designed for an internal working pressure of 150 psi and external loading based on flat bottom trenches without blocks and untamped backfill laying conditions. The pipe shall conform to the following minimum thickness classes: pipe size 4 inches and smaller, Class 51; pipe size 6 inches and larger, Class 50.

2. Fittings shall be Class 250 ductile iron fittings in accordance with ANSI A 21.10 (AWWA C 110).

3. Joints shall be push-on type, mechanical joint type conforming to ANSI A21.11 (AWWA C 111) or restrained joint type. Unless specifically required at designated locations by the Drawings, the type of joint used is optional. Restrained joints shall be TR-Flex type as manufactured by U.S. Pipe and Foundry Co., or approved equal.

   a. Push-on joints shall have an annular recess in the pipe socket to accommodate a single rubber gasket. Plain ends shall be suitably beveled to permit easy entry into the bell. The gasket and annular recess of the socket shall be so designed and shaped that the gasket is located in place against displacement as the joint is assembled.

   b. Mechanical joints shall be bolted and of the stuffing box type and shall consist of a bell with exterior flange and interior recess for the sealing gasket, a pipe or fitting plain end, a sealing gasket, a follower gland, tee-head bolts and hexagon nuts.

c. Restrained joints for a 4" through 54" push-on joint pipe installation is required and indicated in the project plans or specifications, restrained push-on joint pipe and fittings utilizing ductile iron components shall be provided.

Restrained joint pipe shall be ductile iron manufactured in accordance with the requirements of ANSI/AWWA C151/A21.51. Push-on joints for such pipe shall be in accordance with ANSI/AWWA C111/A21.11. Pipe thickness shall be designed in accordance with ANSI/AWWA C150/A21.50, and shall be based on laying conditions and internal pressures as stated in the project plans and specifications. Pipe shall be U.S. Pipe TR FLEX pipe or equal.

Restrained joint fittings shall be ductile iron in accordance with applicable requirements of ANSI/AWWA C110/A21.10 with the exception of the manufacturer's proprietary design dimensions. Push-on joints for such fittings shall be in accordance with ANSI/AWWA C111/A21.11. Fittings shall be U.S. Pipe TR FLEX fittings or equal.

Cement mortar lining and seal coating for pipe and fittings, where applicable, shall be in accordance with ANSI/AWWA C104/A21.4. Bituminous outside coating shall be in accordance with ANSI/AWWA C151/A21.51 for pipe and ANSI/AWWA C110/A21.10 for fittings.

Restrained push-on joints for pipe and fittings shall be designed for a water working pressure of 350 psi in sizes 4" through 24" and 250 psi for sizes 30" through 54".

Restrained push-on joint pipe and fittings shall be capable of being deflected after assembly.

4. All ductile iron pipe and fittings shall have the manufacturer's outside coal tar or asphaltic base coating and a polyethylene lining complying with ANSI/ASTM D1248 on the inside.

5. The inside lining material for pipe and fittings shall be virgin polyethylene complying with ANSI/ASTM D1248, compounded with an inert filler and with sufficient carbon black to resist ultra-violet rays during aboveground storage of the pipe and fittings. The polyethylene shall be bonded to the interior of the pipe of fitting by heat.

All surface areas to be lined shall be blast cleaned comparable to the requirements of SSPC-SP6 or NACE #3.

Polyethylene linings shall cover the inner surface of pipe and fittings as shown and described below. In pipe utilizing push-on gaskets, the lining shall extend from the spigot end through the socket to the edge of the gasket sealing area. In mechanical joint pipe the lining shall extend from the spigot end through the socket to the edge of the gauging ring. The lining in fittings shall cover the interior surfaces including the socket areas as defined above.

Lining in piping and in the fittings shall be 40 mils nominal thickness. Minimum lining thickness shall be 30 mils.

6. Pipe shall be furnished in lengths of 16, 16.5, 18 and 20 feet nominal laying lengths. The weight of any single pipe shall not be less than the tabulated weight by more than 5 percent for pipe 12 inches or smaller in diameter, not by more than 4 percent for pipe larger than 12 inches in diameter.

7. 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.

B. Polyvinyl Chloride (PVC) Gravity Sewer:

1. Polyvinyl chloride (PVC) pipe and fittings, 4 to 15 inch in diameter, for gravity sewers shall conform to the requirements of ASTM specification D-3034 (SDR 35), current approval, "Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings."

2. Polyvinyl chloride (PVC) pipe and fittings, 18 inch to 27 inch in diameter shall conform to the requirements of ASTM specification F679, current approval.

3. Joints for PVC pipe shall be of the elastomeric gasket type and installed per the manufacturer's recommendations. Pipe that has been field cut must be beveled for insertion into gasketed joints. Bevel can be made with hand or power tool. In either case, the finished bevel should be the same as the factory bevel. All pipe shall be provided with home marks to insure proper gasket seating. Gasket material shall comply with the physical requirements specified in ASTM D-1869, C-361, C-433, current approval.

4. Fittings for service connections shall be of the factory made inline type conforming with the requirements of ASTM specification D-3034, current approval. Saddle type fittings shall not be used.

5. PVC sewer pipe shall be supplied in standard lengths of at least 12'6". Longer lengths are permitted.

6. PVC sewer pipe shall be marked with the manufacturer's name, production lot number, ASTM designation, PVC, and the nominal diameter.

7. All underground place piping shall have a metallic tape laid 2 foot above the pipe. The tape shall have the word "Caution" printed on it and shall identify the pipe use. Product shall be Seton Name Plate Corp., New Haven, CT, No. 210, or equal.

8. Five copies of directions for handling and installing shall be furnished the Contractor for the manufacturer at the first delivery of the pipe to the job.

C. Polyethylene Pipe:

1. Polyethylene pipe for force mains shall conform to the requirements of ASTM Specification D-1248 (SDR 11), and have recommended designation valves of 3-3-5-4-3-3-C as referenced in ASTM D3350. Fittings shall be SDR 9.3.

2. Polyethylene pipe shall be supplied in standard lengths of at least 12' -6". Longer lengths are permitted.

3. Polyethylene pipe shall be marked with the manufacturer's name, production lot number, ASTM designation, and nominal diameter.

D. Polyvinyl Chloride (PVC) Force Main

1. PVC pipe shall comply with ASTM D1784 and shall be Class 200 (SDR 21) as shown on the Drawings. All PVC pipe shall conform to the latest revisions of the following specifications:

a. ASTM D2241 (PVC plastic pipe SDR-PR and Class T).

b. Commercial Standard CS 256 (pressure rated type).

c. National Sanitation Foundation Testing Laboratories (NSF).

2. 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 Specification for Polyvinyl Chloride (PVC) Plastic Pipe, D1784, published by ASTM (American Society for Testing and Materials). Rubber gasketing shall conform to ASTM 1869.

3. Pipe lengths shall not exceed 40 feet. Wall thickness shall be in accordance with CS-256 and ASTM D2241. Pipe ends shall be beveled to accept the gasketed coupling.

4. 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.

5. The pipe shall be homogeneous throughout and free from cracks, holes, foreign inclusions or other defects. The pipe shall be as uniform as commercially practical in color.

6. 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.

7. 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.

8. 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 (SDR 21). 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. Coupling method shall allow for half of the expansion or contraction of each pipe section to be taken up at each end of the pipe. Couplings shall permit 5 degree deflection (2-1/2 degree each side) of the pipe without any evidence of infiltration, exfiltration, cracking or breaking. Couplings shall have rubber seals factory installed.

9. Pipe markings shall include the following, marked continuously down the length:

a. Manufacturer's name
b. Nominal size
c. Class pressure rating
d. PVC 1120
e. NSF Logo
f. Identification Code

10. Lubricant shall be water soluble, non-toxic, be nonobjectionable in taste and odor imparted to the fluid, non-supporting of bacteria growth, and have no deteriorating effect on the PVC or rubber gaskets.

11. All underground plastic piping shall have a colored metallic tape laid 2 feet above the pipe. The tape shall have the words "caution" printed on it and shall identify the pipe use. See Section 3.13.

2.02 PIPE JOINTING FOR DUCTILE IRON PIPE - MECHANICAL JOINT

A. Mechanical joints are to be furnished according to AWWA Specifications C111. All pipe joints must be furnished complete with all accessories. Mechanical joint bolts and nuts shall be of alloy cast iron (such as Acipcoloy) or alloy steel (Corten type such as US alloy) or approved equal. Rubber gaskets shall be made of plain first grade rubber, free of imperfections and porosity. Hardness shall be 70 to 75 durometer.

B. Mechanical joints shall be used where specifically called for on the Drawings.

C. Push-in socket joints shall be equal to manufacturer's specifications for "Tyton," "Bell-Tite," or "Fastite." The joints shall consist of a rubber ring gasket compressed in groove in bell of pipe with beveled spigot end of pipe for initial centering into rubber gasket in bell.

D. All items used for jointing pipe shall be furnished with the pipe and tested before shipment. The joints shall be made with tools and lubricant in strict conformity with the manufacturer's instructions. If requested, three (3) copies of such instructions shall be delivered to the Engineer at start of construction.

2.03 PIPE JOINTING FOR PVC PIPE

A. Polyvinyl Chloride (PVC) Pipe Joints: Jointing of PVC pipe shall be by a natural rubber ring inserted in the belled end of the pipe or double hub joints. Solvent weld joints are not acceptable.

B. Joints for PVC pipe shall be of the elastomeric gasket type and installed per the manufacturer's recommendations. Pipe that has been field cut must be beveled for insertion into gasketed joints. Bevel can be made with hand or power tool. In either case, the finished bevel should be the same as the factory bevel. All pipe shall be provided with home marks to insure proper gasket seating. Gasket material shall comply with the physical requirements specified in A.S.T.M. D-1869, C-361, C-433, current approval.

C. Fittings for service connections shall be of the factory made in-line type conforming with the requirements of A.S.T.M. Specification D-3034, current approval. Saddle type fittings shall not be used.

2.04 HIGH DENSITY FOR POLYETHYLENE (HDPE) PIPE AAND FITTINGS (GRAVITY SEWER)

A. Polyethylene Pipe Joints: Jointing of polyethylene pipe shall be by the butt fusion method and shall be performed in strict conformance to the pipe manufacturer's recommendations using approved equipment. Fittings shall be connected with stainless steel couplings if fusion is not possible.

B. Where used in highway crossing, the Contractor shall take precautions to insure no damage to the pipe when placing it in the casing.

PART 3 - EXECUTION

3.01 SHORING, SHEETING, AND BRACING OF EXCAVATION

A. Where unstable material is encountered or where the depth of excavation in earth exceeds five (5) feet, the sides of the trench or excavation shall be supported by substantial sheeting, bracing, and shoring, or the sides sloped to the angle of repose. Sloping the sides of the ditch to the angle will not be permitted in streets, roads, narrow rights-of-way or other constricted areas unless otherwise specified. The design and installation of all sheeting, sheet piling, bracing and shoring shall be based on computations of pressure exerted by the materials to be retained under obtaining conditions. Adequate and proper shoring of all excavations shall be the entire responsibility of the Contractor; however, the Engineer may require the submission of shoring plans (accompanied by supporting computations) for approval prior to the Contractor undertaking any portion of the work. The standards of the Federal Occupational Safety and Health Act and the Ohio Department of Labor shall be followed.

B. Foundations, adjacent to where the excavation is to be made below the depth of the existing foundation, shall be supported by shoring, bracing or underpinning as long as the excavation shall remain open, or thereafter if required to insure the stability of the structure supported by the foundation, and the Contractor shall be held strictly responsible for any damage to said foundations.

C. Solid sheeting will be required for wet or unstable material. It shall consist of continuous vertical sheet piling of timber or steel with suitable wales and braces.

D. Care shall be taken to avoid excessive backfill loads on the completed pipelines and the trench width requirements at the level of the crown of the pipe and at the level of a road or street be strictly observed.

E. Trench sheeting shall not be removed until sufficient backfill has been placed to protect the pipe.

F. All sheeting, planking, timbering, bracing and bridging shall be placed, renewed and maintained as long as is necessary.

3.02 PIPE BEDDING - GRAVITY SEWERS

A. All gravity sewer pipe shall be laid on a bed of granular material except when a concrete encasement situation occurs. All pipe bedding material shall be No. 9 crushed stone aggregate and shall be placed to a depth of 4" in an earth trench and 6" in a rock trench. The Contractor will not be permitted to use dense graded aggregate material for pipe bedding.

B. Pipe bedding shall be graded to provide for a uniform and continuous support beneath the pipe at all points.

C. After each pipe has been brought to grade, aligned, and placed in final position No. 9 crushed stone aggregate material shall be deposited and densified under the pipe haunches and on each side of the pipe up to the spring line of the pipe to prevent lateral displacement and hold the pipe in proper position during subsequent pipe jointing, bedding, and backfilling operations.

D. In wet, yielding and mucky locations where pipe is in danger of sinking below grade or floating out of grade or line, or where backfill materials are of such a fluid nature that such movements of pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective.

E. Where an unstable (i.e., water, mud, etc.) trench bottom is encountered, stabilization of the trench bottom is required. This is to be accomplished by undercutting the trench depth and replacing to grade with a foundation of crushed stone aggregate. The depth of the foundation is dependent upon the severity of the trench bottom. The size of stone aggregate used in the foundation will be determined by the condition of the unstable

material. Once the trench bottom has been stabilized, the required No. 9 crushed stone aggregate bedding material can be placed. No compensation for Crushed Stone for Pipe Foundation will be made if the instability of the trench bottom is caused by the Contractor's neglect.

F. It should be noted that no pipe shall be laid on solid or blasted rock.

3.03 PIPE LAYING

A. The pipe shall be protected during handling against impact shocks and free fall. Care shall be taken to avoid dragging the spigot ring on the ground or allowing it to be damaged by contact with gravel, crushed stone, or other hard objects.

B. After being delivered alongside the trench, the pipe shall be carefully examined for soundness or damage. No piece of pipe or fitting which is known to be defective shall be laid or placed in the lines. If any defective pipe or fitting shall be discovered after the pipe is laid, it shall be removed and replaced with a satisfactory pipe or fitting without additional charge. Before each piece of pipe is lowered into the trench, it shall be thoroughly cleaned out. Each piece of pipe shall be lowered separately unless special permission is given otherwise by the Engineer. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe.

C. The bell and spigot of the joint shall be cleaned of dirt and foreign matter immediately prior to jointing. The contact surfaces shall be coated with the lubricant, primer or adhesive recommended by the pipe pushed together until the joint snaps distinctly in place. The pushing together of the pipe may be done by hand or by the use of a bar.

D. All pipe shall be laid straight between changes in alignment and at uniform grade between changes in grade. When jointed in the trench the pipe shall form a true and smooth line.

E. Trenches shall be kept dry during pipe laying. Before pipe laying is started, all water that may have collected in the trench shall be removed.

F. All pipe shall be laid starting at the lowest point and installed so that the spigot ends point in the direction of the flow.

3.04 PIPE BACKFILLING

A. Backfilling is defined as that material which is placed over the gravity sewer from the spring line to a predetermined point above the top of the pipe according to various backfilling situation as defined in Section C, this article. The material shall be No. 9 crushed stone aggregate and may be machine placed without compaction. Uneven places in the backfill shall be leveled by hand.

B. There are two cases where the method of backfilling varies. The various cases and their trench situations are as follows:

1. Case I - Areas not subject to vehicular traffic.

2. Case II - Areas under bituminous pavement.

C. In all cases, walking or working on the completed pipelines except as may be necessary in backfilling will not be permitted until the trench has been backfilled to a point six (6) inches above the top of the pipe. The method of final backfilling for each of the above cases is as follows:

1. Case I - The trench shall be backfilled from a point 6" above the top of the pipe to a point 8" below the surface of the ground with earth material free from large rock (over one-half cubic foot in volume), acceptable to the Engineer. The remainder of the trench to existing grade shall be backfilled with earth material reasonably free of any rocks.

2. Case II - The trench shall he backfilled to the existing grade with No. 9 crushed stone until the bituminous pavement replacement can be constructed. Extreme care shall be exercised to prevent damage to the pipe during the backfilling operation. Suitable equipment shall "walk" the trench for compaction. A slight mound may be left if, in the opinion of the Engineer or Owner, the public would not be inconvenienced.

   Sufficient stockpiles of No. 9 crushed stone shall be placed throughout the project area to insure immediate replacement by the Contractor of any settled areas. No extra payment will be made for the filling in of settled areas by the Contractor.

D. Excavated materials from trenches and tunnels, in excess of quantity required for trench backfill, shall be disposed of by the Contractor. The Contractor may contact the Owner regarding the location of a suitable disposal site; however, if the Owner cannot recommend a site, it shall be the responsibility of the Contractor to obtain locations or permits for the disposal of the waste material.

3.05 CONNECTION TO EXISTING MANHOLES

Where an existing manhole does not have existing stubs it will be necessary for the contractor to construct a new invert for the existing manhole.

3.06 UTILITY CROSSING CONCRETE ENCASEMENT

A. At locations shown on the Contract Drawings, required by the Specifications, or as directed by the Engineer, concrete encasement shall be used when the clearance between the proposed sanitary sewer pipe and any existing utility pipe is eighteen (18) inches or less. Utility pipe includes underground water, gas, telephone and electrical conduit, storm sewers, and any other pipe as determined by the Engineer.

B. There are two cases of utility crossing encasement. Case I is applicable when the proposed sanitary sewer line is below the existing utility line. Case II is applicable when the proposed sanitary sewer line is laid above the utility line. In either case, the concrete shall extend to at least the spring line of each pipe involved.

C. Concrete shall be Class B (3000 psi) and shall be mixed sufficiently wet to permit it to flow between the pipes to form a continuous bridge. In tamping the concrete, care shall be taken not to disturb the grade or line of either pipe or damage the joints.

D. Concrete is not a separate pay item and will be considered incidental to gravity sewer installation.

3.07 BITUMINOUS PAVEMENT REPLACEMENT

A. Sections of pavement shall be replaced as required to install the pipelines under the work of this Section. Disturbed pavement shall be reconstructed to original lines and grades with bituminous binder as detailed on the Drawings and in such manner as to leave all such surfaces in fully as good or better condition than that which existed prior to these operations.

B. Prior to trenching, the pavement shall be scored or cut to straight edges along each side of the proposed trench to avoid unnecessary damage to the remainder of the paving. Edges of the existing pavement shall be recut and trimmed as necessary to square, straight edges after the pipe has been installed and prior to placement of the binder course.

C. Backfilling of trenches shall be in accordance with the applicable portions of Section 02226.

D. Bituminous concrete binder shall be one course construction in accordance with applicable provisions of the Kentucky Department of Highways Standard Specifications, Section 402. Placement and

compaction of binder course shall he in accordance with Section 402 of the Kentucky Department of Highways Standard Specifications. Minimum thickness after compaction shall be as shown on the Drawings.

E. Bituminous pavement replacement is not a separate pay item and will be considered incidental to gravity sewer and force main installation. Where gravity sewer is installed within a paved street, full width pavement replacement will be required.

3.08 CRUSHED STONE BACKFILL

A. The Class I granular material used in Case II and Case III backfill situations shall be No. 9 Crushed Stone aggregate (No. 9 Stone).

B. The twelve inches (12") of crushed stone backfill that is required in "City and County Maintained Streets, Roads and Driveway Pavement Replacement" or "State Maintained Streets and Roads Pavement Replacement" will not be paid for under the provisions of this article: crushed stone backfill is not a separate pay item and will be considered incidental to gravity sewer and force installation.

3.09 CRUSHED STONE SURFACE REPLACEMENT

The Class II granular material used in Case II backfill situations shall be dense graded aggregate (D.G.A.). Granular material is not a separate pay item and will be considered incidental to gravity sewer and force main installation.

3.10 TESTING OF GRAVITY SEWER LINES

A. After the gravity piping system has been brought to completion, and prior to final inspection, the contractor shall rod out the entire system by pushing through each individual line in the system, from manhole to manhole appropriate tools for the removal from the lines of any and all dirt, debris, and trash. If necessary during the process of rodding the system, water shall be turned into the system in such quantities to carry off the dirt, debris and trash.

B. During the final inspection, the Engineer will inspect each individual line, from manhole to manhole, by the use of television or other means at his disposal as approved by the Engineer to determine whether the completed lines are true to line and grade as laid out or as shown on the Drawings.

1. Deflection testing of all gravity sewer lines shall be required. The test shall be conducted after the backfill has been in place at least 24 hours.

   No pipe shall exceed a deflection of 5%.
   The test shall be run with a rigid ball or an engineer-approved 9-arm mandrel having a diameter equal to 95% of the inside diameter of the pipe. The test must be Performed by manually pulling the device through the line.

2. All lines or sections of lines that are found to be laid improperly with respect to line or grade, that are found to contain broken or leaking sections of pipe, or are obstructed in such a manner that they cannot be satisfactorily corrected otherwise, shall be removed and replaced at the Contractor's expense.

C. The pipe line shall be made as nearly watertight as practicable, and leakage tests and measurements shall be made. All apparatus and equipment required for testing shall be furnished by the Contractor and the cost shall be included in the unit price bid for pipe and manholes.

1. The Engineer may require the Contractor to smoke test the first section (manhole to manhole) of each size of pipe and type of joint prior to backfilling, to establish and check laying and jointing procedures. The test shall consist of smoke blown into closed-off sections of sewer under pressure and observing any smoke coming from the pipe line indicating the presence of leaks. Other supplementary smoke tests prior to backfilling may be performed by the Contractor at his option; however, any such tests shall not supplant the final tests of the completed work unless such final tests are waived by the Engineer.

2. Where the groundwater level is more than 1 foot above the top of the pipe at its upper end, the Contractor shall conduct either infiltration tests or low pressure air test on the completed pipeline.

3. Where the groundwater level is less than 1 foot above the top of the pipe at its upper end, the Contractor shall conduct either exfiltration tests or low pressure air tests on the completed pipeline.

D. Low pressure air tests shall be made using equipment specifically designed and manufactured for the purpose of testing sewer lines using low pressure air. The equipment shall be provided with an air regulator valve or air safety valve so set that the internal pressure in the pipeline cannot exceed 8 psig.

1. The test shall be made on each manhole-to-manhole section of pipeline after placement of the backfill. The Engineer or his designated representative must be present to witness each satisfactory air test before it will be accepted as fulfilling the requirements of these specifications.

2. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.

3. Low pressure air passing through a single control panel, shall be introduced into the sealed line until the internal air pressure reaches 4 psig greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe at the time of test. However, the internal air pressure in the sealed line shall not be allowed to exceed 8 psig. When the maximum pressure exerted by the groundwater is greater than 4 psig, the Contractor shall conduct only an infiltration test.

4. At least two minutes shall be allowed for the air pressure to stabilize in the section under test. After the stabilization period the low-pressure air supply hose shall be quickly disconnected from the control panel. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig (greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe) shall not be less than that shown in the following table:

Pipe in Diameter in Inches	Minutes
4	2.0
6	3.0
8	4.0
10	5.0
12	5.5
15	7.5
18	8.5
21	10.0
24	11.5
30	13.5

5. When the sewer section to be tested contains more than one size of pipe, the minimum allowable time shall be based on the largest diameter pipe in the section, and shall be the time shown in the table reduced by 0.5 minutes.

E. Infiltration Tests:

1. Infiltration tests shall be made after underdrains, if present, have been plugged and other groundwater drainage has been stopped such that the groundwater is permitted to return to its normal level insofar as practicable.

2. Upon completion of a section of the pipeline, the line shall be dewatered and a satisfactory test conducted to measure infiltration for at least 24 hours. The amount of infiltration, including manholes, tees and connections, shall not exceed 200 gallons per nominal inch diameter per mile of sewer per 24 hours.

F. Exfiltration tests which subject the pipeline to an internal pressure, shall be made by plugging the pipe at the lower end and then filling the line and manholes with clean water to a height of 2 feet above the top of the sewer at its upper end. Where conditions between manholes may result in test pressures which would cause leakage at the plugs or stoppers in branches, provisions shall be made by suitable ties, braces and wedges to secure the plugs against leakage resulting from the test pressure.

1. The rate of leakage from the sewers shall be determined by measuring the amount of water required to maintain the level 2 feet above the top of the pipe.

2. Leakage from the sewers under test shall not exceed the requirements for leakage into sewers as hereinbefore specified.

G. The Contractor shall furnish suitable test plugs, water pumps, and appurtenances, and all labor required to properly conduct the tests. Suitable bulkheads shall be installed, as required, to permit the test of the sewer. The Contractor shall construct weirs or other means of measurements as may be necessary.

H. Should the sections under test fail to meet the requirements, the Contractor shall do all work of locating and repairing the leaks and retesting as the Engineer may require without additional compensation.

I. If in the judgement of the Engineer, it is impracticable to follow the foregoing procedures for any reason, modifications in the procedures shall be made as required and as acceptable to the Engineer, but in any event, the Contractor shall be responsible for the ultimate tightness of the line within the above test requirements.

3.11 TESTING OF FORCE MAINS

The completed work shall comply with the provisions listed below, or similar requirements which will insure equal or better results:

A. The pipe shall be hydrostatically tested at 1.5 times the design working pressure at the point of testing. The duration of the test(s) shall be at least 2 hours during which time the pressure shall not fall more than 5 psi. The pipe shall be tested for allowable leakage according to AWWA C-600 (latest revision) concurrently with the pressure test.

B. Where practicable, pipelines shall be tested between line valves or plugs in lengths of not more than 3000 feet. Testing shall proceed from the pump station toward the termination of the line. The line shall be tested upon the completion of the first 3000 feet. After the completion of two consecutive tests without failure, the Contractor, at his option and with the Engineer's approval, may discontinue testing until the system is complete.

C. Duration of test shall be not less than 2 hours.

D. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with.

E. All pipe, fittings and other materials found to be defective under test shall be removed and replaced at the Contractor's expense.

F. Test pressures shall not be less than 1.25 times the working pressure at the highest point along the test section, not exceed pipe or thrust restraint design pressure, not vary more than +5 psi.

G. Before applying the specified test pressure, air shall be expelled completely from the pipe. If permanent air vents are not located at high points within the test section, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water.

3.12 LEAKAGE TEST

A. The leakage shall be defined as the quantity of water that must be supplied to the tested section to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

B. The allowable leakage shall not be greater than that determined by the following formula:

$$L = \frac{ND(P)}{7400}\ 1/2$$

Where L is the allowable leakage in gallons per hour; N is the number of joints in the length of pipeline tested; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gage.

C. All visible leaks are to be repaired regardless of the amount of leakage.

3.13 PLACEMENT OF IDENTIFICATION TAPE AND ABOVE GROUND UTILITY MARKER

A. The placement of detectable underground marking tape shall be installed over all utility lines. Care shall be taken to insure that the buried marking tape is not broken when installed and shall be Lineguard brand encased aluminum foil, Type III. The identification tape is manufactured by Lineguard, Inc., P.O. Box 426, Wheaton, IL 60187.

B. The identification tape shall bear the printed identification of the utility line below it, such as "CAUTION - BURIED FORCE MAIN BELOW." Tape shall be reverse printed, surface printing will not be acceptable. The tape shall be visible in all types and colors of soil and provide maximum color contrast to the soil. The tape shall meet the APWA color code, and shall be two (2) inches in width. Colors are: yellow - gas, green - sewer, red - electric, blue - water, orange -- telephone, brown - force main.

C. The tape shall be the last equipment installed in the ditch so as to be first out. The tape shall be buried 4 - 6 inches below top of grade. After trench backfilling, the tape shall be placed in the backfill and allowed to settle into place with the backfill. The tape may be plowed in after final settlement, installed with a tool during the trench backfilling process, unrolled before final restoration or installed in any other way acceptable to the owner or his agent or engineer.

D. An above ground utility marker shall be installed every 500 feet along the route of the underground sewage force main. The marker shall be approximately 3" in width and 4.5 feet in length, as manufactured by Carsonite, Inc. or equal.

3.14 PLACEMENT OF TRACING WIRE

Detectable underground copper tracing wire shall be installed with all utility lines. Insulated copper trace wire shall be attached to the top of the pipe with adhesive tape or other suitable devices. At each hydrant, valve, customer meter services and end of new pipe installation, the trace wire shall be daylighted and the ends connected together with split bolt connectors covered with waterproof connectors. For long runs of pipe, the maximum unbroken length of the trace wire shall be 760 meters (2500 feet). Underground splicing shall be made using brass split bolt electrical connectors and covered with waterproof tape or wrap. The trace wire shall be solid #14 AWG THWN copper.

- END OF SECTION -

SECTION 02330

MANHOLES, FRAMES AND COVERS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Precast concrete sections.

B. Frames and covers.

1.02 STANDARD REFERENCES

A. ASTM C479-78.

B. ASTM C443-79.

C. ASTM C207-76.

D. ASTM C32-73.

1.03 DEFINITIONS

The following definitions cover the types of manholes used:

A. Standard Manhole: A standard manhole is defined as any manhole that is up to 6 feet in depth, as measured from the invert of the manhole base at its center to the bottom of the manhole frame.

B. Shallow Manhole: A shallow manhole is defined as any manhole that is less than 6 feet in depth, as measured in the preceding sentence.

C. Drop Manhole:

a. Where shown on the Drawings, the Contractor shall construct a drop manhole. The drop shall be constructed as shown on the detail in the Contract Drawings. The drop manhole shall be factory approved precast unit unless prior approval by the Engineer.

b. The drop connection piping shall be so encased in concrete that the tee and the pipe laid upstream of the connection shall be totally contained within the concrete.

c. A pipe shall be provided for a sewer entering a manhole at an elevation of 24 inches (610 mm) or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches (610 mm), the invert shall be filleted to prevent solids deposition.

PART 2 - PRODUCTS

2.01 GENERAL

A. Manholes shall conform to shape, size, dimensions, materials, and other respects to the details indicated on the Drawings or bound in the Specifications.

B. All manholes shall have precast reinforced concrete developed bases. No other type of base will be allowed. Invert channels shall be factory constructed when the base is made. Sloping invert channels shall be constructed whenever the difference between the inlet and outlet elevation is two feet or less.

C. Manhole walls (barrels and cones) shall be precast concrete sections. The top of the cone shall be built of reinforced concrete adjustment rings to permit adjustment of the frame to meet the finished surface.

D. The inverts of the developed bases shall conform accurately to the size of the adjoining pipes. Side inverts shall be curved and main inverts (where direction changes) shall be laid out in smooth curves of the longest possible radius which is tangent, within the manhole, to the centerline of adjoining pipelines.

E. The cast-iron frames and covers shall be the standard frame and cover as indicated on the Drawings and specify hereinafter in this section.

F. All holes for pipe connections in barrels and bases shall have a factory-installed flexible rubber boot to prevent infiltration. The boot shall conform to the latest revision of A.S.T.M. C-443.

G. Excavation for manholes and other underground structures shall be of sufficient size to adequately accommodate installation and proper centering. The cost of excavation of these structures is to be included in the bid for excavation and backfill of the structure.

H. As relocation of manholes (from the original shake out) will change angles between pipe entering and leaving manholes so relocated, the Owner will not be responsible for manhole invert forms pre-built and non-usable as a result of relocations and subsequent angle change between pipes for any manhole beyond 1,000 feet ahead of the laying operation. Changes in angles of manhole inverts, caused by the relocation of a manhole after the original stakeout, shall be the responsibility of the Contractor if such relocation is necessitated by conflict with water, gas, or other utility or drain lines.

2.02 PRECAST CONCRETE SECTIONS

A. Precast concrete sections and appurtenances shall conform to the ASTM Standard Specifications for Precast Reinforced Concrete Manhole Sections, Designation C478, latest revision, with the following exceptions and additional requirements:

B. The wall sections shall be not less than 5 in. thick.

C. Type II cement shall be used except as otherwise permitted.

D. Joints between sections shall be made watertight through the use of O-ring gaskets or a 1-1/4" diameter flexible joint sealer, No. 2 Kent-Seal as manufactured by Hamilton Kent Manufacturing Company, "E-Z Stik" as manufactured by Concrete Products Supply Company, or approved equal. Gaskets shall conform to the A.S.T.M. Standard C-443, latest revision.

2.03 MORTAR FOR MASONRY UNITS

The mortar shall be composed of one part Portland cement and two parts of sand by volume with sufficient water to form a workable mixture. Cement shall be Type II Portland cement as specified for concrete masonry. The sand shall comply with the specifications for "Fine Aggregate" for concrete masonry except that all of the sand shall pass a No. 8 sieve, not more than 35 percent shall pass a No.50 sieve and conform to ASTM C-144.

2.04 MANHOLE FRAMES AND COVERS

A. The Contractor shall furnish all cast-iron manhole frames and covers conforming to the details shown on the Drawings, or as hereinbefore specified.

B. The castings shall be of good quality, strong, tough, even grained cast iron, smooth, free from scale, lumps, blisters, sandholes, and defects of every nature which would render them unfit for the service for which they are intended. Contact surfaces of covers and frame seats shall be machined to prevent rocking of covers.

C. All castings shall be thoroughly cleaned and subject to a careful hammer inspection.

D. Castings shall be at least Class 25 conforming to the ASTM Standard Specifications for Gray Iron Castings, Designation A48, latest revision.

E. Before being shipped from the foundry, castings shall be given one coat of coal-tar-pitch varnish, applied in a satisfactory manner so as to make a smooth coating, tough, tenacious, and not brittle or with any tendency to scale off.

F. Unless otherwise specified manhole covers shall be 22-3/4-in. in diameter, weighing not less than 400 pounds per frame and cover. Manhole covers shall set neatly in the rings, with contact edges machined for even bearing and tops flush with a ring edge. They shall have sufficient corrugations to prevent slipperiness. The covers shall have two pick holes about 1-1/4 inches wide and 2 inches deep with 3/8 inch undercut all around. Covers shall not be perforated. Frames and covers shall be as manufactured by J.R. Hoe and Sons, Neenah Foundry Company, or approved equal.

G. As indicated on the Contract Drawings and other locations as specified by the Owner or Engineer, watertight manhole frames with bolted lids shall weigh not less than 400 pounds per frame and cover, an overall diameter of 38 inches, height of 5-1/2 inches and clear opening of 22 inches. Four anchor bolt holes shall be provided to anchor to the precast concrete eccentric cone of the manhole. Lids shall be bolted to the frame with four bolts. All nuts, bolts and washers shall be stainless steel. The lids shall be the type with the bolts located on the outside edge of the lid and shall not be the type with the countersunk cap screws. Gaskets shall be a round neoprene type gaskets. Lids shall not be perforated. Frames and lids shall be as manufactured by J.R. Hoe and Sons, Neenah Foundry Company, or approved equal.

H. Where indicated on the Drawings, manhole covers shall be of the waterproof type and shall not leak when subjected to an internal pressure of 5 pounds per square inch. Bearing surfaces shall be machined and sealed with a rubber gasket. Waterproof manhole covers shall be fastened to the frame by countersank stainless a steel hexagonal-head cap screws. Covers shall be furnished with concealed pick holes.

I. All covers shall be marked in large letters "SANITARY SEWER" in the center.

2.05 STUBS IN MANHOLES

A. Stubs shall be at the locations indicated on the Drawings.

B. Polyvinyl chloride stubs shall be short pieces of PVC pipe with bell ends and plugs.

C. Stubs shall be set accurately to the required line and elevation and shall be installed in the manhole masonry as indicated on the Drawings.

2.06 PREMOLDED ELASTOMERIC-SEALED JOINTS

A. The Contractor may, as an alternate to suitable nonshrink mortar joints, use premolded elastomeric-sealed joints for pipe into precast manhole bases as indicated and as specified.

B. Premolded elastomeric-sealed joints shall be Lock Joint Flexible Manhole Sleeve made by Interpace Corp., Parsippany, N.J.; Kor-N-Seal made by National Pollution Control Systems, Inc., Nashua, N.H.; Press

Wedge II made by Press-Seal Gasket Corp., Fort Wayne, Ind.; A-Lok Manhole Pipe Seal made by A-Lok Corp., Trenton, N.J.; or an acceptable equivalent product.

C. All materials, accessories, and construction methods used in making the joints shall be supplied or approved by the manufacturer of the premolded elastomeric-sealed joint.

D. The Contractor shall furnish to the Engineer the manufacturer's written instructions for installation prior to such installation.

E. Openings for pipe and materials to be embedded in the wall of the base for these joints shall be cast in the base at the required locations during the manufacture of the base.

PART 3 - EXECUTION

3.01 INSTALLATION - PRECAST SECTIONS

A. Manhole sections shall contain manhole steps accurately positioned and embedded in the concrete when the section is cast.

B. Sections shall be cured by subjecting them to thoroughly saturated steam at a temperature between 100 and 130 degrees F. for a period of not less than 12 hours or, when necessary, for such additional time as may be needed to enable the sections to meet the strength requirements.

C. No more than two lift holes may be cast or drilled in each section.

D. Flat slab tops shall have a thickness and reinforcement as indicated on the Drawings.

E. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of the barrel.

F. Acceptance of the sections will be on the basis of material tests and inspection of the completed product.

G. Cones shall be precast sections of similar construction.

H. The tops of the bases shall be suitably shaped by means of accurate bell-ring forms to receive the barrel sections.

I. Top sections shall be precast eccentric conicals of similar construction of the other precast sections.

J. Where shown on the Drawings, drop manholes shall be constructed in accordance with the standard details.

3.02 SETTING PRECAST MANHOLE SECTIONS

A. Precast-reinforced concrete manhole sections shall be set so as to be vertical and with sections and steps in true alignment.

B. Rubber gaskets shall be installed in all joints in accordance with the manufacturer's recommendations.

C. All holes in sections used for their handling shall be thoroughly plugged with rubber plugs made specifically for this purpose or with mortar. The mortar shall be one part cement to 1-1/2 part=s sand, mixed

slightly damp to the touch (just short of "balling"), hammered into the holes until it is dense and an excess of paste appears on the surface, and then finished smooth and flush with the adjoining surfaces.

3.03 SETTING MANHOLE FRAMES AND COVERS

A. Manhole frames shall be set with the tops conforming accurately to the grade of the pavement or finished ground surface or as indicated on the Drawings. Frames shall be set concentric with the top of the masonry and in a full bed of mortar so that the space between the top of the manhole masonry and the bottom flange of the frame shall be completely filled and made watertight. A thick ring of mortar extending to the outer edge of the masonry shall be placed all around and on the top of the bottom flange. The mortar shall be smoothly finished and have a slight slope to shed water away from the frame.

B. Watertight manhole frames shall be anchored to the eccentric cone of the manhole with four one-inch anchor bolts and of sufficient length to extend through any leveling rings which may be required.

C. Manhole covers shall be left in place in the frames on completion of other work at the manholes.

3.04 ADJUSTING MANHOLE FRAMES AND COVERS TO GRADE

A. Except where shown on the Drawings, the top of the precast concrete eccentric cone of a standard manhole or the top of the flat slab of a shallow manhole shall terminate 4" below existing grades in an unpaved non-traffic area other than in a residential yard and 13" below existing grades in a paved or unpaved traffic area and in a residential yard. The remainder of the manhole shall be adjusted to the required grade as described hereinafter in subparagraphs (B) and (C) of this article.

B. When a manhole is located in an unpaved non-traffic area other than in a residential yard, the frame and cover shall be adjusted to an elevation 3" to 5" above the existing grade at the center of the cover. If field changes have resulted in the installed manhole invert elevation to be lower than the invert elevation shown on the Drawings, the adjustment to an elevation of 3" to 5" above existing grade shall be accomplished by the use of precast concrete rings. If field changes have resulted in the completed manhole invert to be greater than the invert shown on the Drawings and the cover higher than 5" above existing grades, then the top of the eccentric cone, when used, or the top of the barrel section, when used, shall be trimmed down so that the manhole cover, after installation, is no greater than 5" above existing grades at the center of the cover. The area around the adjusted frame and cover shall be filled with the required material, sloping it away from the cover at a grade of one-inch (1") per foot.

C. When a manhole is located in a bituminous, concrete, or crushed stone traffic area, or in a residential yard, the frame and cover shall be adjusted to the grade of the surrounding area by the use of precast concrete rings. The adjusted cover shall conform to the elevation and slope of the surrounding area. If field changes have resulted in the installed manhole invert elevation to be so much higher than the invert elevation shown on the Drawings that the top of the eccentric cone, when use, or the top of the flat slab, when used, is less than the thickness of the frame and cover (7") from the grade of the surrounding area, then the top of the cone or barrel section shall be trimmed down enough to permit the cover, after installation, to conform to the elevation and slope of the surrounding area.

3.05 LAYING GRADING RINGS

Only clean grading rings shall be used. Concrete masonry units shall be dry when laid. Each grading ring shall be laid in a full bed of mortar and shall be thoroughly bonded. Vertical keyways shall be completely filled with mortar.

3.06 COATING

The exterior surfaces of all manholes shall be given two heavy coats of bituminous waterproofing material. The material shall be No.-46-449 Heavy Duty Black made by Tnemec Company, Inc., North Kansas City, Mo.; No. 35-J-10 Hi-Build bituminous coating made by Mobil Chemical Company, Edison, N.J.; Bitumastic Super Service Black made by Koppers Company, Inc., Pittsburgh, Pa.; or acceptable equivalent products. The waterproofing material shall be applied by brush or spray and in accordance with the instructions of the manufacturer.

3.07 TESTING MANHOLES

All precast concrete manholes shall be vacuum tested to determine if they pass the infiltration/inflow requirements. The vacuum test shall be as follows:

1. The testing shall be done after assembly of the manhole and prior to backfilling.

2. The manhole-to-pipe connection shall be a flexible connector, such as the Kor-N-Seal or approved equal.

3. All lift holes shall be plugged with an approved non-shrinking mortar.

4. The seal between the manhole sections shall be in accordance with ASTM C923.

5. The Contractor shall plug the pipe openings, taking care to securely brace the plugs and the pipe. Stubouts, manhole boots and pipe plugs shall be secured to prevent movement while the vacuum is drawn.

6. The test head shall be placed at the inside of the cone section and the seal inflated. The compression band shall be inflated to 40 psi to effect a seal between the vacuum pump and the structure. Then connect the vacuum pump to the outlet port with the valve open and draw a vacuum to 10" of Hg. and close the valve.

7. With a measured vacuum of 10 inches of mercury established in the manhole, the time for the vacuum to drop to 9 inches of mercury shall be recorded.

Acceptance standards for leakage shall be from the elapsed time for a negative pressure change from 10 inches to 9 inches of mercury. The maximum allowable leakage rate for a four-foot diameter manhole shall be in accordance with the following:

Manhole depth	Minimum Elapsed Time for a Pressure Change of 1 Inch Hg
10 ft. or less	60 seconds
> 10 ft. < 15 ft.	75 seconds
> 15 ft. < 25 ft.	90 seconds

For manholes five feet in diameter, add an additional 15 seconds and for manholes six feet in diameter, add an additional 30 seconds to the time requirements for four-foot diameter manholes.

8. If the manhole fails the test, necessary repairs shall be made and the vacuum test and repairs shall be repeated until the manhole passes the test.

9. If a manhole joint mastic is completely pulled out during the vacuum test the manhole shall be disassembled and the mastic replaced.

-END OF SECTION-

SECTION 02340

ENCASEMENT PIPE

PART 1 - GENERAL

1.01 WORK INCLUDED

The Contractor shall furnish all labor, materials, tools and equipment necessary to complete the borings as shown on the Contract Drawings and as herein specified.

PART 2 - PRODUCTS

2.01 MATERIAL

A. The pipe shall be steel, new material, with a minimum yield of 35,000 psi and a wall thickness as shown below. All joints in the encasement pipe shall be welded.

TABLE OF MINIMUM WALL THICKNESS FOR STEEL CASING PIPE

MINIMUM THICKNESS INCHES	NOMINAL DIAMETER INCHES
0.250	4 thru 14
0.250	14 and 16
0.250	18
0.281	20
0.312	22
0.344	24
0.375	26
0.406	28 and 30
0.438	32
0.469	34 and 36
0.500	38, 40 and 42

B. The steel casing pipe for all highway crossings shall be as follows:

CARRIER PIPE SIZE	CASING PIPE SIZE
4"	10"
6"	14"
8"	16"
10"	18"
12"	20"
15"	24"

C. Weldings of the steel casing pipe shall be solidly butt-welded with a smooth non-obstructing joint inside and conform to all specifications as required by American Welding Society (AWS). The casing pipe shall be installed without bends. All welders and welding operators shall be qualified as prescribed by AWS requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Where shown on the Drawings, the Contractor shall install encasement pipe by two methods the open cut method or the boring method. The open-cut method shall consist of placing the encasement pipe in the trench first then the carrier pipe is placed inside of the encasement pipe. All backfilling shall be in accordance with Section 2700, Article 3.05. Two methods of boring will be permitted. In the first, the encasement pipe is pushed or jacked into the hole as the auger cuts out the material. The second method consists of drilling the hole completely through the fill and pushing or jacking the encasement pipe into the hole after the auger has completed the bore. The pipe shall be installed in a manner that will not disrupt traffic.

B. The carrier pipe will not be permitted to rest on bells or couplings. Polyethlene pipe spacers, equally spaced and extending the full length of the pipe contained within the encasement pipe, shall be securely fastened to the carrier pipe. The spacers shall be manufactured by Advanced Products and Systems, Inc. Lafayette, Louisiana or approved equal.

C. When more than one carrier pipe is installed within the encasement pipe, each carrier pipe shall be individually secured to the four pressure treated wood members in the manner described in this article to facilitate removal of any one of the pipes when repair is necessary.

3.02 SEALING

After installation of the carrier pipe within the encasement pipe, the ends of the casing shall be sealed in the following manner. The space between the casing and the carrier pipe shall be filled with concrete or a waterproofing bitumastic compound until a tight seal is obtained. An Ethylene Propylene Diene Monomer (EPDM) elastomeric membrane shall be wrapped around the end of the encasement pipe in three layers and securely bound to the casing and the carrier pipe barrel with stainless steel bands. The EPDM membrane shall be 0.045" thick and have a tear resistance of 125 lbs/in. The membrane shall be manufactured by Carlisle Tire & Rubber Co., Firestone Industrial Products Co., or approved equal.

3.03 DAMAGE

The cost of repairing damage which is caused by the boring operation to the highway above the bore shall be borne by the Contractor.

- END OF SECTION -

SECTION 02500

BITUMINOUS PAVEMENT

PART 1 - GENERAL

1.01 DESCRIPTION OF THE WORK

Extent of bituminous pavement paving 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 Department of Highways Standard Specifications, (KDOHSS) Latest Edition. Appropriate portions of the referenced sections of the Specifications shall apply, but all work shall be included in bid items described herein unless otherwise specified or shown on the Drawings.

B. Crushed stone and dense graded aggregate are specified in this Division, Section 02510.

1.03 QUALITY ASSURANCE

A. Performance: Bituminous seal coat that fails as the result of not meeting the requirements of these Specification shall be corrected 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 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 the KDOHSS.

B. Bituminous materials shall meet the applicable requirements of the KDOHSS.

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 Department of Highways Standard Size No. 8, meeting applicable requirements of Section 805 of KDOHSS.

B. Bituminous materials shall meet applicable requirements of Section 806 of KDOHSS.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

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 the KDOHSS shall be used as determined by local plant mix availability. The mixture shall have been approved recently by the Kentucky Department of Highways, used recently on a state project, and conform to the requirements below when tested in accordance with ASTM D 1559-76:

Stability, minimum pounds	1200
Flow, 0.01 inch	Min. 6, Max. 16
Percent air voids	Min. 4, Max. 8
Minimum voids in mineral aggregate,	
percent: 3/4 inch	14
1 inch	13

B. Construction Methods: Construction requirements shall conform to applicable requirements of the KDOHSS.

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 in accordance with Section 407 of KDOHSS.

D. Where bituminous paving is placed against vertical surfaces such as 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.

E. 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 deg F. Mixing and laying temperatures shall be as follows:

Aggregates	Min. 240 deg F Max. 325 deg F
Asphalt Cement	Min. 225 deg F Max. 325 deg F
Mixture at Plant (measured in truck)	Min. 240 deg F Max. 325 deg F
Mixture when Placed (measured in truck when discharging)	275 deg $\pm$ 20 deg F**

**The 275 deg F + 20 deg F mixture placing temperature is based on 275 deg F being about the ideal temperature for obtaining optimum compaction under average conditions. However, when the distance between asphalt plant and the job is such that specified placing temperatures cannot be maintained even though maximum mixing temperatures are covered, insulated hauling equipment as described below are used, the minimum placing temperature shall be 225 deg F.

F. 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 located material and all covers shall be securely fastened in place before 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.

G. 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.

H. Bituminous paving that fails as the result of not meeting the requirements of these Specifications shall be removed and replaced at the Contractor's expense.

- END OF SECTION -

SECTION 02502

RESTORATION OF SURFACES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes restoration and maintenance of all types of surfaces, sidewalks, curbs, gutters, culverts and other features disturbed, damaged, or destroyed during the performance of the work under or as a result of the operations of the Contract.

B. The quality of materials and the performance of work used in the restoration shall produce a surface or feature equal to the condition of each before the work began.

1.02 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:

1. American Society for Testing and Materials (ASTM)

a. D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)

1.03 SUBMITTALS

A. In addition to those submittals identified in the General Provisions, the following items shall be submitted:

1. A lime schedule and a material schedule of restoration operations. After an accepted schedule has been agreed upon it shall be adhered to unless otherwise revised with the approval of the Engineer.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. In general, permanent restoration of paved surfaces will not be permitted until one month's time has elapsed after excavations have been completely backfilled as specified. A greater length of time, but not more than nine months may be allowed to elapse before permanent restoration of street surfaces is undertaken, if additional time is required for shrinkage and settlement of the backfill.

B. The replacement of surfaces at any time, as scheduled or as directed, shall not relieve the Contractor of responsibility to repair damages by settlement or other failures.

3.02 TEMPORARY PAVEMENT

A. Immediately upon completion of refilling of the trench or excavation, the Contractor shall place a temporary pavement over all disturbed areas of streets, driveways, sidewalks, and other traveled places where the original surface has been disturbed as a result of his operations.

B. Unless otherwise specified or directed the temporary pavement shall consist of compacted run-of-crusher limestone to such a depth as required to withstand the traffic to which it will be subjected.

C. Where concrete pavements are removed, the temporary pavement shall be surfaced with "cold patch". The surface of the temporary pavement shall conform to the slope and grade of the area being restored.

D. For dust prevention, the Contractor shall treat all surfaces, not covered with cold patch, as frequently as may be required.

E. The temporary pavement shall be maintained by the Contractor in a safe and satisfactory condition until such time as the permanent paving is completed. The Contractor shall immediately remove and restore all pavement as shall become unsatisfactory.

3.03 PERMANENT PAVEMENT REPLACEMENT

A. The permanent and final repaving of all streets, driveways, and similar surfaces where pavement has been removed, disturbed, settled, or damaged by or as a result of performance of the Contract shall be repaired and replaced by the Contractor, by a new and similar pavement.

1. The top surface shall conform with the grade of existing adjacent pavement and the entire replacement shall meet the current specifications of the local community for the particular types of pavement.

2. Where the local community has no specification for the type of pavement, the work shall be done in conformity with the Department of Transportation Standard which conforms the closest to the type of surfacing being replaced, as determined by the Engineer.

3.04 PREPARATION FOR PERMANENT PAVEMENT

A. When scheduled and within the time specified, the temporary pavement shall be removed and a base prepared, at the depth required by the local community or Highway Permit, to receive the permanent pavement.

1. The base shall be brought to the required grade and cross-section and thoroughly compacted before placing the permanent pavement.

2. Any base material which has become unstable for any reason shall be removed and replaced with compacted base materials.

B. Prior to placing the permanent pavement all service boxes, manhole frames and covers and similar structures within the area shall be adjusted to the established grade and cross-section.

C. The edges of existing asphalt pavement shall be cut a minimum of one foot beyond the excavation or disturbed base whichever is greater.

1. All cuts shall be parallel or perpendicular to the centerline of the street.

3.05 ASPHALT PAVEMENT

A. The permanent asphalt pavement replacement for streets, driveways, and parking area surfaces shall be replaced with bituminous materials of the same depth and kind as the existing unless otherwise detailed.

B. Prior to placing of any bituminous pavement a sealer shall be applied to the edges of the existing pavement and other features.

C. The furnishing, handling, and compaction of all bituminous materials shall be in accordance with the Department of Transportation Standards.

3.06 CONCRETE PAVEMENT AND PAVEMENT BASE

A. Concrete pavements and concrete bases for asphalt, brick, or other pavement surfaces shall be replaced with Class "B" (4000 psi) Concrete, air-entrained as specified in Section entitled "Cast-in-Place Concrete".

B. Paving slabs or concrete bases shall be constructed to extend one foot beyond each side of the trench and be supported on undisturbed soil. Where such extension of the pavement will leave less than two feet of original pavement slab or base, the repair of the pavement slab or base shall be extended to replace the slab to the original edge of the pavement or base unless otherwise indicated on the Contract Drawings.

C. Where the edge of the pavement slab or concrete base slab falls within the excavation, the excavation shall be backfilled with Special Backfill compacted to 95% maximum dry density as determined by ASTM D698 up to the base of the concrete.

D. The new concrete shall be of the same thickness as the slab being replaced and shall contain reinforcement equal to the old pavement.

1. New concrete shall be placed and cured in accordance with the applicable provisions of the Department of Transportation Standards.

3.07 STONE OR GRAVEL SURFACE

A. All areas surfaced with stone or gravel shall be replaced with material to match the existing surface unless otherwise specified.

1. The depth of the stone or gravel shall be at least equal to the existing.

2. After compaction the surface shall conform to the slope and grade of the area being replaced.

3.08 CONCRETE WALKS, CURBS AND GUTTER REPLACEMENT

A. Concrete walks, curbs, and gutters removed or damaged in connection with or as a result of the construction operations shall be replaced with new construction.

1. The minimum replacement will be a flag or block of sidewalk and five feet of curb or gutter.

B. Walks shall be constructed of 4000 psi concrete, air-entrained with KDOT approved stone aggregate on a 4-inch base of compacted gravel or stone.

1. The walk shall be not less than 4 inches in thickness or the thickness of the replaced walk where greater than 4 inches, shall have construction joints spaced not more than 25 feet apart, shall have expansion joints spaced not more than 50 feet apart and shall be sloped at right angles to the longitudinal centerline approximately 1/8 inch per foot of width.

2. For walkways within traffic areas, the walk shall be not less than 6 inches in thickness or the thickness of the replaced walk where greater than 6 inches.

C. One-half inch expansion joint material shall be placed around all objects within the sidewalk area as well as objects to which the new concrete will abut, such as valve boxes, manhole frames, curbs, buildings and others.

D. Walks shall be hand-floated and broom-finished, edged and grooved at construction joints and at intermediate intervals matching those intervals of the walk being replaced.

1. The intermediate grooves or control joints shall be scored a minimum of 1/4 of the depth of the walk.

2. The lengths of blocks formed by the grooving tool shall be equal to the width of walk, and distances between construction and expansion joints shall be uniform throughout the length of the walk in any one location.

E. The minimum length of curb or gutter to be left in place or replaced shall be 5 feet. Where a full section is not being replaced, the existing curb or gutter shall be saw cut to provide a true edge.

1. The restored curb or gutter shall be the same shape, thickness and finish as being replaced and shall be built of the same concrete and have construction and expansion joints as stated above for sidewalks.

F. All concrete shall be placed and cured as specified in the Section for concrete.

3.09 LAWNS AND IMPROVED AREAS

A. The area to receive topsoil shall be graded to a depth of not less than 4 inches or as specified, below the proposed finished surface.

1. If the depth of existing topsoil prior to construction was greater than 4 inches, topsoil shall be replaced to that depth.

B. The furnishing and placing of topsoil, seed, and mulch shall be in accordance with the Contract Drawings and as specified in the Section entitled “Topsoil and Seeding.”

C. When required to obtain germination, the seeded areas shall be watered in such a manner as to prevent washing out of the seed.

D. Any washout or damage which occurs shall be regraded and reseeded until a good sod is established.

E. The Contractor shall maintain the newly seeded areas, including regrading, reseeding, watering and mowing, in good condition.

3.10 CULTIVATED AREA REPLACEMENT

A. Areas of cultivated lands shall be graded to a depth to receive topsoil of not less than the depth of the topsoil before being disturbed. All debris and inorganic material shall be removed prior to the placing of the topsoil.

B. The furnishing and placing of topsoil shall be in accordance with the Contract Drawings and as specified in the Section entitled, "Seeding and Sodding."

C. After the topsoil has been placed and graded, the entire area disturbed during construction shall be cultivated to a minimum depth of 12 inches with normal farm equipment.

1. Any debris or inorganic materials appearing shall be removed.

2. The removal of stones shall be governed by the adjacent undisturbed cultivated area.

D. Grass areas shall be reseeded using a mixture equal to that of the area before being disturbed, unless otherwise specified.

3.11 OTHER TYPES OF RESTORATION

A. Trees, shrubs and landscape items damaged or destroyed as a result of the construction operations shall be replaced in like species and size.

1. All planting and care thereof shall meet the standards of the American Association of Nurserymen.

B. Water courses shall be reshaped to the original grade and cross-section and all debris removed. Where required to prevent erosion, the bottom and sides of the water course shall be protected.

C. Culverts destroyed or removed as a result of the construction operations shall be replaced in like size and material and shall be replaced at the original location and grade. When there is minor damage to a culvert and with the consent of the Engineer, a repair may be undertaken, if satisfactory results can be obtained.

D. Should brick pavements be encountered in the work, the restoration shall be as set forth in the Special Provisions or as directed.

3.12 MAINTENANCE

A. The finished products of restoration shall be maintained in an acceptable condition for and during a period of one year following the date of Substantial Completion or other such date as set forth elsewhere in the Contract Documents.

-- END OF SECTION --

SECTION 02510

WALK, ROAD AND PARKING PAVING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Crushed stone paving course, compacted.

B. Asphaltic concrete paving. (Replacement of asphaltic pavement disturbed during construction only)

1.02 REFERENCES

A. ASTM C33 - Aggregate for Concrete.

B. State of Kentucky Highway Standard Specifications for Road and Bridge Construction (latest revision).

1.03 TESTS

Gradation of stone materials will be performed in accordance with ASTM C33.

1.04 RELATED WORK

Section 01450 - Quality Control: Compaction requirements of backfill.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials used shall meet the appropriate physical test requirements of the latest edition and/or revision of State of Kentucky Highway Department Standard Specifications for Road and Bridge Construction.

B. Replacement of Bituminous Surface on City Streets and Secondary State Highways: Bituminous surfacing materials for replacement of City Streets and Secondary State Highways of bituminous construction shall be hot mixed bituminous concrete, as specified in the State of Kentucky Highway Department Standard Specifications for Road and Bridge Construction, Section 401 (latest revision).

C. Bituminous Seal Coat Treatment: Bituminous seal coat treatment shall conform to the requirements as set forth in the State of Kentucky Highway Department Standard Specifications for Road and Bridge Construction Section 406 (latest revision).

D. Tack Coat: Bituminous material for tack coat shall be as specified in State of Kentucky Highway Department Standard Specifications for Road and Bridge Construction, Section 407 (latest revision).

E. Dense Graded Aggregate: Crushed rock for temporary or permanent traffic bound surfacing shall be No. 610 as specified in Section 303 (State of Kentucky Highway Department Standard Specifications for Road and Bridge Construction). The crushed stone shall be crushed limestone meeting the requirement of Section 805 of the Kentucky Highway Department Standard Specification for Road and Bridge Construction.

F. Crushed stone shall conform to ASTM C33.

G. The sidewalks and curbs shall consist of 4" of 3000 PSI concrete reinforced with wire mesh placed over the previously prepared stone base. The shapes and sizes of the sidewalks shall be as indicated on the Drawings. The materials and methods of construction shall conform in all respects to the applicable sections under Section 712 of the State of Kentucky Highway Department Standard Specifications for Road and Bridge Construction.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify compacted subgrade.

B. Verify compacted granular base is dry and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

D. Verify surface of existing paved area is clean and prepared for application of tack coat and paving. conditio

E. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

A. Concrete and Bituminous Paving Repair, Replacement or Resurfacing: In case of replacement of state highway paving, depth, other details and method of applying, including base, shall be as specified herein and as required by the Kentucky Highway Department. Pavement for state highway, county road, or city street paving replacement shall be as described in the following Specifications.

B. Trench Surface Repaving on City and County Streets and Roads:

1. Bituminous Paving Replacement: The cut edges of the existing paving surface shall be trimmed a depth of at least 2" to straight lines for uniform appearance and clean surface at joints. The area between the cut edges of the paving shall be removed to a depth of 1" (minimum) below the bottom of the existing paving. All unstable material in the trench shall be removed and replaced with compacted dense graded aggregate added as needed to bring the base surface to 1" below bottom of existing paving. Dense graded aggregate required for stabilizing the subgrade will be paid for as an extra with the width and weight limitations as specified. No extra payment will be allowed for removal of unstable backfill.

2. The paving subgrade shall be compacted under the wheel of a loaded dual wheel vehicle until there is no observed settlement of the subgrade.

3. Prior to placing the paving material, the bottom and sides of surface to be paved shall be covered with a prime coat to insure adhesion.

4. Next, the bituminous paving shall be hot applied and rolled in accordance with the provisions of Section 401, KHDSSRBC. Surface shall then be graded to one-quarter inch above existing paving surface at edges and crowned to one-half inch above such surface at the center.

3.03 PLACING STONE PAVING AND STONE BASE

A. Spread stone material over prepared base to a total compacted thickness of 12 inches.

B. Place stone in 6 inch layers and compact.

C. Level surfaces to elevations and gradients indicated.

D. Add small quantities of sand to stone mix as appropriate to assist compaction.

E. Adequately compact placed stone materials.

F. Add water to assist compaction. With an excess water condition, rework topping and aerate to reduce moisture content.

3.04 SUBSOIL PREPARATION

A. Eliminate uneven areas and low spots.

B. Remove debris, roots, branches and stones in excess of one inch in size.

3.05 PLACING ASPHALT PAVEMENT

A. The preparation of the base shall include cleaning of original surface to be resurfaced, the removal of unstable material from the trench, removal of crushed rock from the trench to bottom of the existing bituminous pavement, and the addition of crushed rock to the trench where needed. No cutting of edges of existing paving will be required.

B. If temporary pavement has been placed, it shall be removed and the stone base course restored as hereinafter specified. All catchbasin and manhole frames and covers, water and gas gates, and other structures in the roadway to receive the surface course shall be adjusted to the elevation required for the finished pavement to conform to the proper grade.

C. Prior to placing pavement, all backfill shall have been properly compacted as required under BACKFILLING AND EMBANKMENT to eliminate settling of backfill. No pavement shall be placed over poorly compacted backfill. Backfill and stone base course shall be compacted, brought to the proper elevation, and dressed so that new pavement construction shall be at the required grade. The Contractor shall maintain the surfaces of all excavated and disturbed areas until the pavement is placed. If there is a time lapse of more than 24 hours between completion of preparation of subgrade or placing of stone base course and placing of paving, or if subgrade or stone base course has been eroded or disturbed by traffic, the subgrade or stone base course shall be restored before placing paving.

D. After the stone base course has been rolled to the required grade, the edges of existing pavement shall be cut back 12" or more, as required, from the trench excavation wall or damaged area to sound undamaged material, straightened, cleaned, and painted with an approved cut back asphalt to insure a satisfactory bond between it and the newly placed permanent paving.

3.06 TEMPORARY PAVEMENT

A. The Contractor upon completing the backfilling of the trenches and the placing of the gravel base, may be required to construct a temporary pavement.

B. The temporary pavement shall be placed in one course and shall consist of 2" compacted thickness of bituminous concrete as directed by the Engineer. The pavement shall be maintained in good repair, flush with the existing pavement at all times, at the Contractor's expense.

C. The materials and methods of construction for temporary bituminous-concrete pavement shall conform in all respects to the applicable
subsections under Section 401, of the Kentucky Highway Department Standard Specifications for Road and Bridge Construction.

3.07 TOLERANCES

A. Flatness: Maximum variation of 1/2" measured with 10 feet straight edge.

B. Compacted Scheduled Thickness: Within 1/4".

C. Variation from True Elevation: Within 1/2".

D. Top of Sidewalk and Curbs: Plus or minus 1 inch.

3.08 PROTECTION

Immediately after placement, protect pavement from damage until surface is sufficiently hardened for traffic.

3.09 SURFACE MAINTENANCE

Until the expiration of the guarantee period, the Contractor shall maintain surfacing placed under this contract and shall promptly correct all defects such as cracks, depressions, and holes that occur. At all times, the surfacing shall be kept in a safe and satisfactory condition for traffic. If defects occur in surfacing constructed by the Contractor, the Contractor shall remove all bituminous concrete and base course as is necessary to properly correct the defect. The Contractor shall replace the base course and bituminous concrete in accordance with the requirements of these Specifications.

- END OF SECTION -

SECTION 02602

LEAKAGE TESTS – NON-STRUCTURAL

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes requirements for testing of pressure and nonpressure piping for leakage as specified.

1. The Contractor shall furnish labor, equipment, test connections, vents, water and materials necessary for carrying out the pressure and leakage tests.

B. Testing shall be witnessed by the Engineer, or Owner at their request.

1.2 REFERENCES

A. Testing shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:

1. American Society for Testing and Materials (ASTM)

a. ASTM C-1244

1.2 SUBMITTALS

A. In addition to those submittals identified in the General Provisions, the following items shall be submitted:

1. Reports of test results.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 TESTS ON PRESSURE PIPING FOR TRANSPORT OF WATER OR SEWAGE

A. General

1. Contractor shall backfill all buried piping to finish grade prior to testing.

2. Pipelines designed to transport water or sewage under pressure shall be tested hydrostatically and for leakage prior to being placed in service.

3. The length of piping and sections included in the tests shall meet the approval of the Engineer.

4. Equipment in or attached to the pipes being tested shall be protected. Any damage to such equipment during the test shall be repaired by the Contractor at his expense.

5. When piping is to be insulated or concealed in a structure, tests shall be made before the pipe is covered.

6. All fittings, hydrants and appurtenances must be properly braced and harnessed before the pressure is applied. Thrust restraining devices which will become a part of the system must also be tested at the test pressure.

7. When testing absorbent pipe materials such as asbestos cement, cement lined or concrete, the pipeline shall be filled with water at least twenty-four (24) hours before the test is made.

8. If the line fails the tests specified herein, the Contractor shall explore for the cause of the excessive leakage and after repairs have been made the line shall be retested. This procedure shall be repeated until the pipe complies.

B. Pressure Test

1. Test pressure for low pressure process yard piping shall be 15 psi, unless otherwise noted. "Low Pressure" shall mean gravity pipe flow conditions for which the design hydraulic grade line is above the pipe crown, i.e. typically process piping running between process tanks.

2. Gravity plant drains and storm drains shall be tested in accordance with the requirements for "Test for Non-Pressure Pipelines for Transport of Water and Sewage" as included herein.

3. Test pressure for all piping used for force mains, the utility water system and the potable water system shall be twice the system working pressure or 150 psi, whichever is less.

4. Test pressure shall be held on the piping for a period of at least 2 hours, unless a longer period is requested by the Engineer.

C. Leakage Test

1. The leakage test shall be conducted concurrently with the pressure test.

2. The rate of leakage shall be determined at 15 minute intervals by means of volumetric measurement of the makeup water added to maintain the test pressure. The test shall proceed until the rate of leakage has stabilized or is decreasing below an allowable value, for three consecutive 15 minute intervals. After this, the test pressure shall be maintained for at least another 15 minutes.

   a. At the completion of the test the pressure shall be released at the furthermost point from the point of application.

3. All exposed piping shall be examined during the test and all leaks, defective material or joints shall be repaired or replaced before repeating the tests.

4. The allowable leakage for pressure pipelines shall not exceed the following in gallons per twenty-four (24) hours per inch of diameter per mile of pipe:

Type of Pipe	Leakage
Ductile iron	10

Type of Pipe	Leakage
Polyvinyl chloride, thermal plastic or fiberglass with rubber joints	10
Polyvinyl chloride, thermal plastic, HDPE (thermal heat fusion joints) or fiberglass with solvent-cemented joints	0
Concrete with steel and rubber joints	10
Steel with welded joints	0
Steel with harnessed joints	10
Wrought steel	0
Copper	0
All piping inside structures	0

5. Regardless of the above allowables, any visible leaks shall be permanently stopped.

3.2 TEST FOR NON-PRESSURE PIPELINES FOR TRANSPORT OF WATER OR SEWAGE

A. General

1. Contractor shall backfill all buried piping to finish grade prior to testing.

2. Pipelines designed to carry water or sewage in open channel flow or at minimal pressures shall be tested for leakage prior to being placed in service.

3. The leakage shall be determined by exfiltration, infiltration or low pressure air.

   a. The testing method directed by the Engineer shall take into consideration the groundwater elevation of the section of pipe being tested.

   b. The maximum non-pressure pipeline to be tested for leakage shall be the section between manholes or 600 feet as directed by the Engineer.

3. Intermediate leakage tests during construction shall be made at the Contractor's discretion. Upon completion of any pipeline, the entire system including manholes shall be tested for compliance to allowable leakage.

4. When testing absorbent pipe materials such as cement or concrete, the pipeline shall be filled with water at least twenty-four (24) hours before the test is made.

5. Groundwater level shall be determined by the Contractor prior to any testing by reading the water level at the observation pipe in the manholes.

6. If the line fails the test, the Contractor shall explore for the cause of the excessive leakage and after repairs have been made the line shall be retested. This procedure shall be repeated until the pipe complies.

B. Exfiltration Testing

1. Exfiltration tests shall be made by filling a section of pipeline with water and measuring the quantity of leakage.

2. The head of water at the beginning of the test shall be at least two feet above the highest pipe within the section being tested.

   a. Should groundwater be present within the section being tested, the head of water for the test shall be two feet above the hydraulic gradient of the groundwater.

   b. Should the requirement of two feet of water above the highest pipe subject any joint at the lower end of the test section to a differential head of greater than 11.5 feet, contractor shall apply testing methods discussed in Section 3.2 of this specification using a test pressure of 15 psi.

C. Infiltration Testing

1. Infiltration tests will be allowed only when the water table gauges determine the groundwater level to be two feet or more above the highest pipe of the section being tested.

2. Infiltration test shall be made by measuring the quantity of water leaking into a section of pipeline.

3. Measurement of the infiltration shall be by means of a calibrated weir constructed at the outlet of the section being tested.

D. Allowable Leakage for Non-Pressure Pipelines

The allowable leakage (exfiltration or infiltration) for non- pressure pipelines shall not exceed the following in gallons per twenty-four (24) hours per inch of diameter per 1000 feet of pipe:

Type of Pipe	Leakage
Ductile iron – mechanical or push-on joints	10
Polyvinyl chloride, thermal plastic or fiberglass with rubber joints	10
Polyvinyl chloride, thermal plastic or fiberglass with solvent-cemented joints	0
Concrete with rubber joints	10
Concrete with steel and rubber joints	10
Corrugated Steel	95
Clay with rubber gasket joints	20
Cast iron soil pipe	
1. drains and vents	0
2. sewer laterals	*
All piping inside structures	0

* The same allowable as pipe to which it is connected.

Regardless of the above allowable leakage any spurting leaks detected shall be permanently stopped.

E. Air Testing

1. For the acceptance of air testing in lieu of hydrostatic testing (exfiltration or infiltration), the Contractor shall perform hydrostatic and air tests on at least three sections of pipeline for each type of pipe being used. The Engineer shall select the sections for the corroborative tests. If these duel tested sections indicate the same results, that is, acceptance under both tests, air testing will be allowed in lieu of hydrostatic testing to meet the project requirements.

2. Air testing for acceptance shall not be performed until the backfilling has been completed.

3. Low pressure air tests shall conform to ASTM C 828 except as specified herein and shall not be limited to type or size of pipe.

4. All sections of pipelines shall be cleaned and flushed prior to testing.

5. The air test shall be based on the average holding pressure of 3 psi gauge, a drop from 3.5 to 2.5 psi, within the period of time allowed for the size of pipe and the length of the test section. The time allowed for the 1 psi drop in pressure, measured in seconds, will be computed by the Engineer and will be based on the limits of ASTM C 828.

   a. When groundwater is present the average test pressure of 3 psig shall be above any back pressure due to the groundwater level.

   b. The maximum pressure allowed under any condition in air testing shall be 10 psig. The maximum groundwater level for air testing is 13 feet above the top of the pipe.

6. The equipment required for air testing shall be furnished by the Contractor and shall include the necessary compressor, valves and gauges to allow for the monitoring of the pressure, release of pressure and a separable test gauge.

   a. The test gauge shall be sized to allow for the measuring of the one psig loss allowed during the test period and shall be on a separate line to the test section.

3.3 MANHOLE TESTING

A. Manhole testing shall be in accordance with ASTM C-1244 for manhole leakage testing requirements.

1. The test head shall be placed at the top of the manhole in accordance with the manufacturer's recommendations.

2. A vacuum of 10 in. of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9 in. of mercury.

3. The manhole shall pass if the time for the vacuum reading to drop from 10 in. of mercury to 9 in. of mercury meets or exceeds the values indicated in the ASTM Standard.

4. If the manhole fails the initial test, necessary repairs shall be made by an approved method. The manhole shall then be retest until a satisfactory test is obtained.

5. Use or failure of this vacuum test shall not preclude acceptance by appropriate water infiltration or exfiltration testing, or other means.

3.4 AIR, OIL AND GAS PIPING

A. All pipelines for air, oil and gas shall be cleaned and tested with air at the pressure specified and no leakage will be allowed. After these tests are complete, fuel gas lines shall be flushed out with nitrogen or carbon dioxide before fuel gas is admitted.

-- END OF SECTION --

SECTION 02610

PIPE AND FITTINGS

PART 1 - GENERAL

1.01 WORK INCLUDED

Provide all labor, materials, equipment and services required for furnishing and installing all exterior piping specified herein. Piping herein specified includes, water, sanitary process and storm sewer. Replace all existing piping that interferes with installation of new pipe or that is damaged by new pipe installation in a manner approved by the Engineer.

1.02 RELATED WORK

A. S**ECTION 02226 - TRENCHING, BACKFILLING AND COMPACTING**

B. Division 15 - Mechanical

1.03 REFERENCES

A. AWWA C104.

B. AWWA C111.

C. AWWA C151.

D. ASTM C443.

E. ASTM C478.

F. ASTM D1785 and D1784.

G. ASTM D2467

H. ASTM D2564

I. AWWA C900

J. AWWA C905

PART 2 - PRODUCTS

2.01 DUCTILE IRON PIPE

A. All ductile iron pipe shall conform to ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51. Ductile iron pipe pressure class 350 shall be the minimum pressure class for that particular pipe size, unless otherwise noted on the Plans.

B. Each piece of pipe shall bear the manufacturer's name or trademark, the year in which it was produced and the letters "DI" or word "DUCTILE." Pipe manufacturer shall furnish notarized certificate of compliance to the above AWWA or ANSI specifications.

C. The cleaning assembly of pipe and fitting joints shall be in accordance with the manufacturer's recommendations.

D. Lining and Coating Ductile Iron Pipe and Fittings for Finished Water:

1. The interior of the pipe shall be cement mortar lined with bituminous seal coat in accordance with ANSI/AWWA C104/A21.4. Thicknesses of the lining shall be set forth in the aforementioned specification unless otherwise directed by the Engineer. The exterior of all pipe, unless otherwise specified, shall receive either coal tar or asphalt base coating a minimum of 1 mil thick.

2. 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.

3. All lining and coatings for DI fittings shall match the pipe lining and coatings of same size.

2.02 PIPE JOINTING FOR DUCTILE IRON PIPE

A. Mechanical and Socket Joint Pipe and Fittings

1. Mechanical joint, push-in socket joint, and restraint joint fittings shall be used for buried pipe applications. All buried DI fittings shall match the pipe lining and coatings of same size as specified in Paragraph 2.01.

2. Mechanical joints shall be ductile iron conforming to ANSI/AWWA C110/A21.10 and are to be furnished according to ANSI/AWWA C111/A21.11. All pipe joints must be furnished complete with all accessories. Ductile iron mechanical joints shall be used for ductile iron pipe. Rubber gaskets shall be made of plain first grade rubber, free of imperfections and porosity. Hardness shall be 70 to 75 durometer.

3. Push-in socket joints shall be equal to manufacturer's specifications for "Tyton," "Bell-Tite," or "Fastite." The joints shall consist of a rubber ring gasket compressed in groove in bell of pipe with beveled spigot end of pipe for initial centering into rubber gasket in bell and conform to ANSI/AWWA C111/A21.11.

4. Restrained joints shall be "Flex-Ring" or "Lok-Ring" restrained joints as manufactured by American Ductile Iron Pipe or pre-approved equal. Field-adaptable restraint shall be provided through the use of "Fast-Grip" or "Field Flex-Ring" as manufactured by American Ductile Iron Pipe or other pre-approved and bolt-less, push-on restrained devices. When restrained joints require factory welding, the MANUFACTURER shall qualify all welding procedures and welders used to produce the product per the requirements of a documented quality assurance system based on ANSI/AWS D11.2. Unless otherwise specified, gasket material shall be standard styrene butadiene copolymer (SBR). Restrained joints and restrained joint pipe shall be rated for the minimum pressure shown in below or the specified pressure rating of the pipe, whichever is less. The PIPE MANUFACTURER shall furnish test results showing that restrained joints in the sizes specified have been successfully tested to at least twice the specified pressure rating of the joint without leakage or failure. Tests shall be performed on pipe with nominal metal thickness less than or equal to that specified for the project. Torque-activated restrained joint devices that rely on threaded bolts or set-screws for joint restraint shall not be used.

RESTRAINED JOINT PRESSURE RATINGS, (psi) & ALLOWABLE JOINT DEFLECTIONS (Limited to the pressure rating of the pipe)				
JOINT SIZE	FAST-GRIP	FIELD FLEX-RING	FLEX-RING	LOK-RING
4"	350 / 5°		350 / 5°	
6"	350 / 5°		350 / 5°	
8"	350 / 5°		350 / 5°	
10"	350 / 5°		350 / 5°	
12"	350 / 5°		350 / 5°	
14"	250 / 4°	350 / 4°	350 / 4°	
16"	250 / 3°	350 / 3.75°	350 / 3.75°	
18"	250 / 3°	350 / 3.75°	350 / 3.75°	
20"	250 / 3°	350 / 3.5°	350 / 3.5°	
24"	250 / 3°	350 / 3°	350 / 3°	
30"	150 / 2.5°	250 / 2.5°	250 / 2.5°	
36"		250 / 2°	250 / 2°	
42"				250 / 0.5°
48"				250 / 0.5°
54"				250 / 0.5°
60"				250 / 0.5°
64"				250 / 0.5°

5. All ductile iron fittings shall be rated at 350 psi WWP for 3 to 24 inch and 250 psi for 30 to 48 inch size and shall be ductile cast iron grade per ASTM A536-84 with same interior and exterior coating as the pipe.

6. All items used for jointing pipe shall be furnished with the pipe and tested before shipment. The joints shall be made with tools and lubricant in strict conformity with the manufacturer's instructions. If requested, three (3) copies of such instructions shall be delivered to the Engineer at start of construction.

7. Reaction Anchorage and Blocking:

   a. All unplugged bell and spigot or all bell tees, Y-branches, bends deflecting 11-1/4 degrees or more, and plugs which are installed in buried piping shall be provided with reaction blocking, anchors, joint harness, or other acceptable means for preventing movement of the pipe and joints caused by the internal test pressure.

   b. Concrete blocking shall extend from the fittings to solid undisturbed earth and shall be installed so that all joints are accessible for repair. The bearing area of concrete reaction blocking shall be as shown on the drawings or as directed by the Engineer. If adequate support against undisturbed ground cannot be obtained, metal harness anchorages consisting of steel rods across the joint and securely anchored to pipe and fitting or other adequate facilities shall be installed to provide the necessary support. Should the lack of a solid vertical excavation face occur due to improper trench excavation, the entire cost of furnishing and installing metal harness anchorages in excess of the Contract

value of the contract blocking replaced by such anchorages shall be borne by the Contractor.

c. Reaction blocking, anchorage, or other supports for fittings installed in fills or other unstable ground or above grade shall be provided as shown on the drawings or as directed by the Engineer.

d. Reaction Anchorage and blocking is required on all pressure lines (pumped) but not on gravity process lines.

B. Flanged Pipe and Fittings:

1. Unless otherwise noted on the Drawings, flanged joints shall be used for housed pipe applications.

2. Flanged fittings shall be ductile iron conforming to ANSI/AWWA C110/A21.10 with respect to dimensions and shall be furnished according to ANSI/AWWA C111/A21.11.

3. Ductile iron flanges for pipe and fittings are to have dimensions, facing, and drilling to correspond with Class 125 with WWP of 250 psi, unless otherwise noted on the Drawings.

4. Where flanges are pit cast integrally with pipe in vertical position in dry sand molds, flanged pipe shall be latest revision of ANSI Specifications A21.2 for Class 150 or Class 250 pipe. Where flanged pipe is made up by threading plain end, centrifugally cast pipe, screwing on specially designed long hub flanges, and refacing across both face of flange and end of pipe, flange shall be per ANSI Specification B16.1 and pipe shall be ANSI Specification A21.6, Class 125. Either method of manufacture of flanged pipe will be acceptable; except when plain ends fit into mechanical joint bells, then centrifugally cast pipe shall be used.

5. Flanged coupling adapters shall be installed as shown on the plans. The flanged coupling adapters shall be as manufactured by Smith-Blair, Dresser "Style 128", or equal. Flange coupling adapters shall be installed in strict accordance with the coupling manufacturer's recommendations. All flanged coupling adapters shall be restrained. The tie rods shall be of sufficient number and strength to restrain the coupling at the test pressure as listed in the pipe schedule and piping detail plan. Use a minimum of two (2) 5/8-in. diameter tie rods at all connections.

C. Threaded Joints: Threaded joints shall have red or white lead painting on male threads. Teflon tape may be used on male threads in lieu of paint.

D. Hot Poured Joints: Compound for cast iron bell and spigot pipe joints shall be caulking lead not less than 99.73% lead meeting AWWA Specifications for jointing water pipes. This method shall be used only when replacing an existing joint.

E. Grooved Pipe and Fittings: Unless specifically otherwise called for on the contract drawings, grooved joints may be an approved substitute for flanged joints. Grooved pipe and groove joints shall be in accordance with AWWA C606. Rigid radius groove dimensions shall be utilized. Flexible grooves shall be provided as necessary for settlement or expansion as determined and approved by the ENGINEER and as specifically shown on the contract drawings. Gasket material shall be Grade "M" halogenated butyl. Bolts shall be heat-treated plated carbon steel, track head, conforming to the physical properties of ASTM A-183, minimum tensile strength 110,000 psi. Grooved ductile iron pipe shall be Special Thickness Class 53 for 4" – 16", Class 54 for 18", Class 55 for 20", and Class 56 for 24" – 36". Couplings and fittings shall be as manufactured by Victaulic Company, or equal.

F. Compact Fittings: Compact fittings may be used in lieu of standard fittings and shall conform to ANSI/AWWA C153/A21.53 for piping 12 inches and smaller. Compact fittings shall not be used for piping larger than 12 inches.

G. Dismantling Joint:

1. Flange Spool: AWWA Class D Flange compatible with ANSI class 125 and 150 bolt circles. For 3" - 12" sizes, pipe is Sch 40 ASTM A53. For 14" - 24" pipe material is ASTM A36.

2. Body: ASTM A536 ductile (nodular) iron meeting or exceeding Grade 65-45-12, with ANSI Class 125 and 150 bolt circles.

3. Gaskets: Compounded for water and sewer service in accordance with ASTM D 2000 (Sizes 3 - 12" have flange O-Ring gasket). Other compounds available for petroleum, chemical, or high temperature service.

4. Gland: Romac RomaGrip™.

5. Restraining Bolts: 7/8 –9 roll thread, Ductile (nodular) iron, meeting or exceeding ASTM A 536.

6. Restraining Lugs: Ductile (nodular) iron, meeting or exceeding ASTM A 536. Heat treated using a proprietary process.

7. Lug Locators: Polyurethane, a thermal plastic.

8. T-bolts and Nuts: High strength low alloy steel T-head bolt. National coarse rolled thread and heavy hex nut. Steel meets AWWA C111 composition specifications. Stainless steel bolts and nuts available on request.

9. Coatings: Fusion bonded epoxy, NSF 61 certified.

2.03 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS (GRAVITY LINES)

A. Polyvinyl chloride (PVC) pipe and fittings, 4 to 24 inch in diameter, for gravity sewers shall conform to the requirements of ASTM specification D-3034 (SDR 35), current approval, "Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings."

B. Large (21"-48") diameter PVC pipe and fittings shall meet the requirements of ASTM F 794, Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter for closed profile (CP) pipe.

C. All pipe and fittings shall be inspected at the factory and on the job site. Testing of PVC pipe and fittings shall be accomplished in conformance with the latest revision of ASTM D3034, ASTM D2444, ASTM D2412, and ASTM D2152. The manufacturer shall submit 5 copies of certification of test for each lot of material represented by shipment to the job site.

D. The pipe shall be homogeneous throughout and free from cracks, holes, foreign inclusions or other defects. The pipe shall be as uniform in color as commercially practical. PVC 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 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. Pipe shall not be stored outside where subject to sunlight.

F. The PVC pipe manufacturer shall provide special fittings, acceptable to the Engineer to make watertight connections to manholes.

G. Fittings for service connections shall be of the factory made inline type conforming with the requirements of ASTM specification D-3034, current approval. Saddle type fittings shall not be used.

H. PVC sewer pipe shall be supplied in standard lengths of at least 12'6". Longer lengths are permitted.

I. PVC sewer pipe shall be marked with the manufacturer's name, production lot number, ASTM designation, PVC, and the nominal diameter.

J. All underground placed piping shall have a metallic tape laid 2 foot above the pipe. The tape shall have the word "Caution" printed on it and shall identify the pipe use. Product shall be Seton Name Plate Corp., New Haven, CT, No. 210, or equal.

K. Five copies of directions for handling and installing shall be furnished to the Contractor from the manufacturer at the first delivery of the pipe to the job.

2.04 POLYVINYL CHLORIDE (PVC) PIPE - C.I. PIPE SIZE (DR 18) (DR14)

A. Pipe shall meet the requirements of AWWA C-900 or AWWA C-905 for Polyvinyl Chlorine (PVC) Pressure Pipe. All Class 200 pipe shall meet the requirements of DR 14 and all Class 150 pipe shall meet the requirements of DR 18 for AWWA C-900 and all Class 235 pipe shall meet the requirements of DR 18 for AWWA C-905. Joints shall be integral bell or twin gasket joints with rubber O-ring seals.

B. All pipe shall be suitable for use as a pressure conduit. Provisions must be made for expansion and contractions at each joint with an elastomeric ring. The bell shall consist of an integral wall section with a solid cross-section elastomeric ring which meets the requirements of ASTM D-1869 and F-477. The bell section shall be designed to be at least as strong as the pipe wall. Sizes and dimensions shall be as shown in this specification.

C. Gaskets and lubricants intended for use with PVC pipe and couplings shall be made from materials that are compatible with the plastic material and with each other when used together, will not support the growth of bacteria, and will not adversely affect the potable qualities of the water that is to be transported. Gaskets and lubricants shall be supplied by the pipe manufacturer.

D. Physical Requirements:

1. Standard Laying Lengths - Standard laying lengths shall be 20 ft. (plus or minus 1") for all sizes. The total footage of pipe of any class and size shall be furnished in standard lengths. Each length of pipe shall be tested to four times the class pressure of the pipe for minimum of 5 second. The integral bell shall be tested with the pipe.

2. Pipe Stiffness - The pipe stiffness (PSI) using F/y for PVC AWWA C-900 class water pipe shall be as follows:

Class	DR	F/y (PSI)
150	18	364
200	14	815

3. Quick Burst Test: Randomly selected tested in accordance with ASTM D-1599 shall withstand without failure pressures listed below when applied in 60 - 70 seconds. Class 150 shall have a minimum burst pressure of 755 psi and Class 200 shall have a minimum burst pressure of 986 psi at 73 degrees F. for all sizes.

4. Drop Impact Test: Pipe shall withstand without failure at 73 degrees F. an impact of 120 ft/lbs created by a falling 12 lb missile with a 2" radius nose without visible evidence of shattering or splitting.

E. All pipe and couplings shall bear identification markings that will remain legible during normal handling, storage and installation, which have been applied in a manner that will not reduce the strength of the pipe or coupling or otherwise damage them. Pipe and coupling markings shall include the nominal size and OD base, material code designation, dimension ratio number, AWWA Pressure Class, AWWA designation number for this standard, manufacturer's name or trademark, seal (mark) of the testing agency that verified the suitability of the pipe material for potable-water service. Each marking shall be applied at intervals of not more than 5 feet for the pipe and shall be marked on each coupling.

F. Tapping C 905: C-905 shall not be direct tapped. Cutting should be done only with a full circle shell cutter tool. The shell cutter must have sharp teeth and clean teeth. A full circle tapping sleeve should be used. Hole cut must be circular. See 4.6.12 Referenced retrievable coupon. Holes cut into PVC C-905 pipes in any method other than above are not acceptable to PVC pipe manufacturers and will void pipe warranty. Hole cutting by any method other than described above could induce stresses into the pipe wall and even hairline cracks which could cause failure of the pipe under pressure.

2.05 POLYVINYL CHLORIDE (PVC) PIPE (SDR 21 OR SDR 17)

A. Polyvinyl chloride (PVC) pipe for water mains shall be Class 200 (SDR 21) or Class 250 (SDR 17) pressure rated pipe as shown on the Drawings or indicated in the proposal form with either twin gasket joints or integral bell joints with rubber O-ring seals.

B. All PVC pipe shall conform to the latest revisions of ASTM D-1784 (PVC Compounds), ASTM D-2241 (PVC Plastic Pipe, SDR) and ASTM D-2672 (Bell-End PVC Pipe). Rubber gasketed joints shall conform to ASTM D-3139. The gaskets for the PVC pipe joint shall conform to ASTM F-477 and D-1869.

C. Couplings shall be furnished by the pipe manufacturer and shall accommodate the pipe for which they are used. Rubber gasket joints shall provide adequate expansion to allow for a 10□C (50□F) change in temperature on one length of pipe. Lubrication for rubber connected couplings shall be water soluble, non-toxic, be non-objectionable in taste and odor and have no deteriorating affect on the PVC or rubber gaskets and shall be as supplied by the pipe manufacturer. Couplings shall conform to ASTM D-3139.

D. All pipe and couplings shall bear identification markings that will remain legible during normal handling, storage and installation, which have been applied in a manner that will not reduce the strength of the pipe or coupling or otherwise damage them. Pipe and coupling markings shall include the nominal size and OD base, material code designation, dimension ratio number, ASTM Pressure Class, ASTM designation number for this standard manufacturer's name or trademark, seal (mark) of the testing agency that verified the suitability of the pipe material for potable-water service. Each marking shall be applied at intervals of not more than 1.5 meters (5 feet) for the pipe and shall be marked on each coupling.

2.06 PVC SCHEDULE 40 & SCHEDULE 80 PVC PIPING -- EXTERIOR PIPING

A. General -This specification sheet covers the manufacturer's requirements for PVC Schedule 40 and Schedule 80 pipe and fittings. The pipe and fittings shall meet or exceed the industry standards set forth by the American Society for Testing and Materials and NSF International, Standards 14/61.

B. MATERIALS - PVC materials used in Schedule 40 and Schedule 80 pipe shall comply with the

ASTM Standard D-1784 and are a Type I Grade I compound. The raw material has only additives that are approved by NSF International for potable water use to the Standards 14/61 for Material Testing requirements.

C. PIPE - Physical dimensions and tolerances of Schedule 40 and Schedule 80 pipe shall meet the requirements of one or more of the following ASTM Standards D-1785 and/or D-2665 and NSF International Standards 14/61 for Physical Testing requirements to ASTM standards.

D. MARKING - Schedule 40 and Schedule 80 pipe shall be marked as prescribed in ASTM Standard D-1785 i.e., nominal pipe size, type of plastic material, schedule size, pressure rating, ASTM Specification designation number, manufacturer's name and code and the NSF International seal.

E. PVC Schedule 40 Fittings

1. PVC Materials - Rigid PVC (polyvinyl chloride) used in the manufacture of Schedule 40 fittings is of Type I, Grade 1 compound as stated in ASTM D-1784. Raw material used in molding shall contain the specified amounts of color pigment, stabilizers, and other additives approved by NSF International.

2. All PVC Schedule 40 fittings shall conform to ASTM D-2466

3. Dimensions - Physical dimensions and tolerances of PVC Schedule 40 fittings meet the requirements of ASTM standard D-2466.

4. Marking - PVC Schedule 40 IPS fittings are marked as prescribed in ASTM D-2466 to indicate the manufacturer's name or trademark, material designation, the NSF mark, size of fitting, and ASTM designation.

F. PVC Schedule 80 Fittings

1. PVC Materials - Rigid PVC (polyvinyl chloride) used in the manufacture of Schedule 80 fittings is of Type I, Grade 1 compound as stated in ASTM D-1784. Raw material used in molding shall contain the specified amounts of color pigment, stabilizers, and other additives approved by NSF International.

2. All PVC Schedule 80 socket fittings shall conform to ASTM D-2467 and ASTM D-2464 for threaded fittings

3. Dimensions - Physical dimensions and tolerances of PVC Schedule 80 IPS fittings meet the requirements of ASTM standard specification D-2467 for socket-type fittings and ASTM D-2464 for threaded fittings. Threaded fittings have Taper Pipe Threads in accordance with ANSI/ASME B1.20.1.

4. Marking - PVC Schedule 80 fittings are marked as prescribed in ASTM D-2464 and D-2467 to indicate the manufacturer's name or trademark, material designation, the NSF mark, size of fitting, and ASTM designation D-6424 (threaded) or D-2467 (socket).

G. Flange Fittings for PVC Pipe

1. Molded Class 150 Flange fittings are coupling devices designed for joining PVC plastic piping systems, where frequent disassembly may be required, and can be used as a transitional fitting for joining plastic to metal piping systems.

2. Pressure Rating shall be 150 psi, water at 73°F.

3. Flange types shall be one piece socket configuration, sizes 1/2" through 4"; sizes 6" through 12" shall be Van Stone Style, two-piece socket configuration design with special reinforced rotating flange ring. A steel backer ring shall be used with blind closed rings for capping off a mating flange, flanged fitting or flanged valve.

4. Materials - All injection molded flanges shall be produced from either PVC or CPVC materials approved for potable water use by the National Sanitation Foundation (NSF). All flanges larger than 6 inches shall be made of glass-filled PVC or CPVC materials for all Van Stone style flange rings and large diameter blind flanges where additional reinforcement is deemed necessary.

5. Conformance Standards –
    a. Socket & Spigot — ASTM D 2467 (PVC); ASTM F 439 (CPVC), as applicable.
    b. Threads — ASTM F 1498.
    c. Bolt Hole Pattern — ANSI B16.5; ASTM D 4024.
    d. Material — ASTM D 1784 (PVC Cell Classification 12454-B, CPVC Cell Classification 23447-B).

2.07 PIPE JOINTING FOR PVC PIPE

A. Polyvinyl Chloride (PVC) Pipe Joints: Jointing of PVC pipe shall be of the elastomeric gasket type inserted in the belled end of the pipe or double hub joints, mechanical joint, or as specified in Paragraph 2.04. Ring shall be corrosion resistant for specific service of piping.

B. Joints for PVC pipe shall be installed per the manufacturer's recommendations. Pipe that has been field cut must be beveled for insertion into gasketed joints. Bevel can be made with hand or power tool. In either case, the finished bevel should be the same as the factory bevel. All pipe shall be provided with home marks to insure proper gasket seating. Gasket material shall comply with the physical requirements specified in A.S.T.M. D-1869, C-361, C-433, current approval.

C. For all buried PVC piping, DI mechanical joints fittings shall be ductile iron conforming to ANSI/AWWA C110/A21.10 and are to be furnished according to ANSI/AWWA C111/A21.11. All DI mechanical fittings must be furnished complete with all accessories. Ductile iron mechanical joints shall be used for ductile iron pipe and buried PVC pipe. Rubber gaskets shall be made of plain first grade rubber, free of imperfections and porosity. Hardness shall be 70 to 75 durometer.

PART 3 - EXECUTION

3.01 YARD PIPING INSTALLATION - GENERAL

A. Excavation for Pipeline Trenches: Trenches in which pipes are to be laid shall be excavated to the depths shown on the Drawings or as specified by the Engineer. Minimum cover for all pipelines shall be 36 inches unless otherwise shown on the Drawings or approved by the Engineer.

B. Jointing: The types of joints described hereinbefore shall be made in accordance with the manufacturer's recommendations.

C. Before final acceptance, the Contractor will be required to level off all trenches or to bring the trench up to grade. The Contractor shall also remove from roadways, rights-of-way and/or private property all excess earth or other materials resulting from construction.

D. Where shown on the Drawings, the Contractor shall install encasement pipe by the boring method. Two methods of boring will be permitted. In the first, the encasement pipe is pushed or jacked into the

hole as the auger cuts out the material. The second method consists of drilling the hole completely through the fill and pushing or jacking the encasement pipe into the hole after the auger has completed the bore. The pipe shall be installed in a manner that will not disrupt traffic.

E. Fittings 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.

F. 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.

G. 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 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. Class "2500" concrete required 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.

H. Non-pressure pipes entering structures underground and unsupported by original earth for a distance of more than 3', shall be supported by Class "B" concrete, where depth of such support does not exceed 3'. All pipes entering buildings or basins, below original ground, which are higher than 3' depth above subgrade, span more than 3' between wall and original earth, and with more than 24" of cover or under a roadway, shall be supported by concrete beams with piers at 6' intervals between structural wall and edge of excavation for the structure, in order to prevent breakage from settlement of backfill about the structure. Concrete and reinforcing steel for those supports shall be in the lump sum portion of the contract; and no extra payment will be allowed. Pipe entering structures shall have flexible joint within 18" of exterior of structure or from point of leaving concrete support.

I. Water mains shall be laid at least 10 feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain ten foot separation, the State of Kentucky may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.

J Water mains crossing 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 sewer. This shall be the case where the water main is either above or below the sewer. At crossings, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.

K. There shall be at least a 10 foot horizontal separation between water mains and sanitary sewer force mains. There shall be an 18 inch vertical separation at crossings as required above.

L. No water pipe shall pass through or come in contact with any part of a sewer manhole.

3.02 PIPE LAYING

A. The pipe shall be protected during handling against impact shocks and free fall. Care shall be taken to avoid dragging the spigot ring on the ground or allowing it to be damaged by contact with gravel, crushed stone, or other hard objects.

B. After being delivered alongside the trench, the pipe shall be carefully examined for soundness or damage. No piece of pipe or fitting which is known to be defective shall be laid or placed in the lines. If any defective pipe or fitting shall be discovered after the pipe is laid, it shall be removed and replaced with a satisfactory pipe or fitting without additional charge. Before each piece of pipe is lowered into the trench, it shall be thoroughly cleaned out. Each piece of pipe shall be lowered separately unless special permission is given otherwise by the Engineer. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe.

C. The bell and spigot of the joint shall be cleaned of dirt and foreign matter immediately prior to joining. The contact surfaces shall be coated with a lubricant, primer or adhesive recommended by the pipe manufacturer, and pushed together until the joint snaps distinctly in place. The pushing together of the pipe may be done by hand or by the use of a bar.

D. All pipe shall be laid straight between changes in alignment and at uniform grade between changes in grade. When jointed in the trench the pipe shall form a true and smooth line.

E. Trenches shall be kept dry during pipe laying. Before pipe laying is started, all water that may have collected in the trench shall be removed.

F. All pipe shall be laid starting at the lowest point and installed so that the spigot ends point in the direction of the flow.

3.03 PIPE BACKFILLING

A. Initial Backfill:

1. This backfill is defined as that material which is placed over the water main from the spring line in an earth trench to a point 6" above the top of the pipe or from the trench bottom in a rock trench to a point 12" above the top of the pipe. The initial backfill for Case I situations shall be earth material free of rocks, acceptable to the Engineer or Class I material (No. 9 crushed stone aggregate). The initial backfill for Case II, Case III and Class IV situations shall be Class I material (No. 9 crushed stone aggregate).

2. In areas where large quantities of rock are excavated, and the excavated earth is insufficient, then the Contractor must either haul in earth or order crushed stone aggregate for backfilling over the top of the pipe. The earth nor crushed stone aggregate used to fulfill the backfill requirements is not considered a pay item.

B. Final Backfill: There are four cases where the method of final backfilling varies. The various cases and trench situations are as follows:

1. Case I: Areas not subject to vehicular traffic.

2. Case II: Gravel areas subject to light vehicular traffic such as residential driveways; church and commercial parking lots and entrances; and farm drives.

3. Case III: City and County gravel roads; gravel and bituminous road shoulders; all bituminous surface areas such as City and County streets, residential driveways, church and commercial parking lots, and entrances; City and County road shoulders.

4. Case IV: State maintained streets and road; road shoulders for State roads and streets.

C. In all cases, walking or working on the completed pipeline, except as may be necessary in backfilling, will not be permitted until the trench has been backfield to a point 12 inches above the top of the pipe. The method of final backfilling for each of the above cases is as follows:

1. Case I - The trench shall be backfilled from a point 6" (12" for a rock trench) above the top of the pipe to a point 8" below the surface of the ground with earth material free from large rock over 0.3 cubic feet, acceptable to the Engineer. The remainder of the trench to existing grade shall be backfilled with earth material reasonably free of any rocks.

   Earth backfill used in this Case is not a separate pay item and is considered incidental to the work for the pay item "Water Main."

2. Case II - The trench shall be backfilled from a point 6" (12" for a rock trench) above the top of the pipe to a point 12" below the surface of the ground with Class I (No. 9 crushed stone aggregate) material. The trench shall be tamped to assure maximum possible compaction (approximately 80 to 85 percent of Standard Proctor density). Extreme care shall be exercised to prevent damage to the pipe during tamping operation. The remainder of the trench to existing grade shall be backfilled with Class II (dense graded aggregate) material with the material being mounded over the trench. The trench shall be tamped again to assure additional compaction. The trench may be left with a slight mound if permitted by the Engineer.

   Class I material used and method of backfilling used in this case is not a separate pay item and is considered incidental to the work for the item "Water Main."

   Class II material used in this method of backfill is not a separate pay item and is considered incidental to the work for the item "Water Main."

   Sufficient stockpiles of Class II material shall be placed throughout the project area to insure immediate replacement by the Contractor of any settled areas. The Contractor shall maintain the trench and replace or fill any settled areas until the section of main is accepted by the Owner. No extra payment will be made for the filling in of settled areas by the Contractor. Earth material shall not be used in this Case for backfill material.

3. Case III - The trench shall be backfilled from a point 6" (12" for a rock trench) above the top of pipe to the height indicated in the "City and County Maintained Streets, Roads and Driveway Pavement Replacement" detail with Class I (No. 9 crushed stone aggregate) material. Said material shall be tamped as described for Case II. A 12-inch layer of Class II (dense graded aggregate) material shall be placed over the compacted backfill before bituminous or concrete surface is placed as shown in the previously mentioned details. The 12-inch layer of Class II material is NOT a separate pay item but such expense will be borne by the Contractor and is considered incidental to the bid items "Bituminous or Concrete Surface Replacement". Also considered incidental is all temporary stone required for a temporary surface between backfilling and pavement replacement.

   Sufficient stockpiles of Class II material shall be placed throughout the project area to insure immediate replacement by the Contractor of any settled areas. The Contractor shall maintain the trench and replace or fill any settled areas with crushed stone until the section of main is accepted by the Owner or until the final bituminous or concrete surface is placed over the trench. No extra payment will be made for the filling in of settled areas by the Contractor. Class II material used in this method of backfill is considered incidental and as a support item under the item "Bituminous Surface Replacement" or "Concrete Surface Replacement" at its unit price.

   Class I material used for backfilling is not a separate pay item and is considered incidental to the bid item "Water Main."

4. Class IV- The trench shall be backfilled from the spring line to a point 1 foot above the top of the pipe with earth material free from rock and acceptable to the Engineer, it shall be carefully and solidly tamped by approved mechanical methods. The remainder of the trench shall be backfilled to the height indicated in the "State Maintained Streets and Roads Pavement Replacement Detail" in the Contract Drawings, with material free from rock and acceptable to the Engineer; said material shall be mechanically tamped in approximately 6 inch layers to obtain the maximum possible compaction. The backfilling method is NOT a separate pay item. A 12 inch layer of dense graded aggregate shall be placed over the compacted earth backfill when a bituminous or concrete surface street or road has been trenched. The 12 inch layer of stone is not a separate pay item but such expense will be borne by the Contractor.

D. Excavated materials from trenches and tunnels, in excess of quantity required for trench backfill, shall be disposed of by the Contractor. The Contractor may contact the Owner regarding the location of a suitable disposal site; however, if the Owner cannot recommend a site, it shall be the responsibility of the Contractor to obtain locations or permits for the disposal of the waste material. Unit prices for the various pipe sizes shall include the cost of disposing of excess excavated materials, as set forth herein, no additional compensation being allowed for hauling or overhaul.

3.04 INTERIOR PIPING INSTALLATION

A. It shall be the Contractor's responsibility to furnish a complete system of pipe supports, to provide expansion joints and to anchor all piping. The pipe support system shall be installed complete with all necessary inserts, bolts, nuts, rods, washers, miscellaneous steel, and other accessories. The Contractor shall submit shop drawings on the pipe supporting system, including type and size of supports, details on thrust anchorage and all their locations.

B. In some instances, expansion joints have been shown on the drawings, but no attempt has been made to indicate every expansion joint for piping included under this portion of the specifications. Portions of the piping are shown on the detail drawings. Some of the piping, however, is shown only on the schematics.

C. Reaction Anchorage and Blocking: All piping exposed in interior locations and subject to internal pressure in which flexible connectors are used shall be blocked, anchored, or harnessed, as shown on the drawings, or as directed by the Engineer to preclude separation of joints.

D. Pipe Hangers:

1. Unless otherwise shown or specified, hangers for 2-1/2 inch and smaller pipe shall be split ring, adjustable swivel type, Elcen 92, Fee and Mason 199, or Grinnell 104.1, Clevis, Elcen 12, Fee & Mason 239, Grinnell 260, or equal; or J-style; hangers for 3 in. pipe or greater shall be clevis type. Strap hangers will not be acceptable. Hangers for use with spring supports shall be split ring or clamp type, Grinnell 212, Elcen, or equal. Hangers for fiber glass reinforced pipe shall be saddle type.

2. Each hanger shall be designed to permit at least 1-1/2 inch of vertical adjustment after installation.

E. Concrete Inserts:

1. Concrete inserts shall be provided at locations to support piping where structural steel supports are not readily available. Inserts shall be located so that the total load on any insert does not exceed the manufacturer's recommended maximum load. The location of all inserts shall be approved by the Engineer.

2. Where it is necessary to anchor supports to hardened concrete or complete masonry, expansion anchors of the type described in the anchor bolt and expansion anchors section shall be used. All expansion anchors shall be sized as required for the service with minimum safety factor of five.

3. Individual concrete inserts shall be Grinnell "Fig. 282", Unistrut M26, or equal. Continuous concrete inserts shall be Unistrut "P-3200 Series", Fee and Mason, or equal.

F. Brackets and Anchors:

1. For suspended piping, anchors shall be centered, as closely as possible, between expansion joints, and between elbows and expansion joints. Anchors shall hold the pipe securely and shall be sufficiently rigid to force expansion and contraction movement to take place at expansion joints and elbows.

2. Thrust Anchors: Anchorage shall be provided as required to resist thrust due to changes in diameter or direction, or dead ending of pipelines. Anchorage shall be required wherever bending stresses exceed the allowable for the pipe.

3. Brackets and anchors shall be installed as required. They shall be Unistrut "P-1000 Series" with all parts galvanized, Grinnell "Fig 199" painted with rust inhibitive primer, or equal, or fabricated steel meeting A.S.T.M. A36 and be painted with a rust inhibitive primer.

G. Guides: Pipe guides shall be provided adjacent to sliding expansion joints in accordance with the recommendations of the National Association of Expansion Joint Manufacturers.

H. Wall Sleeves: Wall sleeve seals for pipes passing through structure walls below grade shall be compression type units consisting of molded rubber links with bolt holes, elongated backup washers, nuts and bolts, or a sleeve capable of being bolted directly to the formwork. Compression type units when assembled around the pipe and inserted in the wall sleeve, tightening the bolts shall expand the rubber against the pipe and sleeve. Sleeve seals bolted directly to the formwork to seal the annular space between the carrier pipe and the sleeve, shall be sealed by means of a confined rubber gasket and capable of withstanding 350 psi. This type of sleeve shall be manufactured from ductile iron with an integrally cast waterstop of 1/2-inch minimum thickness and 2-1/2-inch minimum height. Compression type units shall be Link-Seal or equal. Directly bolted units shall be Omni Sleeve or equal.

I. Anti-Seize Compounds: An anti-seize compound shall be applied to all nuts and bolts.

J. Contact between dissimilar metals shall be prevented.

K. In all cases where piping is in contact with a concrete or metal pipe support, a 1/8 inch thick teflon, neoprene rubber or plastic strip
shall be placed under all piping at the point of bearing. Each strip shall be cut to fit the entire area of contact between pipe and support and shall be neat.

L. Location:

1. In general, the piping work under this Contract shall be done in accordance with the arrangements shown on the plans. The runs of piping are, in part, diagrammatic and the Contractor shall without extra cost run the piping as directed by the Engineer at the time of installation, so as to best fit the conditions in the building, and so that no piping shall pass through beams or other structural members in such a way as to impair their strength.

2. Special care shall be exercised to keep all piping in the building in locations as shown on the plans and to install the risers and horizontal runs so as to occupy a minimum space.

3. Changes in runs and location to meter field conditions shall be done with extra cost to the Owner.

4. All horizontal lines carrying liquids shall be pitched to facilitate draining and all low points shall be provided with 3/4 inch hose bids suitable for the material being handled, located so that the entire system can be drained.

5. Expansion joint locations shall coincide with building control joints and as shown on the plans.

6. Pipe supports and expansions joints shall satisfy the following conditions:

Type of Pipe	Max. Pipe Support Spacing Feet	Liquid Piping Max. Length of Straight Run Without Bend or Expansion Joint Feet	Air Piping Max. Length of Straight Run Without Bend or Expansion Joint Feet
Ductile Iron	14	80	40
Steel			
6" and over	20	80	40
5" to 2-1/2"	14	50	25
2" to 1"	10	50	25
Under 1"	8	50	25
Copper			
2" to 3/4"	7	50	
Under 3/4"	7	NA	
Plastic and Fiberglass Reinforced Plastic			
Over 3"	9	30	
3" to 1-1/2"	7	30	
Under 1-1/2"	5	30	

Unless otherwise shown or authorized by the Engineer, piping running parallel to walls shall be placed approximately 1-1/2 in. out from the face of the wall and at least 3 in. below ceilings.

3.05 GENERAL TESTING REQUIREMENTS

A. During the final inspection, the Engineer will inspect each individual line, either by use of lights or other means at his disposal to determine whether the completed lines are true to line and grade as laid out or as shown on the Drawings.

B. All lines or sections of lines that are found to be laid improperly with respect to line or grade, that are found to contain broken or leaking sections of pipe, or are obstructed in such a manner that they cannot be satisfactorily corrected otherwise, shall be removed and replaced at the Contractor's expense.

C. After the piping systems have been brought to completion, and prior to final inspection, the Contractor shall rod out the entire system by pushing through each individual line in the system appropriate tools for the removal from the lines of any and all dirt, debris and trash.

D. All apparatus and equipment required for testing shall be furnished by the Contractor at no expense to the Owner.

3.06 TESTING OF LINES

A. Upon completion of the construction of water mains but prior to FINAL INSPECTION, all water mains and appurtenances shall be tested for leaks as specified herein. The OWNER shall be notified at least 24 hours in advanced of the scheduled test time and, at its own discretion, have an inspector present during the performance of the test.

B. Where practicable, pipelines shall be tested between line valves, temporary valves or temporary plugs in lengths of not more than 1,500 feet or between isolation valves. The CONTRACTOR may request, in writing, the testing of a section of line greater than 1,500 feet with the Engineer's approval. Testing shall proceed from the source of water toward the termination of the line. The line shall be tested upon the completion of the first 1,500 feet or the first isolation valve. After the completion of the first test without failure, the CONTRACTOR, at his option and with the Engineer's approval, may discontinue testing until the system is complete. The CONTRACTOR shall provide a recording pressure gauge which shall be used for the continuous measurement and recording of test pressures and test times.

C. Water mains shall be tested at a minimum of 150 pounds per square inch in compliance with AWWA C651 but not less than the pressure specified in the sub-paragraphs below. The CONTRACTOR shall furnish a recording pressure gauge which shall be used for the continuous measurement and recording of test pressures and test time.

1. Test pressure shall not be less than 1.5 times the working pressure at the highest point along the test section. Test pressure shall not exceed pipe or thrust-restraint design pressures. The hydrostatic test shall be at least a 2-hour duration. Test pressure shall not vary by more than ±5 psi for the duration of the test.

2. Valves shall not be operated in either direction at differential pressure exceeding the rated valve working pressure. Use of a test pressure greater than the rated valve pressure can result in trapped test pressure greater than the rated valve pressure can result in trapped test pressure between the gates of a double-disc gate pendent of the valve. For test pressures, the test setup should include provision, independent of the valve, to reduce the line pressure to the rated valve pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or fully opened if desired.

3. Test pressure shall not exceed the rated pressure of the valves when the pressure boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.

4. After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure at the point of testing. Each valved section of pipe shall be slowly filled with water, and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Owner. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. It is good practice to allow the system to stabilize at the test pressure before conducting the leakage test.

5. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place at the discretion of the Owner.

6. Any exposed pipe, fittings, valves, hydrants and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, hydrants or joints that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until it is satisfactory to the Owner.

7. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi of the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

D. Loss of water pressure during the test shall not exceed 10 psi in a 24 hour time period or 5 psi in a two (2) hour time period. Duration of test shall be not less than two (2) hours.

E. Where leaks are visible at exposed joints and/or evident on the surface where joints are covered, the joints shall be recaulked, repoured, bolts retightened or relaid, and leakage minimized, regardless of total pressure drop shown by the test.

F. When hydrants are in the test section, the test shall be made against closed hydrant valves.

3.07 LEAKAGE TESTS

A. Only after the line has passed the hydrostatic test, shall the leakage test be used to determine if the line has passed. The leakage shall be defined as the quantity of water that must be supplied to the tested section to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

B. The Contractor shall test all pipelines and appurtenances at normal operating pressure for at least a 24-hour period. Normal operating pressure shall be determined by averaging six (6) pressure readings taken at a point in the test pipe over a minimum period of three hours.

C. The test pipe section shall be considered acceptable if the amount of liquid added to the system at the end of the test period to restore the test pressure does not exceed that allowed by the following formula:

$$L = \frac{ND(P)^{1/2}}{7400}$$

Where L = allowable leakage in gallons per hour.
N = number of joints in length of pipe tested.
D = nominal diameter of pipe (inches).
P = test pressure (psig).

D. If loss exceeds L, the Contractor shall locate and repair to the Engineer's satisfaction all leaks until the pipe section will pass another leakage test.

E. For the pipe line to be accepted, the following will be required:

1. Pass the pressure test.

2. Pass the leakage test, unless waived under the pressure test.

3. All evidence of leakage identified and repaired.

F. Should the sections under test fail to meet the requirements, the Contractor shall do all work of locating and repairing the leaks and retesting as the Engineer may require without additional compensation.

G. If in the judgment of the Engineer, it is impracticable to follow the foregoing procedures for any reason, modifications in the procedures shall be made as required and as acceptable to the Engineer, but in any event, the Contractor shall be responsible for the ultimate tightness of the line within the above test requirements.

3.08 LOW PRESSURE AIR TESTS -- (ODOR CONTROL AIR PIPING)

A. Low pressure air test shall be made using equipment specifically designed and manufactured for the purpose of testing sewer lines using low pressure air. The equipment shall be provided with an air regulator valve or air safety valve so set that the internal pressure in the pipeline cannot exceed 8 psig.

1. The test shall be made on each manhole-to-manhole section of pipeline after placement of the backfill. The Engineer or his designated representative must be present to witness each satisfactory air test before it will be accepted as fulfilling the requirements of these specifications.

2. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.

3. Low pressure air passing through a single control panel, shall be introduced into the sealed line until the internal air pressure reaches 4 psig greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe at the time of test. However, the internal air pressure in the sealed line shall not be allowed to exceed 8 psig. When the maximum pressure exerted by the groundwater is greater than 4 psig, the Contractor shall conduct only an infiltration test.

4. At least two minutes shall be allowed for the air pressure to stabilize in the section under test. After the stabilization period the low-pressure air supply hose shall be quickly disconnected from the control panel. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig (greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe) shall not be less than that shown in the following table:

Pipe in Diameter in Inches	**Minutes**	**Pipe in Diameter in Inches**	**Minutes**
4	2	15	9.5
6	4	18	11
8	5	21	13
10	6.5	24	15
12	7.5	30	19

5. When the sewer section to be tested contains more than one size of pipe, the minimum allowable time shall be based on the largest diameter pipe in the section, and shall be the time shown in the table reduced by 0.5 minutes.

3.09 DISINFECTION OF WATER LINES

A. New potable water lines shall not be placed into service, either temporarily or permanently, until they have been thoroughly disinfected in accordance with the following requirements and to the satisfaction of the OWNER and in accordance with AWWA 651 (latest revision).

B. After pressure testing, a solution of hypochlorite using HTH or equal shall be introduced into the section of the line being disinfected sufficient to insure a chlorine dosage of at least 50 parts per million (PPM) in the entire water main. While the solution is being applied, the water should be allowed to escape at the ends of the line until tests indicate that a chlorine concentration of at least 50 PPM has been obtained throughout the complete water main. Open and close all valves and cocks while chlorinating agent is in the piping system. The chlorinated water shall remain in the pipe for 24 hours. Disinfection shall be repeated until a minimum chlorine residual of 25 PPM is measured after 24 hours. Once a chlorine residual of 25 PPM is obtained after 24 hours, the water main shall be thoroughly flushed until the residual chlorine content is not greater than 1.0 PPM.

C. The CONTRACTOR shall slowly fill the water main being disinfected to allow for full contact of the pipe with the chlorinated water to ensure full contact and proper disinfection per AWWA C-651.

D. Following disinfection of the line, bacteriological samples shall be collected and analyzed in accordance with the requirements of Kentucky Department of Natural Resources and Environmental Protection. When the samples have been tested and reported safe from contamination, the water line may be connected to the system. The Contractor shall provide to OWNER written documentation that the water sample passed the bacteriological test and is safe.

E. Bacteriological samples shall be taken in the following manner:

1. Two samples for the first one-half mile of water main and then one sample per mile thereafter.

2. Two samples when disconnecting or reconnecting a branch line or service line when two or more customers are affected.

F. All bacteriological sampling and testing shall be paid for by the Contractor and included in the unit price for the bid item "water main".

G. The CONTRACTOR shall provide its own chlorine residual analyzer test kit for sampling the chlorine concentration during the disinfection test period.

3.10 DECHLORINATION OF HEAVILY CHLORINATED WATER

A. Dechlorination of heavily chlorinated water shall be in accordance with AWWA C651 and shall be accomplished using sodium bisulfite, sodium thiosulfate, sodium sulfite, or calcium thiosulfate solution of a concentration sufficient to remove all chlorine to a level not to exceed 0.019 mg/l. The solution shall be applied by a metering pump directly into the chlorinated water flow stream by injection into a discharge line or into the free discharge from a hydrant. The treated water may then be conveyed to the nearest sanitary sewer, storm sewer, or local stream.

B. The feed rate (gpm) of solution shall be governed by the chlorine (ppm) concentration of the water to be dechlorinated and the rate (gpm) at which it can be discharged. Constant monitoring of the chlorine residual concentration shall be made using the colorimetric method to ensure the optimum solution feed rate.

C. Feed System: The dechlorinating agent shall be fed from prepared carboys utilizing a metering pump equipped with a suitable meter and valve to adjust/monitor the feed rate.

3.11 CLEAN-UP

A. Upon completion of the installation of the piping and appurtenances, the Contractor shall remove all debris and surplus construction materials resulting from the work. The Contractor shall grade the ground along each side of pipe trenches in a uniform and neat manner leaving the construction area in a shape as near as possible to the original ground line.

B. Unless specifically approved by the Owner or Engineer, cleanup of all disturbed areas shall be kept current with construction activities and restoration efforts shall be initiated by the Contractor no longer than a period of two (2) weeks after the trench excavation work has started. All excavated material not required for backfilling of the trench and any large rocks, stones or debris shall be removed from the site within reasonable time and shall not be an undue burden to the property owner(s) and/or adjacent properties. The Contractor may windrow or track-in the excavated material over the trench prior to final cleanup to allow for and to assist in the initial settlement of the trench. All disturbed areas must be seeded, at least with a temporary seed mix, if for some reason the area cannot be permanently seeded within the two (2) week period.

3.12 PLACEMENT OF TRACING WIRE

A. Detectable underground copper tracing wire shall be installed with all utility lines. Insulated copper trace wire shall be attached to the top of the pipe with adhesive tape or other suitable devices. At each hydrant, valve, and end of new pipe installation, the trace wire shall be daylighted and the ends connected together with split bolt connectors covered with waterproof tape or wrap. For long runs of pipe, the maximum unbroken length of the trace wire shall be 2500 feet. Underground splicing shall be made using brass split bolt electrical connectors. The trace wire shall be #14 AWG THWN copper.

3.13 PLACEMENT OF IDENTIFICATION TAPE

A. The placement of detectable underground marking tape shall be installed over all utility lines. Care shall be taken to insure that the buried marking tape is not broken when installed and shall be Lineguard brand encased aluminum foil, Type III. The identification tape is manufactured by Lineguard, Inc., P. O. Box 426, Wheaton, IL 60l87.

B. The identification tape shall bear the printed identification of the utility line below it, such as "CAUTION - BURIED WATER LINE BELOW". Tape shall be reverse printed, surface printing will not be acceptable. The tape shall be visible in all types and colors of soil and provide maximum color contrast to the soil. The tape shall meet the APWA color code, and shall be two (2) inches in width. Colors are: yellow - gas, green - sewer, red - electric, blue - water, orange - telephone, brown - force main.

C. The tape shall be the last equipment installed in the ditch so as to be first out. The tape shall be buried 4 - 6 inches below top of grade. After trench backfilling, the tape shall be placed in the backfill and allowed to settle into place with the backfill. The tape may be plowed in after final settlement, installed with a tool during the trench backfilling process, unrolled before final restoration or installed in any other way acceptable to the Owner or his agent or Engineer.

- END OF SECTION -

SECTION 02640

VALVES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall furnish and install valves, gates, hydrants, miscellaneous piping appurtenances and filter control valves as indicated on the Drawings and as herein specified.

B. The Drawings and Specifications direct attention to certain features of the equipment, but do not purport to cover all the details of their design. The equipment furnished shall be designed and constructed equal to the high quality equipment manufactured by such firms as are mentioned hereinafter, or as permitted by the Engineer. The Contractor shall furnish and install the equipment complete in all details and ready for operation.

C. Valves for use in the following services are specified under their appropriate sections:

1. Plumbing
2. HVAC
3. Chemical Piping Valves and Appurtenances
4. Plant Process

D. Electrical work and equipment specified herein shall conform to the requirements of the applicable electrical sections.

E. Enclosures shall be of a suitable type for the atmospheres in which they are installed.

F. Sizes and capacities not specified herein are indicated on the Drawings.

PART 2 - PRODUCTS

2.01 BUTTERFLY VALVES FLANGED OR MECHANICAL JOINT

A. Provide and install butterfly valves as shown on the contract drawings having the following features:

1. Full accordance with AWWA C504.
2. Minimum temperature rating of 250 degrees F.
3. Rated at 150 psi for raw water and 300 psi for high service piping
4. Cast iron body and disc.
5. 304 stainless steel shaft.
6. Teflon stainless bearing.
7. Packing self-adjusting.

8. Leak-tight with dependable flow characteristics.

9. Packing removable without disconnecting and removing valves.

10. Each actuator assembly per AWWA C-504.

11. Flanged or mechanical joint connections.

B. Valve Operators: The actuator manufacturer shall supply and integrally mount all operators to valves at the actuator manufacturer facility. The valves and operators shall then be shipped as a unit to the project site.

C. Pneumatic actuators shall be Vane type design with only one moving part. Seal construction shall be molded polyurethane with stainless spring expander to ensure long-term lip seal to case. Actuator housing shall be made of a corrosion resistant Zinc alloy with a stove baked epoxy finish. There shall be no O-Ring seals on the vane. All open/close actuators are to have two limit switches SPDT. Modulating actuators to have 0-1000 ΩOHM feedback signal.

D. Supply air pressure to the actuator shall range between 80 and 100 psi.

E. All new Open/Close valves shall be shipped as plane stem to the actuator manufacturer for mounting, testing and calibrating of actuators.

F. All actuators shall be warranted for three years or Two Million (2,000,000) Cycles.

2.02 BUTTERFLY VALVES LUG WAFER FILTER VALVES

Provide and install filter butterfly valves as shown on the contract drawings having the following features:

A. Bi-directional, drop tight service to 50 psi.

B. Seat shall be EPDM housed in the body and be field replaceable.

C. Aluminum bronze disc symmetrical in style. Offset disc are not acceptable.

D. Bearings shall be Teflon impregnated stainless steel.

E. Stem shall be 316 stainless steel.

F. Bushing shall be bi-directional self-adjusting.

G. Threaded lug style body that meet the ANSI class 125/150 standard.

H. Valves shall be Keystone Figure No. AR-2.

I. Filter Valve Operators: The actuator manufacturer shall supply and integrally mount all operators to valves at the actuator manufacturer facility. The valves and operators shall then be shipped as a unit to the project site.

2.03 PVC BUTTERFLY VALVES LUG WAFER

Provide and install PVC butterfly valves as shown on the contract drawings having the following features:

A. Butterfly valves shall be wafer style. Valve body shall be manufactured of PVC conforming to ASTM D1487 cell classification 12454-A. Valve disc shall be manufactured of PVC of an equal

grade to the body material or of Polypropylene conforming to ASTM D4101 cell classification PP0210B67272. Valve shall have a PTFE resilient seat. Valve stem shall be 316 stainless steel with EPDM seals.

B. Operator: 6" and below – Lever, 8" and above – Handwheel, over 6' above floor level – Chainwheel.

C. Pressure Rating: 150 psi.

D. Service: Water or Air

E. ASAHI/America Type 56, George Fischer Type 570 or approved equal.

2.04 GATE VALVES

A. Unless otherwise specified or permitted, gate valves larger than 3-in. in size shall be iron-body, resilient seat gate valves, with bell, mechanical joint, or flanged ends as indicated on the Drawings or herein specified. Valves shall be designed for working water pressures of 175 psi for 3 to 12 inch.

B. Gate valves for use on potable water lines shall conform to AWWA Standard Specification for Gate Valves 3 in. through 48 in. for Water and Other Liquids, Designation C509. They may be double-disk type.

C. Gate valves shall, in addition, meet the following requirements as applicable:

1. Buried valves or others, where indicated on the Drawings, shall be inside-screw having bell or mechanical joint ends and 2-in. square operating nuts.

2. Exposed valves shall be OS&Y flanged valves.

3. Face-to-face dimensions of flanged valves shall conform to the ANSI Standard Face-to-Face and End-to-End Dimensions of Ferrous Valves (B16.10-1973).

4. Bronze gate rings shall be fitted into grooves of dovetail or similar shape in the gates. For grooves of other shapes, the rings shall be firmly attached to the gates with bronze rivets.

5. Handwheels or operating nuts shall be turned to the left (counterclockwise) to open all valves. Handwheels shall be of ample size for ease of operation and shall have an arrow and the word OPEN cast thereon to indicate the direction of opening.

6. Stuffing box follower bolts shall be of steel and the nuts shall be of bronze.

7. O-ring stuffing boxes may be used.

8. Valves shall be capable of being repacked under line pressure.

9. Buried valves shall be provided with gate boxes and operating wrenches as hereinafter specified. Where necessary, valves shall be furnished with steel extension stems or universal joint operating rods with 2 in. square operating nuts at the upper end and a suitable coupling to connect to the valve stem.

10. Where indicated on the Drawings or necessary due to size or location, valves shall be provided with chain operators and, where required, angle drives with chains extending to within 3 ft. of the floor or operating platform. Chains shall be galvanized. Sprocket wheels shall be provided with chain guides. Valves handwheel centerlines located more

than 6 ft. 6 in. above the floor or operating platforms shall be considered as being inaccessible and shall be provided with chain operators as described above.

D. Gate valves 3 in. and smaller shall be 200 lb. WOG minimum bronze valves with screwed ends to suit the piping in which they are installed. Body material shall conform to ASTM Standard Specification for Composition Bronze or Ounce Metal Castings, Designation B62-80. Valves shall have union bonnet, rising stem, inside screw, and solid wedge gate.

E. Stem material shall be silicon bronze or an acceptable equivalent having high resistance to dezincification.

F. Buried valves shall be inside screw valves provided with operating nut and extension stem, where necessary, in lieu of handwheel.

G. Quick opening valves shall conform with the above except that they shall be provided with a quick opening lever and cam or other acceptable positive action operators in lieu of the stem and hand wheel.

2.05 BALL VALVES

A. Ball valves shall have double union ends to permit removal of the valve without disconnecting the pipeline and shall be of the type, which will not leak when the downstream union end is disconnected.

B. Viton "O" ring seals shall be used with Teflon seats. Ball valves shall be installed with the flow arrow pointed in the direction of flow to permit disconnection of downstream piping.

C. During installation, the valve handle shall be oriented for ease of operation by rotating the valve body about its axis prior to tightening the ends.

D. Where indicated on the Drawings, the valve shall be equipped with a pointer and scale plate, which will indicate the position of the valve at all times.

2.06 SOLENOID VALVES

A. Solenoid valves shall be bronze body, screwed-end, single integral seat, full pipe area, globe type valves, with renewable composition disk seats.

B. Solenoid enclosures shall meet NEMA Type 4X requirements with coils epoxy encapsulated and suitable for high ambient temperatures (140 degrees F).

C. Valves shall be suitable for operation on 120 volt, single-phase, 60 Hz current, and designed to open when energized.

D. The solenoid valves shall be manufactured by ASCO Valve, Automatic Valve Co., Inc., J.D. Gould Co., or approved equal.

2.07 VALVE BOXES

A. Each buried stop and valve shall be provided with a suitable valve box. Boxes shall be of the adjustable, telescoping, heavy-pattern type with the lower part of cast iron and the upper part of steel or cast iron. They shall be so designed and constructed as to prevent the direct transmission of traffic loads to the pipe or valve.

B. The upper or sliding section of the box shall be provided with a flange having sufficient bearing area to prevent undue settlement. The lower section of the box shall be designed to enclose the operating nut and

stuffing box of the valve and rest on the valve bonnet. For PVC piping, valve box shall be supported by brick or block and not by the valve bonnet.

C. The boxes shall be adjustable through at least 6 in. vertically without reduction of the lap between sections to less than 4 in.

D. The inside diameter of boxes for valves shall be at least 4-1/2 in., and the lengths shall be as necessary for the depths of the valves or stops with which the boxes are to be used.

E. Covers for valves shall be close fitting and substantially dirt-tight.

F. The top of the cover shall be flush with the top of the box rim. An arrow and the word OPEN to indicate the direction of turning to open the valve shall be cast in the top of the valve covers.

2.08 FLOORSTANDS

A. Floorstands shall be handwheel or crank operated as indicated on the Drawings or as required to suit the application.

B. Handwheel operated type shall be without gear reduction and crank-operated type will have either single or double gear reduction depending upon the lifting capacity required. Each type shall be provided with a threaded cast bronze lift nut to engage the operating stem. Tapered roller bearings shall be provided above and below a flange on the operating nut to support both opening and closing thrusts. Floorstands shall develop their maximum capacity with not greater than a 40-lb. pull on the crank or handwheel. Gears, where required, shall be steel with machined cut teeth designed for smooth operation. The pinion shafts on crank-operated floorstands, either single or double ratio, shall be supported on tapered roller bearings or other approved bearings. All components shall be totally enclosed in a cast iron case and cover. Positive mechanical seals will be provided on the operating nut and the pinion shafts to exclude moisture and dirt and prevent leakage of lubricant out of the hoist. Lubricating fittings shall be provided for the lubrication of all gears and bearings. Floorstands shall include a cast iron pedestal with the input shaft or handwheel approximately 36 in. above the operating floor. An arrow with the word OPEN shall be cast on the floorstand or handwheel indicating the direction of rotation to open.

C. Floorstands for rising stem sluice gates shall have clear, transparent, rigid, plastic stem covers.

D. Floorstands for nonrising stem sluice gates shall have stem indicators.

E. Floorstands shall be provided by the valve or gate manufacturer with each valve or gate requiring floorstands.

2.09 T-HANDLE OPERATING WRENCHES

T-handle operating wrenches shall be provided in the number and lengths necessary to permit operation of all valves by operators of average height working in normal positions.

2.10 FLOOR BOXES

A. The floor boxes shall be cast iron with a bronze bushing of the size necessary to accommodate the extension stem. The boxes shall be suitable for installation in a concrete floor of the thickness indicated on the Drawings.

B. They shall be similar to those made by Mueller Co., Decatur, Ill.; Clow Corporation, Chicago, Ill.; Coldwell-Wilcox Co., Fairfield, Conn.; or be acceptable equivalent products.

2.11 CORPORATION STOPS

Corporation stops for use in service clamps or direct taps shall be as manufactured by Ford, Mueller, or approved equal for 3/4", 1" and 2" service and have a maximum working pressure of 300 psi. Corporation stops shall have iron pipe threads for use with service clamps and tapered threads for direct taps and shall have compression coupling connection for copper tubing outlets. A rigid stainless steel insert stiffener shall be used inside the PE tubing, when encountered.

2.12 WAFER-STYLE SWING CHECK VALVES

A. Submittals:

1. Submit detailed product data and descriptive literature including dimensions, weights, headloss data, pressure rating and materials of construction.

2. Provide shop drawings which clearly illustrate the general arrangement of the equipment and cross-sectional views of the components.

B. Quality Assurance:

1. Supplier shall have been manufacturing wafer-style swing check valves for a period of at least ten (10) years and shall, at the Engineer's request, provide a list of installations involving equipment of similar size and application.

C. The check valve shall be a semi-lug, swing check design utilizing an external tension spring to assist in faster closure. The valve must be capable of gravity closure should the loss of spring tension occur when system back pressure is present. The valve shall have the capability of adding an adjustable hydraulic cushion for those applications that require damping systems. The external spring (and the damping cushion) must be field adjustable.

D. The body shall be of one-piece construction and shall (1) possess a machined dovetail groove for elastomer and polymer seals, or (2) possess a stainless steel or nickel aluminum bronze seat ring. The metal seat ring shall have a machined dovetail groove to mechanically retain the elastomer seal. No vulcanized bonding or chemical bonding is permitted to facilitate seat retention. The seals shall be field replaceable. The elastomer seals to provide positive shut-off at both low and high pressure.

E. The disc shall completely cover the seat ring/seal when in the closed position to provide positive seal regardless of disc orientation.

F. The valve shall be F815 as manufactured by Tyco Flow Control.

2.13 "DUCKBILL" ELASTOMERIC CHECK VALVES

A. Duckbill Check Valves are to be all rubber and the flow operated check type with a flanged end connection. The port area shall contour down to a duckbill which shall allow passage of flow in one direction while preventing reverse flow. The flange and flexible duckbill sleeve shall be one piece rubber construction fabricated of NSF61 approved elastomers with nylon reinforcement.

B. The flange drilling shall conform to ANSI B16.1 Class 125/ANSI B16.5, Class 150 standards. The valve shall be furnished with stainless steel back-up rings for installation.

C. Company name, plant location, valve size and serial number shall be bonded to the check valve. Elastomeric duckbill check valves shall be manufactured in the United States of America. A single manufacturer shall supply all duckbill check valves.

D. FUNCTION - When line pressure inside the valve exceeds the backpressure outside the valve, the line pressure forces the bill of the valve open, allowing flow to discharge. When backpressure exceeds the line pressure, the bill of the valve is forced closed preventing backflow.

E. MANUFACTURER - All valves shall be of the Series 35 as manufactured by the Red Valve Co., Inc. of Carnegie, PA 5106 or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Valves shall be installed as nearly as possible in the positions indicated on the Drawings consistent with conveniences of operating the handwheel or wrench. All valves shall be carefully erected and supported in their respective positions free from all distortion and strain on appurtenances during handling and installation.

B. All material shall be carefully inspected for defects in workmanship and material, all debris, and foreign material cleaned out of valve openings and seats, all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness.

C. Valves and other equipment, which do not operate easily or are otherwise defective shall be repaired or replaced at the Contractor's expense.

D. Valves shall not be installed with stems below the horizontal.

E. Valves shall be set plumb and supported adequately in conformance with the instructions of the manufacturer. Valves mounted on the face of concrete shall be shimmed vertically and grouted in place. Valves in the control piping shall be installed so as to be easily accessible.

F. Where chain wheels are provided for remote operation of valves, two S-shaped hooks shall be provided for each valve to enable the chains to be hooked so as not to interfere with personnel traffic.

G. Valves shall be provided with extension stems where required for convenience of operation. Extension stems shall be provided for valves installed underground and elsewhere so that the operating wrench does not exceed 8 ft. in length.

H. A permanent type gasket of uniform thickness shall be provided between flanges of valves and sluice gates and their wall thimble.

I. Wall thimbles shall be accurately set in the concrete walls so that the gates can be mounted in their respective positions without distortion or strain.

J. Plug valves in horizontal sewage and sludge piping shall be installed with the shaft horizontal such that when in the open position, the plug is located in the upper part of the valve body. Valves shall be oriented so that in the closed position, the plug is at the upstream end of the valve.

K. Floorstand operators and stem guides shall be set so that the stems shall run smoothly in true alignment. Guides shall be anchored firmly to the walls. Distances from the centerlines of gates to the operating level or base of floorstand shall be checked by the Contractor and adjusted if necessary to suit the actual conditions of installation.

- END OF SECTION -

SECTION 02700

SITE RESTORATION

PART 1 - GENERAL

1.01 CLEAN-UP

Upon completion of the installation of the sewer main and appurtenances, the Contractor shall remove all debris and surplus construction materials resulting from his work. The Contractor shall grade the ground along each side of the pipe trench and/or structure in a uniform and neat manner leaving the construction area in a shape as near as possible to the original ground line.

PART 2 - PRODUCTS

2.01 SEEDING

A. All graded areas shall be seeded at the rate of six (6) pounds of seed per 1,000 square feet. The mixture shall consist of:

Kentucky 31 Fescue	60%
Creeping Red Fescue	20%
Annual Rye Grass	20%

B. After seed has been distributed, the Contractor shall cover areas with straw to a depth of 1-1/2". Any necessary re-seeding or repairing shall be accomplished by the Contractor before final acceptance. Seeding is not a pay item.

2.02 SOD

A. Sod shall be well-rooted Kentucky Bluegrass (Poa pratensis) completely free of noxious weeds. It shall be mowed to a height not to exceed 3" before lifting, and shall be of uniform thickness, with not over 1-1/2" or less than 1" of soil.

B. Nursery sod shall meet applicable requirements set out above and shall be a variety or blend of Kentucky Bluegrass. It shall comply with nursery inspections and plant quarantine regulations of the states of origin and destination as well as with Federal regulations governing interstate movement of nursery stock. A valid copy of the certification of nursery inspection shall accompany each shipment.

PART 3 - EXECUTION

3.01 SITE RESTORATION

A. After installation of water lines, the construction site will be restored to its original condition or better. All paved streets, roads, sidewalks, curbs, etc. removed or disturbed during construction shall be replaced, and all materials and workmanship shall conform to standard practices and specifications of the Owner, and/or to the Kentucky Department of Highways requirements, and specifications, whichever applies. Gravel, cinder or dirt streets, drives and shoulders shall be replaced and sufficiently compacted to provide a surface suitable for carrying the type of traffic normally imposed at the location.

B. All seeded areas shall be watered daily during the germination period, unless rain supplies the required moisture. The Contractor shall replace, at his own expense, trees, shrubs, etc. disturbed during construction.

C. The Contractor shall remove from the site all equipment, unused materials and other items at his expense. The construction site shall be left in a neat, orderly condition, clear of all unsightly items, before the Work is finally accepted.

- END OF SECTION -

SECTION 02830

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall furnish and erect the chain link fence and gates as indicated on the drawings and as herein specified.

B. The chain link fence shall have a top rail and bottom tension wire.

C. The chain link fence materials and installation shall meet or exceed the standards of the Chain Link Fence Manufacturers Institute, New York, N.Y., except as otherwise specified in this section; also fence materials shall meet or exceed Fed. Spec. RR-F-191H/GEN for Fencing, Wire and Post Metal (and Gates, Chain Link Fence Fabric, and Accessories), and shall conform to the ASTM Standard Specifications hereinafter noted.

D. Fence framework, fabric, and accessories.

E. Excavation for post bases.

F. Concrete anchorage for posts.

G. Manual gates and related hardware.

1.02 RELATED WORK

Section 03310 - Structural Concrete.

1.03 REFERENCES

A. ANSI/ASTM A123 - Zinc (Hot Galvanized) Coatings of Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strips.

B. ANSI/ASTM F567 - Installation of Chain Link Fence.

C. ASTM A120 - Pipe, Steel, Black and Hot-dipped Zinc-coated (Galvanized) Welded and Seamless, for Ordinary Uses.

D. ASTM C94 - Ready-mixed Concrete.

E. FS RR-F-191 - Fencing, Wire and Post, Metal, Type I or Type II.

1.04 QUALITY ASSURANCE

A. Manufacturer: Company specializing in commercial quality chain link fencing with 2 years experience.

B. Installation: ANSI/ASTM F567.

1.05 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01300.

B. Include plan layout, grid, spacing of components, accessories, fittings, hardware, anchorages, and schedule of components.

C. Submit manufacturer's installation instructions under provisions of Section 01300.

D. Submit samples under provisions of Section 01300.

E. Submit the following samples illustrating each fence material and fabric finish.

1. A 2" length of each type of post.

2. A 2" length of each type of brace and railing.

3. A 2" length of framework for gates.

4. A 2" length of diagonal truss brace.

5. A 2" length of tension wire.

6. Each type of fitting used at terminal posts.

7. Fittings used at line posts.

8. Fittings for the gate leaf frame.

9. Gate hinge.

10. Gate latch.

11. Stretcher bar, 2" length.

12. Bolt and nut fastener.

13. Fence fabric, 2 weaves, 2 meshes long.

14. Tie.

F. Accompanying the samples, the Contractor shall submit two statements, one on his and one on his subcontractor's letterhead that the samples submitted comply with the requirements of these Contract Documents. Samples shall be submitted for review at least 30 days before fence erection.

PART 2 - PRODUCTS

2.01 MATERIALS

Framework: ASTM A120; Schedule 40 steel pipe, standard weight, one piece without joints.

2.02 CONCRETE MIX

A. Concrete: As specified in Section 03300.

B. Concrete: ASTM C94; Portland Cement; 2500 min. psi at 38 days; 3" slump/1" maximum sized aggregate.

2.03 MATERIALS

A. Type I metal fittings, posts, fence and gate framework, and all accessories shall be galvanized with a heavy coating of 1.8 oz. pure zinc spelter per sq. ft. of surface area to be coated using the hot-dip process. Type II shall be triple coated with 102 zinc, 15 MG of chromate and .3 mils cross link polyurethane.

B. All fabrication and welding shall be done before hot-dip galvanizing. All welding shall conform to the American Welding Society standards.

C. The chain link fence fabric shall be galvanized steel chain link fabric conforming to ASTM Standard Specification for Zinc-Coated Steel Chain Link Fence Fabric, Designation A392-74, with Class 2 zinc coating (2.0 oz. of zinc per sq. ft. of uncoated wire surface). The fabric shall be woven in 2" mesh from No. 9 gauge wire in a 7 foot width with barbed selvages top and bottom.

D. The barbed wire shall be galvanized steel barbed wire consisting of two strands of twisted No. 12 1/2-gage wires with 4-point barbs spaced 3" apart and conforming to ASTM Standard Specification of Zinc-Coated (Galvanized) Steel Barbed Wire, Designation A121-77, with Class 3 zinc coating (minimum of 0.80 oz. of zinc per sq. ft. of uncoated wire surface for No. 12 1/2-gauge wire).

E. The tension wire shall be No. 7-gauge coil spring steel wire with galvanized finish having minimum of 0.80 oz. of zinc coating per sq. ft. of uncoated wire surface.

F. Tie wires for fastening fence fabric to line posts and rails shall be not less than No. 6 gauge aluminum wire.

G. Line posts shall be 2-3/8" (2.375") outside diameter steel pipe weighing not less than 3.65 lb. per ft. for Type I or 3.117 lb. per ft. for Type II, or 1-7/8" high carbon steel H-beams weighing not less than 2.70 lb. per ft.

H. End, corner, and pull posts shall be 2-7/8" (2.875) outside diameter steel pipe weighing not less than 5.79 lb. per ft. for Type I or 4.64 lb. per ft. for Type II, or 2 1/2" square steel tube weighing not less than 5.14 lb. per ft., or 3 1/2" by 3 1/2 roll-formed, steel corner section weighing not less than 5.14 lb. per ft.

I. Gate posts for gate leaves up to and including 6 ft., wide shall be 2-7/8" outside diameter steel pipe weighing not less than 5.79 lb. per ft., or 2 1/2" square steel tube weighing not less than 5.14 lb. per ft., or 3 1/2" by 3 1/2" roll-formed, steel corner section weighing not less than 5.14 lb. per ft.

J. Gate posts for gate leaves over 6 ft. wide and up to an including 13 ft. wide shall be 4" outside diameter steel pipe weighing not less than 9.10 lb. per ft. for Type I or 3 1/2" Type II at 5.71 lb. per ft.

K. Top railings and railings for top, middle and bottom braces between terminal posts and adjacent line posts shall be 1-5/8" outside diameter steel pipe weighing not less than 2.27 lb. per ft., or 1-5/8" by 1 1/4", 14- gauge roll-form section.

L. Diagonal truss braces between terminal and adjacent line posts and for gate framework shall be 3/8" diameter steel rod.

M. Barbed wire support arms shall project outward from the top of the posts at 45 degrees and shall be capable of withstanding a 200 lb. downward pull on the outermost end of the arm, without failure. The arms shall have provision for the attachment of three strands of evenly spaced barbed wire. Arms shall be integral with post top weather caps having holes for the passage of the top rail at intermediate posts.

N. Fittings shall be heavy duty malleable iron or pressed steel of suitable size to produce strong construction.

O. Stretcher bars for attaching fabric to terminal posts such as end, corner, pull, or gate posts and gate frames shall be flat bars with minimum cross-section dimensions of not less than 1/4" by 3/4". The stretcher bars shall be the full height of the fabric and shall be secured with bar bands of not less than 11-gauge sheet steel, spaced approximately 15" on centers and bolted with 3/8" diameter bolts.

P. Gate leave framework shall be 1-7/8" outside diameter steel pipe weighing not less than 2.72 lb. per ft. for Type I or 2.28 lb. per ft. for Type II.

Q. If bolted or riveted corner fittings are not used, the gate frame shall be hot-dip galvanized after welding.

R. Gate hinges shall be of heavy pattern of adequate strength for the gate size, with large bearing surfaces for clamping or bolting in position.

S. The gates shall be provided with a suitable latch accessible from both sides and with provision for padlocking.

T. Double leaf swing gates shall have a center bolt, center stop, and automatic backstops to hold leaves in open position.

U. Gate padlocks shall have solid brass cases, hardened steel shackles, removable core cylinders, and galvanized steel chains attached to the shackle by a clevis. Padlocks shall be manufactured by Eaton Corp. Lock & Hardware Div., of Emhart Corp., Berlin, Conn.; Best Universal Lock Co., Inc., Indianapolis, Ind.; or be an acceptable equivalent product. The padlocks shall be furnished with two keys each.

2.04 FINISHES

A. Galvanized: ANSI/ASTM A120; 1.8 oz./sq. ft. coating.

B. Accessories: Same finish as framing and fabric.

PART 3 - EXECUTION

3.01 INSTALLATION - ERECTION OF CHAIN LINK FENCE

A. The fence and gates shall be erected by skilled mechanics.

B. Post spacing shall be uniform with maximum spacing of 10 ft. in fences erected along straight lines. All posts shall be placed plumb and centered in the concrete foundations.

C. Post foundations in earth shall be concrete cylinders with a minimum diameter of 12", crowned at grade to shed water, and shall not be less than 36" deep in the ground. Posts shall be set in the full depth of the foundations except for 6" of concrete under the posts.

D. If foundation holes are excavated in peat or other unstable soil, the Engineer shall be notified for determination of suitable construction precautions.

E. If solid ledge is encountered without overburden of soil, posts shall be set into the rock a minimum depth of 12" for line posts and 18" for terminal posts. Post holes shall be at least 1" greater in diameter than the post and the grout shall be thoroughly worked into the hole so as not to leave voids, and shall be crowned at the top to shed water. Where solid rock is covered by an overburden, the total setting depths shall not exceed the depths required for setting in earth, and the posts shall be grouted into the rock as described.

F. Any change in direction of the fence line of 30 degrees or more shall be considered corners. Pull posts shall be used at any abrupt change in grade.

G. Maximum area of unbraced fence shall not exceed 1,500 square feet.

H. Terminal posts shall be braced to adjacent posts with horizontal brace rails and diagonal truss rods brought to proper tension so that posts are plumb.

I. There shall be no loose connections or sloppy fits in the fence framework. The fence framework shall withstand all wind and other forces due to the weather.

J. Fabric shall be stretched taut and tied to posts, rails and tension wires with the bottom edge following the finished grade not more than 2" above the grade. The fabric shall be installed on the security side of the fence and shall be anchored to the framework so that the fabric remains in tension after pulling force is released. The fabric shall be attached to line posts with ties spaced at not more than 15" intervals and to rails and braces at not more than 24" intervals. The fabric shall be attached to the tension wire with hog ring ties on 24" centers.

K. Three strands of barbed wire shall be installed on each extension arm of the line fence and at the top of each gate. The wires shall be pulled taut and fastened at each support.

L. Gates shall be installed plumb, level, and secure for the full width of the opening and the hardware adjusted for smooth operation. Provide concrete center drop to foundation depth and drop rod retainers at center of double gate openings.

- END OF SECTION -

SECTION 2930

PUMPING AND BYPASSING

PART 1 - GENERAL

1.01 SCOPE OF WORK:

Provide all labor, materials, equipment and services required for pumping and bypassing sewage flows.

PART 2 - EXECUTION

2.01 PUMPING AND BYPASSING:

A. Flow through existing sanitary sewers and manholes shall not be interrupted, except as follows: flow may be interrupted long enough to reconfigure inverts in existing manholes or to core drill existing manholes, as necessary. Flow may also be interrupted to connect an existing sewer into a new sewer and to plug the outlet to be abandoned in the manhole. All situations requiring interruption of flows shall be carefully coordinated with the OWNER and ENGINEER at least three working days in advance. Anytime the flow through existing sanitary sewers or manholes is interrupted, the CONTRACTOR shall provide bypass pumping of the sewage to a truck or downstream manhole, as approved by the OWNER. Under no circumstances should sewage be allowed to surcharge new or existing sewers or manholes or to flow onto or into the ground. Length of bypass pumping shall be minimized as much as possible.

B. When pumping and bypassing is required, the CONTRACTOR shall supply the pumps, conduits, and other equipment to divert the flow of sewage around the sewer(s) or manhole(s) in which work is to be performed. The bypass system shall be of sufficient capacity to handle the same capacity as the sewer being bypassed, unless otherwise approved in writing by the ENGINEER. Pumps used for bypassing shall be capable of passing at least a 3" solid sphere, and bypass piping shall have a minimum size of 4" diameter. The CONTRACTOR will be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system. If pumping is required on a 24-hour basis, engines shall be equipped in a manner to keep noise to a minimum, and a spare back-up pump will be required. A spare back-up pump may be required at other locations or times as indicated in the construction documents. All fuel tanks for pump or generator motors shall be filled by the CONTRACTOR prior to leaving the job site if bypass pumping must continue. The CONTRACTOR will not suspend work for more than 24 hours during operation of a bypassing system, unless otherwise permitted by the ENGINEER.

PART 3 - BASIS OF PAYMENT

Pumping and bypassing of sewage is <u>not</u> a pay item unless otherwise indicated on the proposal forms.

END OF SECTION

DIVISION 3

CONCRETE

SECTION 03100

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Formwork for cast-in-place concrete, with shoring, bracing, and anchorage.

B. Openings for other affected work.

C. Form accessories.

D. Stripping forms.

1.02 RELATED WORK

A. Section 03210 - Reinforcing Steel

B. Section 03251 - Expansion and Contraction Joints.

C. Section 03310 - Structural Concrete.

1.03 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings.

B. ACI 347 - Recommended Practice for Concrete Formwork.

C. PS 1 - Construction and Industrial Plywood.

D. ACI 318 - Building Code Requirements for Reinforced Concrete.

E. Field Reference Manual, ACI Publication SP-15.

F. ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials.

1.04 SYSTEM DESCRIPTION

Design, engineer, and construct formwork, shoring, bracing to meet design and code requirements, so that resultant concrete conforms to required shapes, lines, dimensions, and tolerances.

1.05 QUALITY ASSURANCE

Construct and erect concrete formwork in accordance with ACI 301 and 347, latest revisions. Contractor shall maintain a copy of these standards, or Publication SP-15 in the field at all times.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Plywood; APA Plyform, Class 1; sound, undamaged sheets with straight edges.

B. Forms shall be sufficiently rigid to prevent displacement or sagging between supports, and so constructed that the concrete will not be damaged by their removal. The Contractor shall be entirely responsible for their adequacy.

C. For surfaces to be given rubbed finish, the form in contact with the concrete shall be made of 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 the number of joints. Forms shall not be pieced out by use of material different from those in the adjacent form or in such manner as will detract from the uniformity of the finished surface.

D. For surfaces other than those to be given rubbed finish forms shall be made of wood, metal, or other acceptable material. Wooden forms shall be constructed of sound lumber or plywood of suitable dimensions, free from knotholes and loose knots. Plywood shall be in reasonably good, condition. Metal forms shall be of an acceptable type for the work involved.

2.02 FORMWORK ACCESSORIES

A. Form ties to be encased in concrete shall not be made of through bolts or common wire, but shall be of a well established type, so made and installed as to embody the following features:

1. After removal of the protruding part of the tie, there shall be no metal nearer than 1-1/2" to the face of the concrete.

2. That part of the tie which is to be removed shall be at least 1/2" in diameter, or if smaller, it shall be provided with a wood, metal, or plastic cone 1" long placed against the inside of the forms. Cones shall be carefully removed from the concrete after the forms have been stripped.

3. Ties which pass through walls of liquid retaining basins and all below grade structures which are to remain dry shall be provided with acceptable water stop, securely fastened to the ties.

B. Form Release Agent: Colorless material, which will not stain concrete, absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete. Acceptable products include Nox-Crete Form Coating Release Agent, Debond Form Coating by L&M Construction Chemicals Inc., or approved equal.

C. Fillets for Chamfered Corners: Provide ¾” chamfers constructed using wood strip. Chamfers are required along all concrete edges except along edges wall and slab penetrations.

D. Nails, spikes, lag bolts, through bolts, anchorages: Sized as required of strength and character to maintain formwork in place while placing concrete.

PART 3 - EXECUTION

3.01 INSPECTION

Verify lines, levels, and measurements before proceeding with formwork.

3.02 PREPARATION

Earth or rock forms for vertical surfaces are not permitted. The vertical surface of footings shall be formed unless approved otherwise by Engineer based on soil conditions.

3.03 ERECTION

A. Provide bracing to ensure stability of formwork. Strengthen formwork liable to be overstressed by construction loads.

B. Camber slabs and beams to achieve ACI 301 tolerances.

C. Forms for walls, columns, or piers shall have removable panels at bottom for cleaning, and inspection. Forms for thin sections (such as walls or columns) of considerable height shall be arranged with suitable openings so that the concrete can be placed in a manner that will prevent segregation and accumulations of hardened concrete on the forms or reinforcement above the fresh concrete, unless special spouts are used to place concrete, and so that construction joints can be properly keyed and treated.

D. Forms for exposed surfaces shall be built with 3/4" chamfer strips attached to produce smooth, straight chamfers at all sharp edges of concrete. See 2.02 above.

E. Before form material is reused, all surfaces that are in contact with the concrete shall be thoroughly cleaned, all damaged places repaired, and all projecting nails withdrawn.

3.04 TOLERANCES

ACI 117 shall be followed for forming tolerance limits.

3.05 APPLICATION OF RELEASE AGENT

Apply form release agent on formwork in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.

3.06 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for work embedded in or passing through concrete.

B. Coordinate work of other sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

C. Install accessories in accordance with manufacturer's instructions, level and plumb. Ensure items are not disturbed during concrete placement.

3.07 FORM REMOVAL

A. Do not remove forms and bracing until concrete has sufficient strength to support its own weight, construction and design loads, which may be imposed upon it. Remove load supporting forms when concrete has attained 75 percent of required 28-day compressive strength, provided construction is reshored immediately, and the shoring remains until the concrete attains its 28 day compressive strength.

B. Reshore structural members due to design requirements or construction conditions to permit successive construction.

C. Remove formwork progressively so that unbalanced loads are not imposed on structure.

D. Do not damage concrete surfaces during form removal.

3.08 CLEANING

A. Clean forms to remove foreign matter as erection proceeds.

B. Ensure that water and debris drain to exterior through clean out ports.

C. During cold weather, remove ice and snow from forms. Do not use deicing salts. Do not use water to clean out completed forms, unless formwork and construction proceed within heated enclosure. Use compressed air to remove foreign matter.

-- END OF SECTION --

SECTION 03210

REINFORCING STEEL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Reinforcing steel.

B. Shop Drawings.

1.02 RELATED WORK

A. Section 03100 - Concrete Formwork.

B. Section 03251 - Expansion and Contraction Joints.

C. Section 03310 - Structural Concrete.

1.03 REFERENCES

A.	ASTM A-615	Deformed and Plain Billet - Steel Bars for Concrete Reinforcement.
B.	ASTM A-616	Rail Steel Deformed and Plain Bars for Concrete Reinforcement.
C.	ASTM A-617	Axle Steel Deformed and Plain Bars for Concrete Reinforcement.
D.	ACI 315	Details and Detailing of Concrete Reinforcement.
E.	ACI 315R	Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
F.	ASTM A-185	Welded Steel Wire Fabric For Concrete Reinforcement.
G.	ACI 301-96	Standard Specifications For Structural Concrete.
H.	ACI 117-90	Standard Specifications for Tolerances for Concrete Construction and Materials.

1.04 SUBMITTALS

A. Shop Drawings: The Contractor shall submit a complete set of shop drawings including schedules and bending drawings for all reinforcement used in the work in accordance with ACI 315, and ACI 315R. Review of drawings by the Contractor and the Engineer is required before shipment can be made. Splices shall be indicated on the shop drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

A. The minimum yield strength of the reinforcement shall be 60,000 pounds per square inch. Bar reinforcement shall conform to the requirements of ASTM A-615. All bar reinforcement shall be deformed.

B. Smooth dowels shall be plain steel bars conforming to ASTM A-615, Grade 60.

C. Welded wire fabric shall conform to ASTM 185, welded steel wire fabric for concrete reinforcement.

D. Reinforcement supports and other accessories in contact with the forms for members, which will be exposed to view in the finished work, shall have approved high-density polyethylene tips so that the metal portion shall be at least one quarter of an inch from the form or surface. Supports for reinforcement, when in contact with the ground or stone fill, shall be precast concrete blocks.

2.02 FABRICATION

A. Reinforcement shall be bent cold. It shall be bent accurately to the dimensions and shapes shown on the plans and to within tolerances specified in the CRSI Manual of Standard Practice (latest edition).

B. Reinforcement shall be shipped with bars of the same size and shape, fastened securely with wire and with metal identification tags using size and mark.

PART 3 - EXECUTION

3.01 PLACING AND FASTENING

A. Before being placed in position, reinforcement shall be cleaned of loose mill and rust scale, dirt and other coatings that will interfere with development of proper bond.

B. Reinforcement shall be accurately placed in positions shown on the drawings and firmly held in place during placement and hardening of concrete by using annealed wire ties. Bars shall be tied as required to prevent displacement under foot traffic and during casting operations, and shall be placed within tolerances allowed in ACI 117. Unless otherwise indicated, all reinforcement shall be placed to provide the minimum concrete cover specified by ACI.

C. Distance from the forms shall be maintained by means of stays, blocks, ties, hangers, or other approved supports. (See paragraph 2.01 D) If fabric reinforcement is shipped in rolls, it shall be straightened into flat sheets before being placed.

D. Before any concrete is placed, the Engineer or his designee shall have inspected the placing of the steel reinforcement and given permission to deposit the concrete. Concrete placed in violation of this provision will be rejected and thereupon shall be removed.

E. Unless otherwise specified, reinforcement shall be furnished in the full lengths indicated on the plans. Splicing of bars, except where shown on the plans, will not be permitted without the approval of the Engineer. Where splices are made, they shall be staggered insofar as possible. Splices shall be Class B according the ACI 318. Mat dowels and hook bars shall extend into concrete in compliance with ACI 318 regarding development length.

F. Wire mesh reinforcement shall be continuous between expansion joints. Laps shall be at least one full mesh plus 2", staggered to avoid continuous lap in either direction and securely wired or clipped.

G. Dowels within pads and slabs on grade shall be installed at right angles to construction joints and expansion joints. Dowels shall be accurately aligned parallel to the finished surface, and shall be rigidly held in place and supported during placing of the concrete. One end of dowels shall be oiled or greased or dowels shall be coated with high-density polyethylene with a minimum thickness of 14 mils. At expansion joints, provide dowel caps with a minimum expansion capacity of ¾”

-- END OF SECTION --

SECTION 03251

EXPANSION AND CONTRACTION JOINTS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Forming integral contraction and control joints in concrete.

B. Visually concealing expansion joints in concrete.

1.02 RELATED WORK

A. Section 03100 - Concrete Formwork.

B. Section 03310 - Structural Concrete.

PART 2 - PRODUCTS

2.01 INTEGRAL JOINT MATERIAL

A. Waterstop for Construction and Control Joints: Unless otherwise shown, waterstops shall be 6" wide, 3/16" minimum thickness, flat-ribbed, or dumbbell polyvinyl chloride (PVC), in accordance with Corps of Engineers Specifications CRD-C-572, latest revision, as manufactured by Vinylex Corp, W. R. Grace Company, Greenstreak, or equal. Split-ribbed waterstops may be used where appropriate.

B. Self Expanding Waterstops:

1. When approved by the Engineer, the Contractor may install self-expanding waterstop impregnated with sodium bentonite similar to Volclay Waterstop-RX. The manufacturer's recommended installation procedures shall be followed.

2. Self Expanding Waterstops shall not be used at expansion joints.

C. Joint Filler: ANSI/ASTM D994, bituminous impregnated fiberboard; closed cell polyethylene; self-expanding cork; of the sizes detailed and in the locations indicated on the Drawings. Bituminous impregnated fiberboard shall not be used to fill joints in liquid retaining structures. Where the application requires cementing the joint filler into place, a pressure sensitive adhesive recommended by the manufacturer shall be used.

2.02 SEALANTS

Sealant and Caulking: Specified in Section 07900.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Locate and form expansion control and contraction joints.

B. Waterstops shall be provided at all joints where indicated on the drawings. Waterstops shall

also be provided in all joints, vertical and horizontal, in water containment and subterranean structures. Install waterstops continuous without displacing reinforcement. All joints between adjacent continuing and intersecting sections of waterstop including butt joints, tee joints, and other angled joints shall be heat fused to form a watertight seal. Waterstops shall not be lapped. Waterstops shall be securely wired in place to maintain proper position during placement of concrete.

C. Place formed construction joints in slabs or walls as detailed on the Drawings or as directed by Engineer. Set top screed to required elevations. Secure to resist movement of wet concrete.

D. Install joint fillers and sealants in accordance with manufacturer's instructions. Use primers of type recommended by joint filler and sealant manufacturer.

E. Apply sealants in accordance with Section 07900.

-- END OF SECTION --

SECTION 03310

STRUCTURAL CONCRETE

PART 1 - GENERAL

1.01 WORK INCLUDED

The work in this section shall include all formwork, shoring, bracing, anchorage, concrete reinforcement and accessories for cast-in-place concrete.

1.02 GENERAL REQUIREMENT

All concrete construction shall conform to all applicable requirements of ACI 301, Specifications for Structural Concrete for Buildings, except as modified by the supplemental requirements specified herein.

1.03 RELATED WORK

A. Section 02200 - Earthwork

B. Section 03100 - Concrete Formwork

C. Section 03210 - Reinforcing Steel

D. Section 03251 - Expansion and Contraction Joints

E. Section 04300 - Unit Masonry

F. Section 05520 - Metal Fabrications

1.04 REFERENCES

A. The Contractor shall obtain and have available in the field office at all times the following references:

1. Specifications for Structural Concrete for Building ACI 301-89.
2. Specifications for Structural Concrete for Buildings ACI Sp-15 (88).
3. Manual of Standard Practice - CRSI (latest revision).
4. Placing Reinforcing Bars - CRSI (latest revisions).
5. Building Code Requirements for Reinforced Concrete ACI 318-89.

B. The following standard shall also apply to this work:

1. ASTM C-143 Test Method for Slump of Hydraulic Cement Concrete
2. ASTM C-150 Specification for Portland Cement
3. ASTM C-33 Specification for Concrete Aggregates
4. ASTM C-260 Specification for Air Entraining Admixtures for Concrete

5. ASTM C-494 Specification for Chemical Admixtures for Concrete

6. ASTM A-615 Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement

7. ASTM C-94 Specification for Ready-Mixed Concrete

8. ASTM C-31 Practice for Making and Curing Concrete Test Specimens in the Field

9. ASTM C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens

10. ASTM C42 Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

1.05 SUBMITTALS

A. The Contractor shall submit the following data established per Section 3.9 of ACI 301.

1. Concrete mix designs, test results and curves plotted to establish water cement ratio if paragraph 3.9.3.3 of ACI 301 is used.

2. Proposed mix designs and all necessary substantiating data used to establish proposed mix designs if paragraph 3.9.1.1 or 3.9.1.2 of ACI 301 is used.

3. Mix designs for all mixes proposed or required to be used, including all mixes containing admixtures.

4. A certified copy of the control records of the proposed production facility establishing the standard deviation as defined in paragraph 3.9.1.1 of ACI 301.

B. Certification attesting that admixtures equal or exceeds the physical requirements of ASTM C-494 for Type A (water reducing) Type D (water reducing and retarding), and Type E (water reducing and accelerating) admixtures.

C. Drawings showing locations of all proposed construction joints.

D. Certification that the concrete aggregates comply with the provisions of ASTM C33.

E. Certification that the air-entraining admixture complies with ASTM C-260.

1.06 QUALITY ASSURANCE

A. Consistency: Concrete shall be of such consistency that it can be worked readily into all parts of the forms and around embedded work, without permitting the materials to segregate, or free water to collect on the surface.

B. Compression Tests:

1. During the progress of the work, at least one set of three compression test cylinders shall be made for each 50 cubic yards of structural concrete or major fraction thereof, and not less than one such set for each type of concrete for each days pouring. Cylinders made in the field shall be made and cured in accordance with the ASTM Standard Method of Making and Curing Concrete Test Specimens in the Field, designation C31,

except that wherever possible molds shall be left on cylinders until they reach the laboratory.

2. One cylinder of each set shall be broken in accordance with ASTM C-39 at seven days and the other two at twenty-eight days.

   Two copies of these test results shall be submitted to the Engineer on the same day of the tests.

3. Additional tests of the in-place concrete shall be made when test results indicate specified concrete strengths and other characteristics have not been attained in the structure. Cored cylinders used to test concrete adequacy shall comply with ASTM C42. All test procedures and results shall be subject to the review and approval of the Engineer. The Contractor shall pay for such tests when unacceptable concrete is verified. On evidence of these tests, any concrete that fails to meet the specified strength requirements shall be strengthened or replaced as directed by the Engineer at the Contractor's expense.

C. Inserts in Concrete Other Trades:

1. All trades shall be notified, at the proper time, to install items to be embedded in concrete.

2. All castings, inserts, conduits, and other metalwork shall be accurately built into or encased in the concrete by the Contractor as directed and all necessary precautions shall be taken to prevent the metalwork from being displaced or deformed. The installation shall be inspected before concrete is placed.

3. Anchor bolts shall be set by means of substantial templates.

D. Testing:

1. The necessary testing service of this section shall be performed by a testing agency hired by the Owner, at his expense.

2. The testing agency shall perform the following tests on the sampled concrete:

   a. Slump
   b. Air Content
   c. Concrete Temperature
   d. Compression test of cylinders made under paragraph B.

3. If, in the opinion of the Engineer, there is reasonable doubt that the concrete aggregates comply with ASTM C33. The testing agency shall, test the fine aggregate and course aggregate for compliance with these specifications.

4. Written reports shall be submitted to the Engineer.

E. Hot Weather Requirements: Placing of concrete under conditions of high temperatures, low humidity or wind shall be done in accordance with the American Concrete Institute "Hot Weather Concreting" (ACI 305R-89).

F. Cold Weather Requirements: Cold weather concreting procedures and precautions shall conform with American Concrete Institute "Cold Weather Concreting" (ACI 306 R-88).

PART 2 - PRODUCTS

2.01 CONCRETE MIX

Structural concrete of the various classes required shall be proportioned by Section 3.9 of ACI 301 to produce the following 28-day compressive strengths:

Selection of Proportions for Class A Concrete:

1. 4,000 psi compressive for strength at 28 days.

2. Type II cement plus water reducing dispersing agent and air. Type I cement may be used if the C3A content of the cementitious material is less than 8 percent.

3. Maximum (water)/ (cement and water reducing dispersing agent) ratio = 0.45.

4. Minimum cement content = 564 lbs. (6.0 bags)/cu. yd. concrete.

5. Nominal maximum size coarse aggregate = No. 57 (1" maximum).

6. Air content = 6% plus or minus 1% by volume.

7. Slump = 2" - 3" in accordance with ASTM C-143.

2.02 OPTIONAL CONCRETE MIX USING FLY ASH

A. Selection of Proportions for Class A Concrete:

1. 4,000 psi compressive for strength at 28 days.

2. Type II cement plus water reducing dispersing agent and air. Type I cement may be used if the C3A content of the cementitious material is less than 8 percent.

3. Maximum (water)/ (cement plus water reducing dispersing agent) ratio - 0.45.

4. Minimum cement content - 517 lbs. (5.5 bags)/cu. yd. concrete.

5. Maximum Fly Ash Content - 71 lbs. /cu. yd.

6. Nominal maximum size coarse aggregate - No. 57 (1" maximum).

7. Air content - 6% plus or minus 2% by volume.

8. Slump = 2" - 3" in accordance with ASTM C-143.

2.03 GROUT

A. Provide the following grout mixture at locations noted on the plans to be grouted, such as fillets, tank, and trough bottoms:

1) Less than 2" in depth

Material	Volume
Cement	1 part
Sand	2 parts
Water = 5 gals. /200 lbs cement	

2) From 2" to 12" in depth

Material	Volume
Cement	1 part
Pea Gravel	2.5 parts
Sand	2 parts
Water = 5 gals. /100 lbs cement	

3) Greater than 12" in depth

Material

Concrete as specified in paragraph 2.01 or 2.02.

B. The mixtures in part A are not to be used in areas that are to receive non-shrink grout.

C. Grout fill, which is formed in place by using rotating equipment as a screed, such as for clarifiers, shall be mixed in proportions and consistencies as required by the manufacturer or supplier of the equipment.

2.04 FLY ASH CONCRETE

A. In the absence of a verified and acceptable history of fly ash concrete mixes, the following procedure is required to establish the quality of the concrete mix.

B. Trial batches must be made starting 30 days ahead of initial concrete pour. Three (3) mixes shall be designed and produced at no cost to the Owner or the Engineer as follows:

1. Mix using Type I cement with water reducing admixture for normal temperatures (Class A).

2. Mix using Type I cement with water reducing admixture for cold weather temperatures (Class A).

3. Mix using Type I cement with water reducing admixture for hot temperatures (Class A).

C. Four (4) test cylinders shall be cast for each of the (3) mixes. Two (2) cylinders shall be broken at 7 days, and two (2) cylinders shall be broken at 28 days, for each of the (3) mixes. The trial batch design report shall include strength breaks at 7-days and 28-days, air content, etc.

D. The water-reducing, cement dispersing admixture used in fly ash concrete, shall be a normal, accelerated, or retarded hardening admixture. The admixture shall be used at optimum dosage to offset the slow strength development and setting characteristics of the fly ash. Only those brands of admixture that can provide readily available field service on short notice to provide field services, inspection, and assistance, will be acceptable.

E. Prior to the use of fly ash concrete, recent mill reports shall be submitted on a regular basis during the project. Maximum loss of ignition (LOI) shall be 6%.

F. Tests for air content shall be made twice a day at the jobsite prior to pouring, for all mixes containing fly ash.

2.05 ADMIXTURES

A. An air entraining admixture shall be used on all concrete and shall be the Master Builders MB-VR, or MicroAir, Euclid Chemical Company AIR-MIX, W. R. Graces Darex, or equal. The admixture shall meet the requirements of ASTM C-260. Certification attesting to the percent of effective solids and compliance of the material with ASTM C-260 shall be furnished.

B. A water-reducing, admixture for concrete shall conform to ASTM C-494 for type A (water-reducing and normal setting admixtures) and shall be Master Builders Pozzolith 344N, Nox-Crete Plastiflow, or Plastocrete 161 by Sika, or an approved equal.

C. The water-reducing, set retarding admixture for concrete shall conform to ASTM C494 for Type D (water reducing and retarding admixtures) and shall be Master Builders, Pozzolith 100-XR, Daratard-17 by W. R. Grace, or an approved equal.

D. Certification shall be furnished attesting that the admixture exceeds the physical requirements of ASTM C-494, Type A, water reducing and normal setting admixture, and when required, for ASTM C-494, Type D, water reducing and retarding admixture when used with local materials with which the subject concrete is composed.

E. The admixture manufacturer shall provide a qualified concrete technician employed by the manufacturer to assist in proportioning concrete for optimum use. He also will be available to advise on proper addition of the admixture to the concrete and on adjustment of the concrete mix proportions to meet changing job conditions.

F. Where the Contractor finds it impractical to employ fully the recommended procedures for hot weather concreting, the Engineer may at his discretion require the use of a set retardant admixture for mass concrete 2.5 feet or more thick and for all concrete whenever the temperature at the time concrete is cast exceeds 80 degrees F. The admixture shall be selected by the Contractor subject to the review of the Engineer. The admixture and concrete containing the admixture shall meet all the requirements of these specifications. Preliminary tests of this concrete shall be required at the Contractor's expense.

G. When more than one admixture is used, all admixtures shall be compatible. They should preferably be by the same manufacturer.

H. Calcium chloride will not be permitted as an admixture in any concrete.

I. Water-reducing, non chloride, accelerators shall conform to ASTM C494 Type E and shall be Accelguard 80 by the Euclid Chemical Company or an approved equal.

2.06 WATER

The water for concrete shall be clean, fresh, and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

2.07 AGGREGATES

A. Fine aggregates shall be natural and having clean, hard, uncoated grains, and shall be free from injurious amounts of clay, dust, organic matter or other deleterious substances, and shall conform to ASTM C-33. Sand shall be graded as follows:

	Percent
Passing 3/8 Inch Sieve	100
Passing No. 4 Sieve	90-100
Passing No. 16 Sieve	45-80
Passing No. 50 Sieve	5-25
Passing No. 100 Sieve	0-8

B. Coarse aggregate shall be crushed stone having clean, hard, uncoated particles, and shall be free from injurious amounts of soft, friable, thin, elongated or laminated pieces. Coarse aggregates shall conform to ASTM C-33 and shall be graded in accordance with the following:

	Percent by Weight No. 57
Passing 1-1/2-Inch Square Sieve	100
Passing 1-Inch Square Sieve	95-100
Passing 3/4-Inch Square Sieve	
Passing 1/2-Inch Square Sieve	25-60
Passing 3/8-Inch Square Sieve	
Passing No. 4 Square Sieve	0-10
Passing No. 8 Square Sieve	0-5

Refer to Section 3.6 of ACI 301-84 for maximum size of coarse aggregate.

2.08 AGGREGATES AND DETERMINING PROPORTIONS

A. No concrete shall be used in the work until the materials and mix designs have been tested by the testing laboratory and accepted by the Engineer.

B. The Engineer shall have the right to order changes as may be necessary to meet the specified requirements.

C. If concrete of the required characteristics is not being produced as the work progresses, the Engineer may order such changes in proportions or materials, or both, as may be necessary to secure concrete of the specified quality. The Contractor shall make such changes at his own expense and no extra compensation will be allowed because of such changes.

2.09 MIXING

All central plant and rolling stock equipment and methods shall conform to the Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers' Bureau of the National Ready Mixed Concrete Assn., as well as the ACI Standards for Measuring, Mixing, Transporting, and Placing Concrete ACI 304R-89, and with the ASTM specification for Ready Mixed Concrete, Designation C94-89b.

PART 3 - EXECUTION

3.01 PLACING AND COMPACTING CONCRETE

A. At least 20 hours before the Contractor proposed to make any placement of concrete, he shall notify the Engineer of his intention and planned procedure. Unless otherwise planned, the work shall be so executed that a section begun on any day shall be completed during daylight of the same day.

B. Ready mixed concrete shall be transported to the site in watertight agitator or mixer trucks. The quantity of concrete to be mixed or delivered in any one batch shall not exceed the rated capacity of the mixer or agitator for the respective conditions as stated on the nameplates.

C. Information necessary to calculate the total mixing water shall be recorded on the delivery slip for the Engineer's information. Total mixing water includes free water on the aggregates, water and ice batched at the plant, and water added by the truck operator. The Contractor must request permission to add water at the job site from the ready mix plant and the engineer. When the addition of water is permitted, the quantity added shall be the responsibility of the Contractor and in no case shall the total water per bag of cement exceed that determined by the designed mix. Mixing and discharge time shall be as recommended in ACI-304.

D. Concrete, which has become compacted or segregated during transportation to or on the site of the work, shall be satisfactorily remixed just prior to being placed in the forms.

E. Partially hardened concrete shall not be deposited in the forms. The retempering of concrete, which has partially hardened (that is, the remixing of concrete with or without additional cement, aggregate, or water) will not be permitted.

F. The concrete shall be mixed only in the quantity required for immediate use. Concrete that has developed an initial set shall not be used. The Contractor shall have sufficient plant capacity and transporting apparatus to insure continuous delivery at the rate required.

G. The temperature of the concrete mixture immediately before placement shall be between 50 degrees F and 90 degrees F.

H. Concrete that is truck mixed or transported in truck mixers or truck agitators shall be delivered to the site of the work and discharge completed in the forms within 1-1/2 hours or before the drum has revolved 300 revolutions whichever comes first after the introduction of the mixing water to the cement and aggregates, or the introduction of the cement to the aggregates. When the concrete temperature exceeds 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed in the forms within 15 minutes after discharge from the mixer at the job site.

I. If concrete is placed by pumping, no aluminum shall be used in any parts of the pumping system, which contact or might contaminate the concrete. Aluminum chutes and conveyors shall not be used.

J. No concrete shall be placed on frozen subgrade or in water, or until the subgrade, forms, and preliminary work have been accepted. No concrete shall be placed until all materials to be built into the concrete have been set and have been accepted by the various trades and by the Engineer. All such materials shall be thoroughly clean and free from rust, scale, oil, or any other foreign matter.

K. Forms and excavations shall be free from water and all dirt, debris, and foreign matter when concrete is placed. Except as otherwise directed, wood forms and embedded wood called for or allowed shall be thoroughly wetted just prior to placement of concrete.

L. Chutes for conveying concrete shall be metal or metal lined and of such size, design and slope as to ensure a continuous flow of concrete without segregation. The slope of chutes shall have approximately the same slope. The discharge end of the chute shall be provided with a baffle, or if required, a spout and the end of the chute or spout shall be kept as close as practicable to, but in no event more than 5 ft. above the surface of the fresh concrete. When the operation is intermittent, the chute shall discharge into a hopper.

M. In thin sections of considerable height (such as walls and columns), concrete shall be placed in such manner as will prevent segregation and accumulations of hardened concrete on the forms or reinforcement above the mass of concrete being placed. To achieve this end, suitable hoppers spouts with restricted outlets, etc. shall be used as required or permitted unless the forms are provided with suitable openings.

N. Chutes, hoppers, spouts, etc. shall be thoroughly cleaned before and after each run and the water and debris shall not be discharged inside the form.

O. For any one placement, concrete shall be deposited continuously in layers of such thickness that no concrete will be deposited on concrete, which has hardened sufficiently to cause the formation of seams and planes of weakness within the section, and so as to maintain until the completion of the unit, an approximately horizontal plastic surface.

P. No wooden spreaders shall be left in the concrete.

Q. During and immediately after being deposited, concrete shall be thoroughly compacted by means of suitable tools and methods, such as internal type mechanical vibrators operating at not less than 5,000 rpm. or other tool spading to produce the required density and quality of finish. Vibration shall be done only by experienced operators under close supervision and shall be carried in such manner and only long to produce homogeneity and optimum consolidation without permitting segregation of the solid constituents, "pumping" of air, or other objectionable results.

All vibrators shall be supplemented by proper spade puddling approximately 2 to 3 in. away from forms to remove included bubbles and honeycomb. Excessive spading against the forms, causing the deposition of weak mortar at the surface shall be avoided.

R. The concrete shall be thoroughly rodded and tamped about embedded materials so as to secure perfect adhesion and prevent leakage. Care shall be taken to prevent the displacement of such materials during concreting.

S. The distance between construction joints shall not exceed 25 feet for all concrete construction and not less than 48 hours shall elapse between casting of adjoining units unless these requirements are waived by the Engineer. Provision shall be made for jointing successive units as indicated or required. Where joints are not shown on the Drawings, they are required to be made at a spacing of approximately 25 feet. Additional construction joints required to satisfy the 25 foot spacing shall be located by the Contractor subject to the review of the Engineer. The Contractor shall submit for review Drawings separate from the steel reinforcing Drawings, showing the location of all proposed construction joints. All construction joints shall be prepared for bonding as specified in 301 and Section 3.02 Bonding Concrete at Construction Joints. Joints in walls and columns shall be maintained level.

T. All subgrades of building slabs shall be covered with a 6 m.1 minimum thickness polyethylene sheet with joints lapped a minimum of 12 inches unless otherwise required or permitted.

3.02 BONDING CONCRETE AT CONSTRUCTION JOINTS

A. In order to secure full bond at construction joints, the surface of the concrete previously placed (including vertical, inclined, and substantially horizontal areas) shall be thoroughly cleaned at foreign materials and laitance, if any.

B. The previously placed concrete at the joint shall be damp but free of standing water. The surface shall be prepared as per ACI 301. The referenced cement grout shall be between 1 and 2 inches thick on all wall pours.

C. Waterstops shall be used on all construction joints below water level within the Plant. See Paragraph 3.06 - Watertightness.

3.03 CURING AND PROTECTION

A. All concrete, particularly slabs and including finished surfaces, shall be treated immediately after concreting or cement finishing is completed, to provide continuous moist curing for at least seven days, regardless of the adjacent air temperature. Walls and vertical surfaces may be covered with continuously saturated burlap, or kept moist by other acceptable means. Horizontal surfaces, slabs, etc., shall be ponded to a depth of 1/2" wherever practicable, or kept continuously wet by the use of lawn sprinklers, a complete covering of continuously saturated burlap, or by other acceptable means.

B. For at least seven days after having been placed, all concrete shall be so protected that the temperature at the surface will not fall below 45 degrees F. The methods of protecting the concrete shall be as specified in that section of the General Specifications titled "Precautions During Adverse Weather" and shall be subject to the review of the Engineer.

C. No manure, salt, or other chemicals shall be used for protection.

D. The above mentioned 7 day periods may be reduced if compression tests, in accordance with ASTM C-39, on field cured cylinders indicate that expected 7 day strength gain has been achieved, and approval is granted by the Engineer.

E. Wherever practicable, finished slabs shall be protected from the direct rays of the sun to prevent checking and crazing.

3.04 TRIMMING AND REPAIR OF SURFACE DEFECTS

A. The Contractor shall use suitable forms, mixture of concrete, and workmanship so that concrete surfaces, when exposed, will require no patching. Concrete, which, in the opinion of the Engineer has excessive honeycomb, aggregate pockets, or depressions, will be rejected and the Contractor shall, at his own expense remove the entire section containing such defects and replace it with acceptable concrete.

B. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed, recesses left by the removal of form ties shall be filled and surface defects, which do not impair structural strength, shall be repaired.

C. Defective concrete shall be cut perpendicular to the surface until sound concrete is reached, but not less than 1" deep. The remaining concrete shall be thoroughly roughed and cleaned. Concrete in an area at least 6" wide surrounding the area to be patched shall be dampened. A bonding grout shall be prepared using a mix of approximately 1 part cement to 1 part fine passing a No. 30 mesh sieve, mixed to the consistency of thick cream, and then well brushed into the surface.

D. The patching mixture shall be made of the same materials and approximately the same proportions as used for the concrete except that the course aggregate shall be omitted and the mortar shall consist of not more than 1 part cement to 2-1/2 parts sand by damp loose volume. White portland cement shall be substituted for a portion of the gray portland cement on exposed concrete in order to produce a color matching the color of the surrounding concrete. The quantity of mixing water shall be no more than necessary for handling and placing. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.

E. After surface water has evaporated from the area to be patched, the bond coat shall be well brushed into the surface. When the bond coat begins to lose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, it shall be left undisturbed for at least 1 hour before being finally finished. The patched area shall be kept damp for 7 days. Metal tools shall not be used in finishing a patch in a formed wall, which will be exposed.

F. After being cleaned and thoroughly dampened, the tie holes shall be filled solid with patching mortar.

G. The use of mortar patching as above specified shall be confined to the repair of small defects in relatively green concrete. If substantial repairs are required, the defective portions shall be cut out to sound concrete and the defective concrete replaced by means of gunite, or the structure shall be taken down and rebuilt, all as the Engineer may decide or direct.

3.05 FINISHES

A. Exposed to View Concrete Surfaces:

1. All concrete exposed to view in the completed structures shall be produced using materials and workmanship to such quality that only nominal finishing will be required.

The provisions of paragraphs 13.3, 13.4, and 13.6 of ACI 301 shall apply to all exterior exposed to view concrete surfaces, including the outside surfaces of tanks.

2. All formed, exterior, exposed to view, concrete shall be prepared as paragraph 3.04 B, then rubbed. Exterior vertical surfaces shall be rubbed to one foot below grade. Interior vertical surfaces of dry pits shall not be rubbed. Interior vertical surfaces of open topped liquid containers shall be rubbed to one foot below the minimum liquid level that will occur during normal operations. Walls inside a building shall not be rubbed. Overhead slabs (exterior or interior) shall not be rubbed.

B. All vertical surfaces below minimum liquid level in liquid containing structures and all other surfaces that are not be rubbed shall have a smooth form finish.

C. All smooth form concrete vertical surfaces shall be true plane within 1/4" in 10 feet as determined by a 10 foot straight edge place anywhere on the surface in any direction. Abrupt irregularities shall not exceed 1/8".

D. Basin, flume, conduit and tank floors shall have a "troweled" finish unless shown otherwise on Drawings.

E. Weirs and overflow surfaces shall be given a troweled finish.

F. Exterior platforms, steps and landings shall be given a broom finish. Broom finish shall be applied to surfaces, which have been steel troweled to an even smooth finish. The troweled surface shall then be broomed with a fiber bristle brush in the direction transverse to that of the main traffic.

G. Walking surfaces of slabs shall have a troweled finish unless shown otherwise on Drawings.

H. Nox-Crete Harbeton, Chem Hard by L & M Construction Chemicals, Lapidolith by Sonneborn hardener treatment, or an approved equal shall be applied to all exposed concrete floors in occupied spaces. The floors shall be thoroughly cured, cleaned, and perfectly dry with all work above them completed. The hardener shall be applied evenly and freely and in conformance with manufacturer's instructions, using not less than 3 coats, allowing 24 hours between coats. One gallon of hardener shall cover not more than 100 square feet. After the final coat is completed and dry, surplus hardener shall be removed from the surface of the concrete by scrubbing and mopping with water.

3.06 WATERTIGHTNESS

A. The structures, which are intended to contain liquids and/or will be subjected to exterior hydrostatic pressures shall be so constructed that when completed and tested, there shall be no loss of water and no wet spots shall show.

B. As soon as practicable after the completion of the structures, the Contractor shall fill them with water and if leakages develop or wet spots show, the Contractor shall empty such structures and correct the leakage in an approved manner. Any cracks, which appear in the concrete, shall be dug out and suitably repaired. Temporary bulkheads over pipe openings in walls shall be provided as required for the testing.

C. After repairs, if any are required, the structures shall be tested again and further repaired if necessary until satisfactory results are obtained. All work in connection with these tests and repairs shall be at the expense of the Contractor.

D. Pipes shall not be poured or solidly grouted in concrete walls or floors unless fixations are indicated on the Project Drawings, for example as anchorage to resist pipe thrusts, unless otherwise required or permitted.

E. At wall and slab penetrations, openings shall be formed approximately 1 inch greater than the OD of the pipe. For openings 10 inches and less in diameter, openings may be cored if permitted by the Engineer before pouring wall or slab so that extra reinforcing steel can be accurately located and referenced to avoid the subsequent core hole, unless otherwise required or permitted. After pipe placement and alignment adjustment, the annular space between opening and outside of pipe shall be packed with dry braided hemp (or unbraided where pipe does not center in openings) to within 2 inches of the wall or slab surface. The 2-inch deep annular spaces shall be packed with non-shrink grout or caulked as required or permitted with materials specified in Division 7 of these Specifications and in strict accordance with the material manufacturers' instructions.

F. Sleeves shall be cast in floors and walls for penetrations of small pipe, cut and fitted on the job, such as steel, wrought iron, copper, plastic and rubber pipe and hoses. Unless otherwise required or permitted, sleeves shall be steel, cast iron or plastic or about 1 inch greater ID than the OD of the pipe and shall be flush with wall and slab surfaces. The annular space between sleeve and outside of pipe shall be packed and grouted or caulked as previously described, except the joint depth shall be 1 inch and, if required or permitted, hemp packing may be replaced with backer rod and joint sealant according to Division 7 of these Specifications. Penetrations may be made by coring according to previously described requirements if permitted by the Engineer.

G. Where openings larger than 10 inches in diameter are required for pipe penetrations in existing walls and slabs, the opening shall be made approximately 2 inches to 4 inches larger in diameter than the pipe OD. The pipe shall be wrapped with 1/2-inch braided hemp and positioned in the opening. The space between the hemp and the opening shall be solidly packed with non-shrink grout previously described, after application of a bonding adhesive to the opening surfaces. The grout shall be finished flush with wall and floor surfaces. After the grout has hardened sufficiently, hemp shall be removed to 2-inch depths on each side of walls and slabs and the resulting annular spaces shall be packed with non-shrink grout or caulked as required or permitted, as previously described.

H. All joints around pipe shall be watertight unless otherwise required or permitted.

I. The top surface of all concrete decks (except slabs on grade) shall be coated with Sikagard-70 water-repellent penetrating sealer as manufactured by the Sika Corporation, Nox-Crete Stifel, or another approved equal. The manufacturer's recommendations shall be followed in all areas of application.

3.07 EQUIPMENT PADS

Unless otherwise shown or directed, all pumps, other equipment, and items such as lockers, motor control centers and the like, shall be installed on concrete bases. The bases shall be constructed to the dimensions shown on the plans or as required by the equipment manufacturer to meet plan elevations. Where no specific footprint or elevation are required, the bases shall be 6" thick and shall extend 6" outside the metal equipment base. In general, the concrete bases shall be placed up to 1" below the metal base. The equipment shall then be properly shimmed to grade and the 1" void filled with nonshrink grout. Prior to the final set of the grout, it shall be cut back and the edge plastered with 1:2 cement mortar.

- END OF SECTION -

SECTION 03600

PRECISION GROUTING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provided all labor, material, equipment and services required for grouting of equipment, machinery, structural steel, handrails, anchor bolts and other items or work for which grouting is specified or required. All unnecessary holes, openings and cracks in existing concrete shall be filled and patched.

B. The object of these Specifications is to obtain grout which can be mixed to a flowable consistency (i.e., thinner than plastic consistency), placed in leakproof forms, with a minimum of strapping, without bleed water exceeding specification requirements. The requirement of 24 hour presoak of existing concrete is of prime importance and must be adhered to.

1.02 DESCRIPTION OF WORK

A. High strength, precision support of machine bases and soleplates, setting anchor bolts.

B. Work includes providing a non-shrink, ready-to-use, fluid precision grout material; proportioned, pre-mixed and packaged at the factory; delivered to the job site to place with only the addition of water; forming, placing and curing as specified in this section.

1.03 RELATED WORK

A. Section 03310 - Structural Concrete.

B. Review all divisions and sections for equipment, machinery and other items to be grouted.

1.04 QUALITY ASSURANCE

Comply with the following codes, standard, test and recommended practices for foundation concrete as apply to precision grouting.

A. ACI 304 "Guide for Measuring, Mixing, Transporting and Placing Concrete".

B. ACI 305 "Hot Weather Concreting".

C. ACI 306 "Cold Weather Concreting".

D. ACI 347 "Guide to Formwork for Concrete".

E. ASTM C-91 - Standard Test Method for Time of Set of Hydraulic Cement by Vicat Needle.

F. ASTM C-827 - Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.

G. Manufacturer's Information on Use of Grout.

H. Corps of Engineers CRD C-621 Corps of Engineers Specification for Nonshrink Grout.

I. ASTM C 109 "Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.

1.05 SUBMITTALS

A. The Contractor shall submit to the Engineer prior to installation, manufacturer's literature and certified test data that material complies with the requirements of these specifications.

PART 2 - PRODUCTS

2.01 GROUT

Cement-based grouts must have a minimum 15 year history of use and meet the following performance requirements at maximum water content. They must not contain expansive cement or metallic particles such as aluminum powder or iron fillings.

A. Plastic Volume Change: The grout shall show no shrinkage (0.0%) and a maximum 4.0% expansion from time of placement until final set when tested according to ASTM C-827.

B. Hardened Volume Change: The grout shall show no shrinkage (0.0%) and a maximum 0.2% expansion in the hardened state when tested according to CRD C-621.

C. Compressive Strength: The grout shall show a minimum of 28-day compressive strength of 5,000 psi when tested according to ASTM C 109, restrained.

D. Creep: The grout shall show creep equal to or less than .6 in./in. x 10^{-3} at 70EF for a minimum of one year when tested according to CPR Creep Test (extrapolated data is not acceptable).

E. Working Time: The grout shall show a consistency greater than 125% for a minimum 45 minutes when tested according to applicable consistency sections of ASTM C 827 at 15 minutes intervals.

F. Tests: Upon request of the Engineer, the Cylinder Plate Test shall be run on any field shipments.

2.02 WATER

Water shall be potable.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect concrete surfaces to receive grout and verify that they are free of ice, frost, dirt, grease, oil, curing compounds, paints impregnations and all loose material or foreign matter likely to affect the bond or performance of the grout.

B. Newly placed concrete shall have been placed and cured sufficiently to attain its design strength.

C. Inspect baseplates for rust, oil, and other deleterious substances.

3.02 PREPARATION

A. In order to ensure proper bond to the baseplate and the concrete, all grease, oil, dirt, curing compounds, laitance and other deleterious materials must be completely removed from the concrete and bottom of baseplate.

B. Roughen the surfaces by chipping, sandblasting or other mechanical means to assure bond of the grout to the existing concrete. Loose or broken concrete shall be removed.

C. After concrete surfaces have been washed clean, they shall then be saturated with water for 24 hours prior to placement of cement-based grout.

D. Upon completion of saturation period excess water shall be removed with clean compressed air prior to grouting.

E. Formwork shall be compatible with proposed method of placing grout. Design for rapid, continuous and complete filling of space to be grouted.

1. Build strong, tight forms braced so they will not leak or buckle under weight of fluid grout. On placing side, slant form at 45 degrees angle and pour grout directly on slanted face. On other sides, place form and pour grout directly on slanted face. On other sides, place form 1/2" or more from edge of baseplate and 1" or more higher than underside of the plate.

2. Caulk forms with grouting material being used on inside or a sand-cement mortar outside to prevent leakage and loss of "head". Use expanded polystyrene or other means to caulk between foundation and portions of the baseplate and equipment to seal off areas where grout is not desired.

3.03 INSTALLATION

A. Preparation of grout shall be in paddle-type mortar mixer suitable mechanical mixer. DO NOT MIX BY HAND. Mix according to the manufacturer's recommendations.

B. Mix grout adjacent to area being grouted, have sufficient manpower and equipment available for rapid and continuous mixing and placing. Do not add cement, sand or pea gravel, additives.

C. Avoid a consistency that produces bleeding. Mix materials for a minimum of 3 minutes and not more than 5 minutes and place immediately. Do not retemper. Do not use mixing water with a temperature above 80 degrees F (27 degrees C).

D. Grout shall be placed under environmental conditions acceptable to manufacturer's standards for the product.

E. Placing: Grout may be drypacked, flowed, vibrated or pumped into place. All grouting shall take place from one side of the plate to the other to avoid trapping air.

F. Cutback: Just before the grout has reached its final set, the grout shall be cut back to the lower edge of the bearing or column base plate. A 45 degree angle or vertical cutback shall be used.

G. Curing: The grout shall be kept moist for a minimum of three days. The method needed to protect the grout will depend on temperature, humidity and wind. Wet burlap, a soaker hose, sun shading, ponding and in extreme conditions a combination of methods shall be employed.

H. Field service representative of the manufacturer shall be available during initial planning for installation to suggest recommended procedures and at start of placement for further suggestions. A minimum of three (3) days notice shall be given by the Contractor to the manufacturer prior to use of the product.

-- END OF SECTION --

DIVISION 4

MASONRY

SECTION 04810

UNIT MASONRY ASSEMBLIES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units (CMUs).
2. Decorative concrete masonry units.
3. Mortar and grout.
4. Reinforcing steel.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Miscellaneous masonry accessories.
8. Lead wedges in reglets.

B. Related Sections include the following:

1. Division 7, Section “Sheet Metal Flashing and Trim” for reglets in masonry joints for metal flashing

1.02 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.03 REFERENCES

A. ASTM C129 - Non-Load Bearing Concrete Masonry Units.

B. ASTM C140-81 (1981 Rev.) - Sampling and Testing Concrete Masonry Units. Type I water absorption not to exceed 10.6 lbs./cu. ft.

1.04 CERTIFICATES

A. Submit manufacturer's certificates under provision of Section 01400.

B. Submit manufacturer's certificate that materials meet or exceed specified requirements.

1.05 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths (f’m) at 28 days.

B. Determine net-area compressive strength (f'm) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

C. Determine net-area compressive strength (f'm) of masonry by testing masonry prisms according to ASTM C1314.

1.06 SUBMITTALS

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

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes. Provide custom corner units in exterior walls to conform to wall dimensions shown on drawings.

2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement" Show elevations of reinforced walls.

3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection, For the following:

1. Decorative concrete masonry units, in the form of small-scale units.

2. Colored mortar.

D. Samples for Verification: For each type and color of the following:

1. Exposed concrete masonry units.

2. Pre-faced concrete masonry units.

3. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.

4. Accessories embedded in masonry.

E. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of owners representative and approved in writing.

F. Qualification Data: For testing agency.

G. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.
b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include brand, type, and name of manufacturer.

3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.

4. Grout mixes. Include description of type and proportions of ingredients.

5. Reinforcing bars.

6. Joint reinforcement.

7. Anchors, ties, and metal accessories.

H. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.

2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

I. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

J. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.07 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

D. Preconstruction Testing Service: Owner may engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be

made by Owner. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

1. Concrete Masonry Unit Test: For each type of unit required, per ASTM C 140.

2. Mortar Test (Property Specification): For each mix required, per ASTM C 780.

3. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019.

4. Prism Test: For each type of construction required, per ASTM C 1314.

E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials, workmanship and execution.

1. Build mockup for each type of exposed unit masonry construction at least 48 inches long by 48 inches high. Mockups shall incorporate all items and accessories that make up a complete wall system. Construct mockups in a fashion that allows all items to be viewed for inspection in elevation or cross-section. The mockups shall include but not be limited to the following:

   a. A sealant-filled joint with backer rod, compressible filler, preformed control joint, etc at least 16 inches long.
   b. A masonry linteled opening at least 24-inches wide by 16-inches high.
   c. Reglets and flashing.
   d. Horizontal joint reinforcing, flashing, mortar control device, weeps/vent, control joint, vertical reinforcing with bar positioner, etc.

2. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.

3. Clean one-half of exposed faces of mockups with masonry cleaner indicated.

4. Protect approved mockups from the elements with weather-resistant membrane.

5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

   a. Approval of mockups is also for other material and construction qualities specifically approved by Owner's Representative in writing.
   b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Owner's Representative in writing.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.09 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

2. Where 1 wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.

2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged

by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 PRODUCTS

2.01 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.02 CONCRETE MASONRY UNITS (CMUs)

A. Shapes: Provide shapes indicated and as follows:

1. Provide manufactured special shapes for lintels, corners/square-edged units for outside corners, jambs, sashes, movement joints, bond beams, and other special conditions.

2. Modification of standard units by saw cutting, etc will not be allowed to create manufactured special shapes listed above.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed exterior units.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.

a. Available Products:

1) Addiment Incorporated; Block Plus W-10.
2) Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block.
3) Master Builders, Inc.; Rheopel.
4) Or approved equal.

C. Concrete Masonry Units: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi, unless shown otherwise.

2. Weight Classification: Normal weight, unless otherwise indicated.

3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

4. Exposed Faces: Provide color and texture matching the range represented by the owner's representative selected sample.

D. Decorative Concrete Masonry Units: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.

2. Weight Classification: Normal weight.

3. Size (Width): Manufactured to dimensions specified in "Concrete Masonry Units" Paragraph above.

4. Pattern and Texture:

a. Standard pattern, split-face finish.

5. Color and Texture: Provide decorative concrete units matching existing color range and texture of existing adjacent decorative concrete units at project site.

2.03 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.

D. Masonry Cement: ASTM C 91.

1. Available Products:

a. Lafarge North America Inc.; Lafarge Masonry Cement.
b. Lehigh Cement Company; Lehigh Masonry Cement.
c. National Cement Company, Inc.; Coosa Masonry Cement.
d. Or approved equal.

E. Mortar Cement: ASTM C 1329.

1. Available Products:

a. Lafarge North America Inc.; Lafarge Mortar Cement.
b. Or approved equal.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Available Products:

a. Bayer Corporation, Industrial Chemicals Div.; Bayferrox Iron Oxide Pigments.
b. Davis Colors; True Tone Mortar Colors.
c. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.
d. Or approved equal.

G. Colored Cement Product: Packaged blend made from portland cement and lime, masonry cement or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.

2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.

3. Available Products:

a. Colored Portland Cement-Lime Mix:

1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
3) Lafarge North America Inc.; Eaglebond.
4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
5) Or approved equal.

b. Colored Masonry Cement:

1) Capital Materials Corporation; Flamingo Color Masonry Cement.
2) Essroc, Italcementi Group; Brixment-in-Color.
3) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
4) Lafarge North America Inc.; Florida Custom Color Masonry or Magnolia Masonry Cement.
5) Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
6) National Cement Company, Inc.; Coosa Masonry Cement.
7) Or approved equal.

c. Colored Mortar Cement:

1) Lafarge North America Inc.; Magnolia Superbond Mortar Cement.
2) Or approved equal.

H. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

2. For joints less than ¼ inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

3. White-Mortar Aggregates: Natural white sand or crushed white stone.

4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

I. Aggregate for Grout: ASTM C 404.

J. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Available Products:

a. Addiment Incorporated; Mortar Kick.
b. Euclid Chemical Company (The); Accelguard 80.
c. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset.
d. Sonneborn, Div. of ChemRex; Trimix-NCA.
e. Or approved equal.

K. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with exposed exterior concrete masonry units, containing integral water repellent by same manufacturer.

1. Available Products:

a. Addiment Incorporated; Mortar Tite.
b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
c. Master Builders, Inc.; Color Cure Mortar Admix or Rheomix Rheopel.
d. Or approved equal.

L. Water: Potable.

2.04 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951.

1. Interior Walls: Hot-dip galvanized, carbon steel.

2. Exterior Walls: Hot-dip galvanized, carbon steel.

3. Wire Size for Side Rods: W1.7 or 0.148-inch diameter.

4. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.

5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.

6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

1. Hohmann and Barnard, Inc.: # 220 or # 120

2. Durowall: DA3100 or DA3200.

3. Or approved equal.

2.05 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with subparagraphs below, unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.

2. Galvanized Steel Sheet: ASTM A 653, Commercial Steel, G60 zinc coating.

3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153.

4. Steel Plates, Shapes, and Bars: ASTM A 36.

B. Corrugated Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from steel sheet, galvanized after fabrication not less than 0.043 inch.

C. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

D. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.

2. Where wythes do not align or are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.

3. Wire: Fabricate from 3/16-inch-diameter, hot-dip galvanized steel wire.

E. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.188-inch-diameter, hot-dip galvanized steel wire.

F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins, unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153.

2.06 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of dimensions indicated.

B. Post-installed Anchors: Provide torque-controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or

grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).

2.07 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing**,** where flashing is exposed or partly exposed, complying with SMACNA's "Architectural Sheet Metal Manual and as follows:

1. Copper: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet, 10-oz./sq. ft. weight or 0.0135 inch thick for fully concealed flashing; 16-oz./sq. ft.weight or 0.0216 inch thick elsewhere.

2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.

B. Flexible Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:

1. Copper-Laminated Flashing: 7-oz./sq. ft. copper sheet bonded with asphalt between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

a. Available Products:

1) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
2) York Manufacturing, Inc.; York Copper Fabric Flashing.
3) Or approved equal.

C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.08 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation 2AA-805 or PVC, complying with ASTM D 2240, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated. QS-8 Quadra-seal rubber control joint by Hohmann & Barnard, or equal.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.

1. Products:

    a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
    b. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
    c. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.
    d. Or approved equal.

2.09 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Available Manufacturers:

    a. Diedrich Technologies, Inc.
    b. EaCo Chem, Inc.
    c. ProSoCo, Inc.
    d. Or approved equal.

2.10 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

2. Limit cementitious materials in mortar to portland cement, and lime.

3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type S.

2. For reinforced masonry, use Type S.

3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match existing mortar color.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.

2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

F. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

2.11 SOURCE QUALITY CONTROL

A. Owner may engage a qualified independent testing agency to perform source quality-control testing indicated below:

1. Payment for these services will be made by Owner.

2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

B. Concrete Masonry Unit Test: For each type of unit furnished, per ASTM C 140.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

2. Verify that foundations are within tolerances specified.

3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

F. Mix units from several pallets or cubes as they are placed.

G. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

H. For Masonry Construction: Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet or ¼ inch in 20 feet maximum.

2. For vertical alignment of exposed head joints, do not vary from plumb by more than ¼ inch in 10 feet maximum.

3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet or ¼ inch in 20 feet maximum.

4. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

3.03 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.

3.04 MORTAR BEDDING AND JOINTING

A. Lay hollow brick and concrete masonry units as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.

2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.

3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.

4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes, other than paint, unless otherwise indicated.

3.05 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, ½ inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.

2. Space reinforcement not more than 8 inches o.c. in parapet walls.

3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

a. Reinforcement above is in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, control joints, pipe enclosures, and other special conditions.

3.06 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:

1. Install preformed control-joint gaskets designed to fit standard sash block.

C. Form expansion joints in brick made from clay or shale as follows:

1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 7 Section.

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 7 Section, but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.07 LINTELS

A. Install masonry lintels where and as indicated.

B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.08 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows, unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

2. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.

3. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.09 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.10 FIELD QUALITY CONTROL

A. Inspectors: Owner may engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

B. Testing Agency: Owner may engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:

1. Payment for these services will be made by Owner.

2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

D. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.

E. Mortar Test (Property Specification): For each mix provided, per ASTM C 780.

F. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

3.11 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.

3. Protect adjacent non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.12 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

-- END OF SECTION --

DIVISION 5

METALS

SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes structural steel, as shown on the Contract Drawings, complete including framing members, base and anchor plates, connections, grouting under base and anchor plates, fabrication, delivery and installation.

1.02 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements are specified herein:

1. American Society for Testing and Materials (ASTM)

    a. ASTM A36 - Angles, plates and threaded rods.
    b. ASTM A992, Grade 50 - Structural Steel.
    c. ASTM A53 - Pipe, steel, black and hot-dipped, zinc-coated welded and seamless.
    d. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.
    e. ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
    f. ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.
    g. ASTM A325 - High Strength Bolts for Structural Steel Joints.
    h. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
    i. ASTM F1554 - Anchor Bolts

2. American Welding Society

    a. AWS A2.0 - Standard Welding Symbols.
    b. AWS D1.1 - Structural Welding Code.

3. American Institute of Steel Construction

    a. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

4. SSPC - Steel Structures Painting Council.

1.03 QUALITY ASSURANCE

A. Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity

to fabricate structural steel without delaying the Work. Fabricator shall have AISC Category I, II or III Quality Certification.

C. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Specification for Allowable Stress Design of Single-Angle Members."

2. AISC's "Seismic Provisions for Structural Steel Buildings."

3. AISC's "Specification for the Design and Erection of Structural Steel for Buildings."

a. Connections, unless noted otherwise in the Contract Documents, shall be properly designed for the end loads indicated on the Contract Drawings. Shop standards shall be used to the largest extent possible.

b. Design connections not detailed on the Contract Drawings under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State of Georgia.

4. ASTM A 6 "Specification for General Requirements for Rolled Steel Plates, Shapes, and Bars for Structural Use."

5. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Professional Engineer shall be a licensed engineer legally authorized to practice in the State of Georgia and who is experienced in providing engineering services of the kind indicated. Engineering services are defined, as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.

E. Comply with applicable provisions of AWS D1.1 "Structural Welding Code – Steel."

F. Owner shall employ the services of a special inspector to provide special inspections of the structural steel work in accordance with Section 1704.3 of IBC 2003.

1.04 PERFORMANCE REQUIREMENTS

A. Engineer structural steel connections required by the Contract Documents to be selected or completed by the fabricator to withstand the design load for the size and length of the members indicated on the Contract Drawings.

B. Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.

1.05 SUBMITTALS

A. In addition to those submittals identified in the General Provisions, the following items shall also be submitted:

B. Product data for each type of product indicated.

C. Shop drawings showing fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.

3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical, high-strength bolted connections.

D. Manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualifications within the previous 12 months.

E. Mill test reports signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.

2. Bolts, nuts, and washers including mechanical properties and chemical analysis.

3. Shop primers.

4. Nonshrink grout.

1.06 FIELD MEASUREMENTS

A. Verify that field measurements are as shown on Contract Drawings.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver structural steel to project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.

2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.08 SEQUENCING

A. Supply anchorage items to be embedded in, or attached to, other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Not applicable

2.02 MATERIALS AND CONSTRUCTION

A. Structural steel members, except for angles, plates, anchor bolts and threaded rods shall comply with ASTM A992, Grade 50, high strength steel.

B. Steel angles, plates and threaded rods shall comply with ASTM A36, carbon steel.

C. Anchor bolts shall comply with ASTM F1554, Grade 36 minimum.

D. Pipe shall comply with ASTM A53, Grade B.

E. Bolts, nuts, and washers shall meet ASTM A325.

F. Welding materials shall meet AWS D1.1, type required for materials being welded.

G. Grout shall be a non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water-reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days.

H. Primer shall be fast curing, lead and chromate free, universal primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS-TT-P-664. Primer shall be compatible with finish paint system.

2.03 FABRICATION

A. Fabricate and assemble in shop to greatest extent possible. Fabricate items according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC specifications referenced in this section, and as indicated on final shop drawings.

1. Provide cambered structural-steel members where indicated.

2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.

3. Mark and match-mark materials for field assembly.

4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

5. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.

6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

B. Perform thermal cutting by machine to greatest extent possible. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Accurately finish ends of columns and other members transmitting bearing loads.

E. Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning. Drill holes in bearing plates.

2. Weld threaded nuts to framing and other specialty items indicated to receive other work.

F. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure, free of marking, burns and other defects.

2.03 FINISH

A. Prepare structural component surfaces in accordance with SSPC specifications. Exposed structural steel shall receive a finish paint system.

B. Surface preparation, primer and finish coating shall be as specified in specification Section 09900 Painting.

2.04 SHOP CONNECTIONS

A. Shop-install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

B. Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

C. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

2.04 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

B. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

C. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

D. Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

E. In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.

2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

3. Ultrasonic Inspection: ASTM E 164.

4. Radiographic Inspection: ASTM E 94.

PART 3 EXECUTION

3.01 INSTALLATION

A. Examination

1. Verify that field conditions are acceptable and are ready to receive work.

2. Beginning of installation means erector accepts existing conditions.

B. Setting Bases and Bearing Plates

1. Remove bond-reducing materials from all concrete and masonry bearing surfaces and roughen to improve bond to surfaces. Clean the bottom surface of base and bearing plates.

2. Set loose and attached base plates and bearing plates for structural members or wedges or other adjusting devices. A minimum of 4 anchor bolts shall be used for column base plates.

3. Weld plate washers to top of base plate.

4. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.

5. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Erection

1. Allow 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.

2. Erect structural steel accurately in locations and to elevations indicated and according to AISC specs referenced in this section.

3. Field weld components indicated on Contract Drawings. Components shall be free of primer and paint prior to field welding.

4. Do not field cut or alter structural members without prior approval from Owner.

5. After erection, prime welds, abrasions, and surfaces not shop primed except surfaces to be in contact with concrete.

6. Level and plumb individual members of structures within specified AISC tolerances.

3.02 FIELD CONNECTIONS

A. Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

B. Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC specifications referenced in this section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

a. Grind butt welds flush.
b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.03 FIELD QUALITY CONTROL

A. Owner will engage a special inspector to perform special inspections in accordance with Section 1704.3 of IBC 2003.

B. Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Field welds will be visually inspected according to AWS D1.1.

1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.04 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Cleaning and touchup painting are specified in specification Section 09900 Painting.

- - END OF SECTION - -

SECTION 05520

MISCELLANEOUS METAL

PART 1 - GENERAL

1.01 SCOPE OF WORK

Furnish all labor, materials, and equipment required to construct and install miscellaneous metal and metal fabrications as shown on the Drawings and specified herein. Included in this section are handrails, nuts, bolts, anchors, miscellaneous framing and supports.

1.02 RELATED WORK NOT INCLUDED

A. Concrete work is included in Division 3.

B. Flashing and sheet metal work is included in Division 7

C. Painting is included in Division 9.

1.03 COORDINATION OF WORK

Coordinate with all other trades and sections of these Specifications whose work connects to, or is affected by, work under this Section. Obtain templates or drawings from suppliers of connecting items for proper size and locations of drilling, clip angles and other anchorage requirements.

1.04 QUALITY ASSURANCE

A. All fabricated materials shall be of the highest quality, free of structural, handling, and workmanship defects.

B. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. All work under this section shall be governed by:

1. Aluminum Construction Manual, Section 1, Specifications for Aluminum Structures - the Aluminum Association 1982.

2. All welding shall conform to the latest code of the American Welding Society.

D. Aluminum work shall be fabricated in a shop where the quality of work is in accordance with the highest standards for work of this type. All work shall be executed by mechanics skilled in the fabrication of aluminum, and shall be true to detail with sharp, clean profiles, fitted with proper joints and intersections and with finishes as specified.

E. Fastening shall be concealed where practicable. Thickness of metal and details of assembly and supports shall give ample strength and stiffness. Joints exposed to weather shall be formed to exclude water. Provide holes and connections for the work of other trades.

1.05 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.

3. The general design and dimensions of the miscellaneous metal work are indicated on the drawings, but the Contractor shall be responsible for the correctness of the details and dimensions of the finished articles. He shall verify conditions at the job before fabrication and coordinate the work with that of all other trades to prevent interference.

B. Samples: 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.

1.06 MEASUREMENTS AND FITTINGS

A. Obtain measurements of all work required to be accurately fitted, at the job and not from the drawings. The Contractor will be responsible for the accuracy of all such measurements and the precise fitting and assembly of the finished product. Coordinate work with that of all other trades to prevent interferences. Verify conditions at the job before fabrication.

B. Wherever possible, all parts shall be formed, cut, drilled, tapped, welded, fitted, assembled or otherwise fabricated in the shop, ready for erection.

PART 2 - PRODUCTS

2.01 ALUMINUM

A. Aluminum work shall be fabricated of plates, rolled or extruded shapes, sheets or castings conforming (unless otherwise permitted or indicated) to the following alloy and temper designations of the Aluminum Association:

1. Structural rolled or extruded shapes 6601-T6.

2. Extruded shapes 6063-T6.

3. Plates 6061-T6.

4. Castings 214.

5. Sheets 3003-F.

6. Bolts and nuts 2024-T4.

7. Pipe Railings 6063-T6.

B. The Contractor shall furnish the Engineer with mill certificates and a signed statement from the fabricator that all aluminum work furnished is of the proper alloys, as specified above.

C. All structural and miscellaneous aluminum shall be Alloy 6061 (Alloy 6063 for extrusions), Temper T6, unless otherwise noted, indicated or accepted by the Engineer.

D. Aluminum fabrication shall be in accordance with ASCE the Aluminum Association "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 rods and electrodes shall be in strict accordance with above specifications.

E. Where anodic coating is required and type is not specified or shown on the Drawings, coating shall be Class I, A44 integral color, to be selected by Architect. Anodic coatings shall conform to the following requirements:

1. Class I Anodized Coatings:

   a. The finish shall meet quality requirements of AAMA 611-89.

   b. The coating shall be continuous, uniform in appearance and free from powdery areas.

   c. Class I coating minimum of 0.7 mil thickness.

   d. Remove any factory applied protection films immediately after installation.

   e. Provide 20-year warranty.

2. Clear Anodic Coatings (Where Indicated): 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).

2.02 HANDRAILS

A. General

1. All handrail components and systems shall meet applicable federal and state regulations.

2. All handrails shall be the standard aluminum pipe 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 flush 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. Design as inside fittings.

C. Performance (OBBC/BOCA)

1. Handrail design and construction: Handrails shall be designed and constructed for a concentrated load of 200 pounds (91 kg) applied at any point and in any direction. Handrails shall also be designed and constructed for a uniform load of 50 pounds per foot (74 kg/m) applied in any direction. The concentrated and uniform loading conditions shall not be applied simultaneously.

2. Guardrail system design and construction: Guardrails shall be designed and constructed for a concentrated load of 200 pounds (91 kg) applied at any point and in any direction along the top railing member. Guardrail system shall also be designed and constructed for a uniform load of 50 pounds per foot (74 kg/m) applied horizontally at the required guardrail height and a simultaneous uniform load of 100 pounds per foot (149 kg/m) applied vertically downward at the top of the guardrail. The concentrated and uniform loading conditions shall not be applied simultaneously.

3. In-fill areas: The in-fill area of a guardrail system shall be designed and constructed for a horizontal concrete load of 200 pounds (91kg) applied on a 1-square foot (.093 m^2) area at any point in the system, including intermediate rails or other elements serving this purpose. This loading condition shall not be applied simultaneously with the loading conditions in Section 1109.8.2.

4. The manufacturer shall submit to the Engineer certified test data verifying the strength of his handrail system, (B.O.C.A.) including calculations.

2.03 NUTS AND BOLTS

A. 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 316 stainless steel. All other nuts, bolts, washers and accessories shall be Type 304 stainless steel. Stainless steel nuts, bolts, and washers shall be used to fasten aluminum to all materials including aluminum.

B. Expansion Anchors: All expansion anchors shall be stainless steel wedge type meeting the requirements of Fed. Spec. FF-S-325, Group II, Type 4, Class 1, and shall be Phillips Red Head, Hilti, or equal. The entire anchor (bolt, expansion clip, nut and washer) shall be AISI Type 304 or 316 Series stainless steel, depending on the environment as specified above.

2.04 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. Materials shall be Type 304 or 316 stainless steel, depending on the environment specified in 2.03 A, above.

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.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall be responsible for all errors, omissions, and deviations of the shop drawings from the Drawings 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 locations shown on the Drawings.

D. All members shall be assembled true and without twists or open joists. Holes that are out of match by more than 1/16-inch shall be reamed to the greatest diameter and the proper sized bolt or rivet used.

E. In case members do not properly fit during erection, any new holes which are necessary shall be drilled and material shall be cut where necessary with hack saws or other tools. No work shall be done with burners except by special permission of the Engineer.

F. Painting

1. Cleaning and painting of all fabricated materials shall be in strict accordance with Division 9, of these Specifications.

2. All ferrous metal shall be properly cleaned and given one shop coat of red lead zinc chromate, or other approved rust resisting paint. Anchors that are built into masonry or concrete shall be coated with asphalt paint unless specified to be galvanized. Where galvanized or zinc coated metal is required, it shall not be shop primed unless specifically called for.

G. 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. Areas where the paint has been damaged by abrasion or other cause shall be cleaned and repainted as directed so that the aluminum will have a complete protective paint film when brought into contact with the material against which it is being protected. Before application of coating, the surface shall be cleaned of all dirt, heavy deposits of grease or oil, and other foreign substances and shall be immersed in or swabbed with an acceptable solvent. Next the surfaces shall be rinsed with clear water and thoroughly dried.

4. Where a shop coating of methacrylate lacquer has been specified on aluminum work to protect the surface from stain, the protective coating of lacquer worn off during handling or erection shall be replaced in the field by a new coating of lacquer of the same type.

5. During construction care shall be taken to prevent damage to the aluminum work from splashing or the accumulation of paint, concrete, mortar, or other similar materials.

3.02 FABRICATION AND INSTALLATION OF METAL WORK

A. General: All metal items shall be accurately fabricated and erected with exposed joints close fitting. All joints shall be of such character and so assembled that they will be as strong and rigid as adjoining sections. Joints shall be located where least conspicuous. Items shall have smooth finished surfaces except where otherwise shown or specified.

B. Built-In Items: Members or parts to be built in with masonry or concrete shall be in a form affording a suitable anchorage or shall be provided with approved anchors, expansion shields or other approved means of securing members.

C. Dissimilar Metals: Ferrous and non-ferrous metals shall be insulated at all contacts with felt washers, strips or sheets, bitumastic paints, or other acceptable means.

D. Connections:

1. All required anchors, couplings, bolts, and nut required to support miscellaneous metal work shall be furnished and installed as required.

2. Weights of connections and accessories shall be adequate to safely sustain and withstand stresses and strains to which they will be normally subjected.

3. Connections shall be bolted except where welding is called for in the Drawings. Bolts shall be 3/4" diameter unless noted or required otherwise.

E. Expansion Anchors:

1. Expansion anchors shall be installed in holes drilled into concrete with carbide tipped drill bits conforming to ANSI B94.12-1977, using a rotary impact hammer for ½" and larger anchors, or a hammer drill for 1/4" and 3/8" inch Hole depth shall equal or exceed the anchor manufacturer's minimum recommended embedment. Should hole depth equal anchor manufacturer's minimum recommended embedment, hole shall be cleaned out by air pressure. The minimum hole depth table following serves only as a general guide, anchor manufacturer's recommendations shall govern. Contractor shall assure hole is perpendicular and conforms in size to anchor manufacturer's recommendation.

2. Washer and nut shall be assembled on anchor so that the top of the nut is flush with the top of the anchor. Then the anchor shall be driven into the hole through the work until the washer bears against the work. The anchor shall be expanded in accordance with the manufacturer's recommendations. Edge and end distances and spacing of anchor table hereinafter, shall be complied with.

3.03 WELDING

Welding procedures, welders and welding operators, both for shop and field welding, shall be qualified and certified in accordance with the requirements of AWS D1.1 "Welding in Building Construction" of the American Welding Society. Manufacturer's and fabricator's shop drawings shall clearly show complete information and Contractor shall perform all field welding in conformance with this information regarding location, type, size and length of all welds, all in accordance with AWS A2.0 "Standard Welding Symbols" of the American Welding Society. Special conditions shall be fully explained by notes and details.

3.04 MISCELLANEOUS METAL FABRICATIONS

Rough Hardware: Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 sections.

Fabricate items to sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

3.05 HANDRAILS

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 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 unspliced lengths between posts 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

1. To prevent excessive stresses and misalignment in standard aluminum handrail systems, expansion 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 coefficients of expansion of 0.000013 inch/°F or 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'-00" on centers for steel. Where it is known 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	
Temperature (°F) at Time of Installation	Aluminum Railing with Expansion Joints on 24'0" Centers
20 to 0	1/2"
0 to 20	7/16"
20 to 35	3/8"
35 to 50	5/16"
50 to 70	1/4"
70 to 90	3/16"
90 to 120	1/8"

3.07 NUTS AND BOLTS

A. 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.

B. Damaged galvanized surfaces on nuts and bolts shall be repaired according to Article 2.04, this Section.

3.08 CONCRETE ANCHORS

A. Concrete anchors shall be installed strictly in accordance with manufacturer's printed instructions which shall be available on the job site.

B. Refer to Division 15 for supporting small pipe.

- END OF SECTION -

DIVISION 6

WOOD AND PLASTICS

SECTION 06100

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

Definition: 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 the following where applicable and as detailed or indicated on the Drawings:

A. Erection and construction of project sign as shown on detail in Section 01580 – Project Identification and Signs.

B. Wood framing, plates, and fascias.

C. Wood grounds, nailers, blocking and sleepers.

D. Treated materials connected with covered or roofing area.

E. Installation of doors, trim and shims.

F. Installation of finished hardware.

G. Blocking that may be required for soffits and overhangs.

H. Blocking for toilet accessories.

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 Product 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

Wood Treatment Data: Submit treatment manufacturer's instructions for proper use of each type of treated material.

A. 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.

B. 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.

1.04 PRODUCT HANDLING

Delivery and Storage: 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

Coordination: 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 - LUMBER

A. 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. Moisture content should be 19% maximum for lumber items not specified to receive wood preservative treatment.

B. 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. 1 boards (SPIB or WWPA).

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 AWPS 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. 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 or embedded in masonry or concrete.

C. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

2.03 LUMBER, GENERAL

A. Lumber Standards: Manufacture lumber to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

B. Grade Stamps:

1. Factory-mark each piece of lumber with grade stamp of inspection agency evidencing compliance with grading rule requirements identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

2. For exposed lumber apply grade stamps to end or back of each piece, or omit grade stamps entirely and issue certificate of grade compliance from inspection agency in lieu of grade stamp.

C. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content spec or each use.

D. Provide dressed lumber, S4S, unless otherwise indicated.

E. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2" or less in nominal thickness, unless otherwise indicated.

2.04 DIMENSION LUMBER

A. For structural light framing (2" to 4" thick, 2" to 4" wide), provide the following grade and species:

1. No. 1 grade.
2. Species: Southern Pine

B. For structural framing (2" to 4" thick, 5" and wider), provide the following grade and species:

1. No. 1 grade.
2. Species: Southern Pine.

2.05 BOARDS

A. Exposed Boards:

1. Where boards will be exposed in the finished work, provide the following:

2. Moisture Content: 19 percent maximum, "S-DRY".

B. Where painted finish is indicated, provide No. 1 Boards per SPIB rules, Select Merchantable Boards per WCLIB rules, or No. 2 Common Boards and Better per WWPA rules.

C. Concealed Boards:

1. Where boards will be concealed by other work, provide lumber of 19 percent maximum moisture content (S-DRY) and of following species and grade:

2. Redwood construction common per RIS rules, Southern Pine No. 2 Boards per SPIB rules, or any species graded construction boards per WCLIB or WWPA rules.

2.06 MISCELLANEOUS LUMBER

A. Provide wood for support or attachment of other work including bucks, nailers, blocking, furring, grounds, stripping and similar members. Provide lumber of sizes indicated, worked into shapes shown, and as follows:

B. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.

C. Grade: Standard grade light framing size lumber of any species or board size lumber as required. No. 2 Common or Construction grade boards per WCLIB or WWPA rules or No. 2 boards per SPIB rules.

2.07 CONSTRUCTION PANELS

A. Construction Panel Standards: Comply with PS 1 "U.S. Product Standard for Construction and Industrial Plywood" for plywood panels, and for products not manufactured under PS 1 provisions, with American Plywood Associates (APA) "Performance Standard and Policies for Structural-Use Panels", Form No. E445.

B. Trademark: Factory-mark each construction panel with APA trademark evidencing compliance with grade requirements.

2.08 MISCELLANEOUS MATERIALS

A. Fasteners and Anchorages: Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable 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.

B. 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 coating (ASTM A 153).

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. Securely 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; predrill 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" 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. 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.

3.02 WOOD FRAMING

A. 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 N.F.A.). Do not splice structural members between supports.

B. Anchor and nail as shown, and to comply with "Recommended Nailing Schedule" of "Manual for House Framing" and "National Design Specifications for Wood Construction" published by N.F.P.A.

3.03 RAFTER AND CEILING JOIST FRAMING

A. Rafters:

1. Provide member size and spacing shown. Notch to fit exterior wall plates and special metal framing anchors as indicated. Double rafters to form headers and trimmers at openings in roof framing (if any), and support with metal hangers.

2. Provide glued and nailed plywood gusset plates as indicated.

B. Provide special framing as shown for eaves, overhangs, dormers and similar conditions, if any.

- END OF SECTION -

SECTION 06200

FINISH CARPENTRY

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

Definition: Finish carpentry includes carpentry work which is exposed to view, is non-structural, and which is not specified as part of other sections. Types of work in this section include the installation of finish carpentry for the following, where applicable, and as detailed or indicated on the Drawings.

A. Running trim.

B. Builders hardware and doors are specified in Division 8 sections.

C. Architectural woodwork is specified in another section of Division 6.

1.02 DETAILED WORK SPECIFIED ELSEWHERE

Rough carpentry is specified in another section of Division 6.

1.03 QUALITY ASSURANCE

Factory-mark each piece of lumber and plywood with type, grade, mill and grading agency identification, except omit marking from surfaces to receive transparent finish, and submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on a concealed surface.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect finish carpentry materials during transit, delivery, storage and handling to prevent damage, soiling and deteriorations.

B. Do not deliver finish carpentry materials until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, finish carpentry materials must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

1.05 JOB CONDITIONS

A. Conditioning: Installer shall advise Contractor of temperature and humidity requirements for finish carpentry installation areas. Do not install finish carpentry until required temperature and relative humidity have been stabilized and will be maintained in installation areas.

B. Maintain temperature and humidity in installation area as required to maintain moisture content of installed finish carpentry within a 1.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period. The fabricator of woodwork shall determine optimum moisture content and required temperature and humidity conditions.

PART 2 - PRODUCTS

2.01 WOOD PRODUCT QUALITY STANDARDS

A. Softwood Lumber Standard: Comply with PS 20 and with applicable grading rules of the respective grading and inspection agency for the species and product indicated.

B. Woodworking Standard: Where indicated for a specific product, comply with specified provisions of the Architectural Woodwork Institute (AWI) "Quality Standards".

2.02 MATERIALS

A. Nominal sizes are indicated, except as shown by detailed dimensions. Provide dressed or worked and dressed lumber, as applicable, manufactured to the actual sizes as required by PS 20 or to actual sizes and pattern as shown, unless otherwise indicated.

B. Moisture Content of Softwood Lumber: Provide seasoned lumber having a moisture content from time of manufacture until time of installation not greater than values required by the applicable grading rules of the respective grading and inspecting agency for the species and product indicated.

2.03 MISCELLANEOUS MATERIALS

Fasteners and Anchorages: Provide nails, screws and other anchoring devices of the type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible, and complying with applicable Federal Specifications. Where finish carpentry is exposed in areas of high relative humidity, provide fasteners and anchorages with a hot-dipped zinc coating (ASTM A153).

2.04 WOOD TREATMENT

A. Preservative Treatment: Following basic fabrication, provide 3-minute dip treatment of finish carpentry items indicated to receive preservative treatment in 5 percent solution of pentachlorophenol, with vehicle which will not interfere with finish application and will produce minimum effect upon appearance. Apply brush coat on surfaces cut after treatment. Provide preservative treatment on wood trim at shower enclosures and toilet rooms.

B. Kiln-dry wood after treatment to a maximum moisture content of 15% for plywood, 19% for lumber.

C. Inspect each piece of lumber and plywood or each unit of finish carpentry after drying; do not use twisted, warped, bowed or otherwise damaged or defective wood.

PART 3 - EXECUTION

3.01 PREPARATION

Condition wood materials to average prevailing humidity conditions in installation areas prior to installing.

3.02 INSTALLATION

A. Discard units of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements, or which are of defective manufacture with respect to surfaces, sizes or patterns.

B. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level countertops; and with 1/16" maximum offset in flush adjoining 1/8" maximum offsets in revealed adjoining surfaces.

C. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

D. Anchor finish carpentry work to anchorage devices or blocking built-in or directly attached to substrates. Secure to ground, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fasteners heads are required, use fine finishing nail for exposed nailings, countersunk and filled flush with finished surface, and matching final finish where transparent is indicated.

3.03 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

A. Repair damaged and defective finish carpentry work wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.

B. Clean finish carpentry work on exposed and semi-exposed surfaces. Touch-up shop-applied finishes to restore damaged or soiled areas.

C. Refer to Division 9 sections for final finishing of installed finish carpentry work.

D. Protection: Installer of finish carpentry work shall advise Contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

-- END OF SECTION --

DIVISION 7

THERMAL AND MOISTURE PROTECTION

KENTUCKY ENGINEERING GROUP, PLLC

SECTION 07115

BITUMINOUS DAMP-PROOFING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes cold-applied, cut-back asphalt damp-proofing applied to the following surfaces:

1. Exterior, below-grade surfaces of concrete foundation walls.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include recommendations for method of application, primer, and number of coats, coverage or thickness, and protection course.

B. Material Certificates: For each product, signed by manufacturers.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain primary damp-proofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

1.4 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt damp-proofing to be performed according to manufacturers' written instructions.

B. Ventilation: Provide adequate ventilation during application of damp-proofing in enclosed spaces. Maintain ventilation until damp-proofing has thoroughly cured.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cold-Applied, Emulsified-Asphalt Damp-proofing:

a. Euclid Chemical Company (The).
b. Gardner Asphalt Corporation.
c. Henry Company.
d. Karnak Corporation.
e. Koppers Industries, Inc.
f. Malarkey Roofing Company.

g. Meadows, W. R., Inc.
h. Sonneborn, Div. of ChemRex, Inc.

i. Tamms Industries.

2. Protection Course, Asphalt-Board Type:

a. Grace, W. R. & Co.; Construction Products Div.
b. Meadows, W. R., Inc.
c. Sonneborn, Div. of ChemRex, Inc.

2.2 BITUMINOUS DAMP-PROOFING

A. Cold-Applied, Emulsified-Asphalt Damp-proofing:

2.3 MISCELLANEOUS MATERIALS

A. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.

B. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.

C. Protection Course, Asphalt-Board Type: Premolded, 1/8-inch- thick, multi-ply, semirigid board consisting of a mineral-stabilized asphalt core sandwiched between layers of asphalt-saturated felt, and faced on 1 side with polyethylene film.

D. Protection Course, Polystyrene Type: Fan-folded, rigid, extruded-polystyrene board insulation; nominal thickness not less than 3/16 inch.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, with applicator present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.

1. Begin damp-proofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with damp-proofing. Prevent damp-proofing materials from entering and clogging weep holes and drains.

B. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

3.3 APPLICATION, GENERAL

A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of damp-proofing.

1. Apply additional coats if recommended by manufacturer or required to achieve coverages indicated.

2. Allow each coat of damp-proofing to cure 24 hours before applying subsequent coats.

B. Apply damp-proofing to footings and foundation walls where opposite side of wall faces building interior space and where indicated.

1. Apply from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches over outside face of footing.

2. Extend 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.

3.4 INSTALLATION OF PROTECTION COURSE

A. Where indicated, install protection course over completed-and-cured damp-proofing. Comply with damp-proofing material manufacturer's written recommendations for attaching protection course. Support protection course with spot application of trowel-grade mastic where not otherwise indicated.

3.5 CLEANING

A. Remove damp-proofing materials from surfaces not intended to receive damp-proofing.

- - END OF SECTION - -

SECTION 07200

INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of insulation work is shown on Drawings. Required thickness shall be as indicated on the Drawings and/or by provisions of this section.

B. Applications of insulation specified in this section, where applicable, include the following:

1. Rigid insulation below grade and under slab.

2. Board cavity wall insulation.

3. Sound attenuation insulation.

1.03 RELATED WORK UNDER OTHER SECTIONS

A. Division 4 - Masonry.

B. Division 13 - Prefabricated Metal Building.

C. Rough and Finish Carpentry specified in Division 6.

D. Gypsum Drywall specified in Division 9.

1.04 QUALITY ASSURANCE

A. Thermal Resistivity: Where thermal resistivity properties of insulation materials are designated by R-values they represent the rate of heat flow through a homogenous material exactly 1" thick, measured by test method included in reference material standard or for the total installation. They are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

B. Fire Performance Characteristics: Provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.

C. Surface Burning Characteristics: ASTM E 84.

D. Fire Resistance Ratings: ASTM E 119.

E. Combustion Characteristics: ASTM E 136.

F. Maximum Allowable Asbestos Content of Inorganic Insulations: Provide insulations composed of mineral fibers or mineral ores which contain less than 0.25% by weight of asbestos of any type or mixture of types occurring naturally as impurities as determined by polarized light microscopy test per Appendix A of 40 CFR 763.

1.05 DELIVERY, STORAGE AND HANDLING

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

B. Protection for Plastic Insulation

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver plastic insulating materials to project ahead of installation time.

3. Complete installation and concealment of plastic materials as rapidly as possible in each area of work.

1.06 SUBMITTALS

A. Submit shop drawings in accordance with Division 1 requirements. Include manufacturer's installation data, limitations and any accessory products required for complete installation.

B. Indicate where each type of insulation is to be used and provide details for respective installations.

PART 2 - PRODUCTS

2.01 INSULATING MATERIALS

A. General: Provide insulating materials which comply with requirements indicated herein for materials, comply with referenced standards, other characteristics.

B. Preformed Units: Sizes to fit applications indicated, selected from manufacturer's standard thickness, widths and lengths.

C. Extruded Polystyrene Board Insulation: Rigid, cellular thermal insulation with closed-cells and integral high density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C 578 for type indicated; with 5-year aged r-values of 5.4 and 5 at 40 and 75 deg. F. (4.4 and 23.9 deg.C), respectively; and as follows:

1. Type IV, 1.6 lb./cu. ft. minimum density, unless otherwise indicated.

2. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 5 and 165, respectively.

D. Unfaced Sound Attenuation/Batt Insulation:

1. Fiber Type: Fibers manufactured from glass.

2. Combustion Characteristics: Passes ASTM E 119 test.

3. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 25 and 50, respectively.

2.02 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Type recommended by insulation manufacturer, and complying with requirements for fire performance characteristics.

B. Mechanical Anchors: Type and size indicated or, if not indicated, as recommended by insulation manufacturer for type of application and condition of substrate.

C. Mastic Sealer: Type recommended by insulation manufacturer for bonding edge joints between units and filling voids in work.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. Require installer to examine substrates and conditions under which insulation work is to be performed. A satisfactory substrate is one that complies with requirements of the section in which substrate and related work is specified. Obtain installer's written report listing conditions detrimental to performance of work in this section. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

B. Clean substrates of substances harmful to insulations.

3.02 INSTALLATION, GENERAL

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

B. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.

C. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

3.03 INSTALLATION OF CAVITY-WALL

On units of plastic insulation, install small pads of adhesive spaced approximately 1'-0" O.C. both ways on inside face, as recommended by manufacturer. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against masonry or other construction as shown.

3.04 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joint between closed-cell (non-breathing) insulation units by applying mastic or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with mastic or sealant.

C. Stuff loose glass fiber insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40% of normal maximum volume (to a density of approximately 2.5 lbs. per cu. ft.).

3.05 PROTECTION

General: Protect installed insulation and vapor retarders from harmful weather exposures and from possible physical abuses, where possible by nondelayed installation of concealing work or where that is not possible, by temporary covering or enclosure.

-- END OF SECTION --

SECTION 07210

THERMAL INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Board insulation at exterior foundation walls.
2. Blanket insulation above ceilings and in exterior gable end walls.
3. Eave ventilation troughs.
4. Adhesive for bonding insulation.
5. Insulation tape.

1.2 DEFINITIONS

A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blankets with the latter formed into batts (flat-cut lengths) or rolls.

1.3 SUBMITTALS

A. General: Submittals shall be provided in accordance with the requirements of the General Provisions and shall include, but not be limited to, the following:

1. Product data for each type of product specified.

1.4 QUALITY ASSURANCE

A. Fire Performance Characteristics: Provide insulation materials identical to those whose indicated fire performance characteristics have been determined per the ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristic: ASTM E 84.
2. Fire Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

B. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering insulation products that may be incorporated in the work include, but are not limited to, the following:

1. Extruded Polystyrene Board Insulation:

   a. Owens Corning.
   b. Dow: The Dow Chemical Company.
   c. Or approved equal.

2. Glass-Fiber Blanket Insulation:

   a. Johns Manville Corporation
   b. Owens Corning.
   c. Or approved equal.

2.2 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths, and lengths.

B. Extruded Polystyrene Board Insulation: ASTM C 578 as indicated below.

1. Type VII, 2.2 pcf minimum density.

2. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 75 and 450, respectively.

3. 5-year aged r-values of 5.4 and 5 per inch thickness at 40 and 75 deg F, respectively

C. Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft vapor-retarder membrane on 1 face.

D. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:

1. 3-1/2 inches thick with a minimal thermal resistance of R-11.

2. 12 inches thick with a minimal thermal resistance of R-38.

2.3 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation or substrates.

1. Sonneborn Hydrocide 600, 700, 700B.

2. Tamms Dehydratine 75, 85, 95.

3. Or approved equal.

B. Eave Ventilation Troughs: Preformed rigid fiber-board or plastic sheets designed and sized to fit between roof framing members and provide cross ventilation between insulated attic space and vented soffits.

C. Insulation Tape: Type recommended by insulation manufacturer to provide continuity of faced insulation's vapor barrier.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions with Installer present, for compliance with requirements of the Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation, insulation's vapor retarder and adhesive for bonding, including removal of projections that might puncture insulation's vapor retarder or interfere with insulation attachment or that may affect application of adhesive.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with installation of insulation.

B. Extend insulation full thickness as indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions, and fill voids full with insulation. Remove projections that interfere with placement.

C. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations. Bond units to substrate to provide permanent placement and support of units.

B. Seal joints between board insulation units by applying adhesive for bonding to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive for bonding as recommended by insulation manufacturer.

C. Stuff mineral-fiber insulation into miscellaneous voids and cavity spaces.

D. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity provide lengths that will produce a snug fit between ends.

2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

3. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.

4. Support blankets mechanically, by taping or stapling flanges to flanges of metal studs or bottom chord of truss.

5. Tape all joints for continuity of vapor barrier.

3.5 INSTALLATION OF PERIMETER FOUNDATION INSULATION

A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive approved by insulation manufacturer.

1. If not otherwise indicated, extend insulation to top of footing.

3.6 INSTALLATION OF INSULATION IN CEILINGS

A. Install mineral-fiber insulation over ceilings, between and parallel with trusses, so that insulation extends over entire ceilings.

1. Set faced units in ceiling with vapor barrier to warm side.

2. Set faced units in gable end walls with barrier to cold side.

3.7 PROTECTION

A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

- - END OF SECTION - -

SECTION 07460

VINYL SIDING PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preformed vinyl siding, trim, and accessories for facing exterior walls.

B. Preformed vinyl soffit panels, trim, and accessories for facing exterior roof overhangs, eaves and fascia.

1.2 RELATED SECTIONS

A. Section 06100 - Rough Carpentry: Wood stud framing, furring, and sheathing for support of aluminum siding.

B. Section 07210 - Building Insulation: Rigid thermal insulation installed behind siding.

C. Section 07600 - Flashing and Sheet Metal: Sheet metal gutters and downspouts.

D. Section 07900 - Joint Sealers: Sealants used in conjunction with aluminum siding installation.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM) D256 - Determining the Izod Pendulum Impact Resistance of Plastics.

B. American Society for Testing and Materials (ASTM) D635 - Rate of Burning and/or Extent and Time of Burning of Self-Supported Plastics in a Horizontal Position.

C. American Society for Testing and Materials (ASTM) D638 - Tensile Properties of Plastics.

D. American Society for Testing and Materials (ASTM) D648 - Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.

E. American Society for Testing and Materials (ASTM) D696 - Coefficient of Linear Thermal Expansion of Plastics.

F. American Society for Testing and Materials (ASTM) D790 - Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

G. American Society for Testing and Materials (ASTM) D1929 - Determining Ignition Temperature of Plastics.

H. American Society for Testing and Materials (ASTM) D3679 - Rigid Polyvinyl Chloride (PVC) Siding.

I. American Society for Testing and Materials (ASTM) D4216 - Rigid Poly (Vinyl Chloride) (PVC) and Related PVC and Chlorinated Poly (Vinyl Chloride) (CPVC) Building Products Compounds.

J. American Society for Testing and Materials (ASTM) E84 - Surface Burning Characteristics of Building Materials.

K. Underwriters Laboratories (UL) 94 - Test for Flammability of Plastic Materials.

L. Vinyl Siding Institute (VSI): Vinyl Siding Installation, a How-To Guide.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Manufacturer's data sheets on each product to be used, including:
1. Material descriptions, dimensions, and profiles.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.

C. Shop Drawings: Layout, dimensions, weatherproofing, penetrations, terminations, trim, and installation methods.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, 4 inches (102 mm) long minimum samples of siding and trim in selected finish and color.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with a minimum of 10 years' successful experience manufacturing aluminum, steel and vinyl siding.

B. Design: Panel system shall be fabricated and installed to comply with:

1. Vinyl Panels:
a. International Code Council-ESR - 1133.
b. Canadian Construction Materials center (CCMC): Report No. 06541-L.
c. New York City Department of Building Material Equipment and Acceptance: MEA 132-94-M.
d. Federal Housing Administration (FHA), Department of Housing and Urban Development (HUD): Minimum Property Standards.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver siding in manufacturer's protective cartons and clearly labeled as to specific products contained.

B. During delivery and storage keep siding cartons flat and supported along entire length.

C. Store materials off ground, out of weather, in dry place. Provide ventilation. Protect from falling objects and construction activities.

1.7 WARRANTY

A. Upon Completion, provide a Lifetime limited, transferable warranty. In the case of siding purchased by, or installed upon property owned by or in part by corporations, government entities or agencies, religious organizations, trusts, condominium or corporate housing arrangements, intangible legal entities or any other entity or organization capable of an infinite life, the warranty period will be fifty (50) years following the installation of the siding (prorated as indicated in the Warranty Transfer Schedule).

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Requests for substitutions will be considered in accordance with provisions of Section 01600. To ensure functional and appearance compatibility, siding and all trim pieces shall be products of single manufacturer.

2.2 MATERIALS

A. PVC: Fabricate siding and trim from polyvinyl chloride (PVC) meeting ÅSTM D3679 requirements for compound class number 2 with the following properties:
   1. Tensile strength tested in accordance with ÅSTM D638: 6,700 PSI (46 MPa).
   2. Flexural strength tested in accordance with ÅSTM D790: 14,000 PSI (96 MPa).
   3. Modulus of elasticity tested in accordance with ÅSTM D638: 410,000 PSI (2827 MPa).
   4. Impact resistance tested in accordance with ÅSTM D256:
      a. At 32 degrees F (0 degrees C): 2.0 foot pounds per inch of notch.
      b. At 70 degrees F (21 degrees C): 3.6 foot pounds per inch of notch.
   5. Coefficient of linear thermal expansion tested in accordance with ASTM D696: (2.9 x 10 to the minus 5 inch/inch/degree F. (5.3 x 10 to the minus 5 mm/mm/degree C.)
   6. Deflection temperature when tested in accordance with ASTM D648 with 264 PSI (1820 kPa) load: 163 degrees F. (73 degrees C.)
   7. Average maximum burn distance tested in accordance with ÅSTM D635: 0.8 inch. (20 mm.)
   8. Average maximum burn time tested in accordance with ÅSTM D635: 5 seconds.
   9. Maximum ignition temperature tested in accordance with ÅSTM D1929:
      a. Flash ignition: 752 degrees F. (400 degrees C.).
      b. Self ignition: 860 degrees F. (460 degrees C).
   10. Flame spread tested in accordance with ÅSTM E84: 15 maximum.
   11. Smoke development tested in accordance with ASTM E84: 500 maximum.

2.3 VINYL SIDING PANELS

A. Sovereign Select: Double 5 inch Clapboard.
   1. Dimensions: 10 inches (254 mm) exposed width by 144 inches (3658 mm) long with 3/4 inch (19 mm) butt.
   2. Thickness: 0.046 inch (1.17 mm).
   3. Type: Advantage lock system with double thick rolled over nail hem.
   4. Surface Finish: Embossed cedar-grain texture.
   5. Color: As selected from manufacturer's standard colors.

2.4 TRIM

A. Standard Accessories:
   1. Consistent with shape, size, and/or properties shown on the drawings and as required for complete installation.
   2. Produced from the same compound materials and with comparable properties as the siding.
   3. Color: Matching or color coordinated with siding.

B. Trim Essentials Decorative Vinyl Accessories:
   1. Outside corner post:
      a. 6 inches (152 mm) designer.
      b. 6-5/8 inches (168 mm) beaded with foam insert.
      c. 5-3/4 (146 mm) inch fluted.
   2. 2 inches (51 mm) quarter round beaded corner starter.

3. 2-1/2 inches (64 mm) wide face J-channel.
4. Window and Door Surround:
   a. 3-1/2 (89 mm) inch.
   b. 5 inch (127 mm).
   c. 5 inch (127 mm) fluted.
   d. Surround starter.
5. Soffit crown molding.
6. 45 degree bay/bow corner.
7. 3-1/2 inches (89 mm) H-trim.
8. Color: Matching or color coordinated with siding.

PART 3 EXECUTION

3.1 EXAMINATION

A. Confirm that all critical dimensions are as specified on the drawings

B. Beginning installation indicates Installer's acceptance of substrate as suitable to accept siding and soffits.

3.2 PREPARATION

A. Repair substrate flaws or defects before applying siding or soffits.

B. Where necessary, fur surfaces to an even plane and free from obstructions before application.

3.3 INSTALLATION

A. Install vinyl siding and vinyl soffits in accordance with the latest edition of "Vinyl Siding Installation Manual," published by the Vinyl Siding Institute (VSI) and special details from the drawings.

B. Install aluminum and steel siding products in accordance with manufacturers printed installation manual.

C. Install siding, soffits, and accessories in accordance with best practice, with all joint members plumb and true.

3.4 FIELD QUALITY CONTROL

A. After installation of siding and soffits, check entire surface for obvious flaws or defects.

B. Replace and repair any problem areas, paying close attention to the substrate for causes of the problem.

3.5 CLEANING AND PROTECTION

A. After application of siding and soffits, clean as necessary to remove all fingerprints and soiled areas.

B. Upon completion of siding application, clean entire area, removing all scrap, packaging, and unused materials related to this work.

END OF SECTION

SECTION 07620

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 DESCRIPTION

This Section includes through wall masonry flashing, valley flashing, drip edges, fascias, miscellaneous sheet metal and accessories.

1.2 QUALITY ASSURANCE

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

1.3 SUBMITTALS

A. Submit shop drawings as specified in the "General Provisions".

B. Submit manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.

C. Submit 8-inch-square samples of specified sheet materials to be exposed as finished surfaces.

D. Submit shop drawings showing layout, profiles, methods of joining, and anchorages details. Provide layouts at 1/4-inch scale and details at 3-inch scale.

E. Color: To be selected by Owner.

PART 2 MATERIALS

2.1 DETAILED MATERIAL REQUIREMENTS

A. Copper valley flashing shall be ASTM B 370; temper H00 (cold-rolled) except where temper 060 is required for forming; 16 oz. (0.0216-inch thick) except as otherwise indicated.

1. Provide lead coating of 0.06 psf on exposed copper surfaces.

B. Sheet aluminum fascias shall be ASTM B 209, alloy 3003, temper H14, AA-C22A41 clear anodized finish; 0.032-inch thick (20 gage) except as otherwise indicated.

C. Extruded aluminum drip edges shall be manufacturer's standard extrusions of sizes and profiles indicated; 0.080-inch minimum thickness for primary legs of extrusions. Custom colors to be selected by Engineer during shop drawing review.

D. Through wall masonry flashings shall be 3-oz. copper sheet laminated between 2 sheets of bituminous impregnated creped Kraft paper or saturated fabric.

E. Miscellaneous Materials and Accessories:

1. For use with copper, provide lead-free solder, with rosin flux.

2. Fasteners shall be same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

3. Bituminous coating shall be SSPC - Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.

4. Elastomeric sealant shall be generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealants."

5. Epoxy seam sealer shall be 2-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior nonmoving joints including riveted joints.

6. Adhesives shall be the type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.

7. Paper slip sheet shall be 5-lb. rosin-sized building paper.

8. Polyethylene underlayment shall be minimum 6-mil carbonated polyethylene film resistant to decay when tested in accordance with ASTM E 154.

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

G. Fabricate nonmoving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.

H. Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

I. Where movable, nonexpansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

J. Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

K. Fabricate extruded aluminum running units with formed or extruded aluminum joint covers for installation behind main members where possible. Fabricate

metered and welded corner units.

PART 3 EXECUTION

3.1 INSTALLATION

A. Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Where aluminum is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.

C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

- - END OF SECTION - -

SECTION 07710

GUTTER SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following manufactured roof specialties:

1. Pre-formed gutters.
2. Break metal formed gutters.
3. Downspouts.
4. Straps, supports and accessories.
5. Leaf screens.
6. Splash blocks.

B. Related Sections include the following:

1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 Section "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
3. Division 07 Section "Joint Sealants" for field-applied sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General: Manufacture and install manufactured roof specialties to resist thermally induced movement and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. MG Listing: Manufacture and install components specified that are listed in FMG's "Approval Guide" and approved for Windstorm Classification, Class 1-90. Identify materials with FMG markings.

C. Manufacture and install components tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressure: Wind Zone 1. For velocity pressures of 10 to 20 lbf/sq.ft.: 40-lbf/sq.ft. perimeter uplift force, 60-lfb/sq. ft. corner uplift force, and 20-lbf/sq.ft. outward force.

D. Thermal Movements: Provide manufactured roof specialties that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Water Infiltration: Provide manufactured roof specialties that do not allow water infiltration to building interior.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of manufactured roof specialties, including plans and elevations. Identify factory- vs. field-assembled work. Include the following:

1. Details for fastening, joining, supporting, and anchoring manufactured roof specialties including fasteners, clips, cleats, and attachments to adjoining work.

2. Details for expansion and contraction.

C. Samples for Initial Selection: For each type of manufactured roof specialty indicated with factory-applied color finishes.

D. Fabrication Samples: For roof edge drainage systems made from 12-inch lengths of full-size components including fasteners, cover joints, accessories, and attachments.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, verifying compliance of roof edge drainage systems with performance requirements.

F. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Owner's Representative, except with Owner's Representative's approval. If modifications are proposed, submit comprehensive explanatory data to Owner's Representative for review.

1.6 COORDINATION

A. Coordinate installation of manufactured roof drainage system with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

1.7 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace manufactured roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.

c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2. Products: Subject to compliance with requirements, provide one of the products specified.

3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

5. Basis-of-Design Product: The designs for roof edge drainage system are based on the products named. Subject to compliance with requirements, provide either the named products or comparable products by one of the other manufacturers specified.

2.2 EXPOSED AND CONCEALED METALS

A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for use and finish indicated, finished as follows:

1. Surface: Smooth, flat finish.

2. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

   a. Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil, complying with AAMA 2605.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.

   1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.

C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15 mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 ROOF EDGE DRAINAGE SYSTEMS

A. Basis-of-Design Product for Preformed Gutters: Metal Era Seal-Tite Industrial Gutter System, customized sizes and shapes as required, or a comparable product by one of the following:

B. Available Manufacturers:

   1. ATAS International, Inc.

2. Hickman, W. P. Company.

3. Merchant & Evans, Inc.

4. MM Systems Corporation.

C. Gutters and Downspouts: Manufactured and break-formed gutter in uniform section lengths not exceeding 12 feet, with mitered and welded or soldered corner units, end caps, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front gutter rim. Furnish with flat-stock gutter straps and gutter support brackets and expansion joints and expansion-joint covers fabricated from same metal as gutters.

1. Fabricate gutter from the following exposed metal:

a. Aluminum: 0.050 inch thick.

2. Gutter Style: Boxed, according to SMACNA's "Architectural Sheet Metal Manual."

3. Applied Splice Plates at Joints: Exposed, formed aluminum, 0.032 inch thick. 6” wide. Finish to match gutter.

4. Gutter Accessories: Continuous removable leaf screen.

5. Straps and Brackets: 0.125 aluminum, finish to match gutter; 1-inch wide minimum.

6. Downspouts: Square closed-face with mitered elbows, manufactured from the following exposed metal. Furnish wall brackets, from same material and finish as downspouts, with anchors.

a. Formed Aluminum: 0.063 inch thick.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.

1. Examine walls and roof edges for suitable conditions for manufactured roof specialties.

2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install manufactured roof specialties according to manufacturer's written instructions. Anchor manufactured roof specialties securely in place and capable of resisting forces specified in performance requirements. Use fasteners, separators, sealants, and other miscellaneous items as required to complete manufactured roof specialty systems.

1. Install manufactured roof specialties with provisions for thermal and structural movement.

2. Torch cutting of manufactured roof specialties is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum manufactured roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Install manufactured roof specialties level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil-canning, buckling, or tool marks.

D. Install manufactured roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.

E. Expansion Provisions: Provide for thermal expansion of exposed manufactured roof specialties. Space movement joints at a maximum of 12 feet with no unplanned joints within 18 inches of corners or intersections.

F. Fasteners: Use fasteners of type and size recommended by manufacturer but of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

G. Seal joints with elastomeric or butyl sealant as required by manufacturer of roofing specialties.

3.3 ROOF EDGE DRAINAGE SYSTEM INSTALLATION

A. General: Install gutters and downspouts to produce a complete roof drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Gutters: Join and seal gutter lengths. Attach gutters to firmly anchored gutter brackets or straps spaced not more than 36 inches apart. Slope gutters to downspouts at 1/16 inch per foot slope.

1. Install gutter with expansion joints not exceeding 50 feet apart. Install expansion joint caps.

2. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.

C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 48 inches o.c. in between.

1. Provide elbows at base of downspout to direct water away from building.

2. Provide precast concrete, splash blocks at base of downspouts.

3.4 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as manufactured roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace manufactured roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

- - END OF SECTION - -

SECTION 07910

JOINT SEALANTS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:

1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:

   a. Construction joints in cast-in-place concrete.

   b. Control and expansion joints in unit masonry.

   c. Joints between different materials listed above.

   d. Perimeter joints between materials listed above and frames of doors and louvers.

   e. Other joints as indicated.

2. Exterior joints in the following horizontal traffic surfaces:

   a. Isolation and contraction joints in cast-in-place concrete slabs.

   b. Joints between different materials listed above.

   c. Other joints as indicated.

3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:

   a. Control and expansion joints on exposed interior surfaces of exterior walls.

   b. Perimeter joints of exterior openings where indicated.

   c. Vertical joints on exposed surfaces of interior unit masonry or concrete walls and partitions.

   d. Perimeter joints between interior wall surfaces and frames of interior doors and louvers.

   e. Joints between plumbing fixtures and adjoining walls, floors, and counters.

   f. Other joints as indicated.

4. Interior joints in the following horizontal traffic surfaces:

   a. Isolation joints in cast-in-place concrete slabs.

   b. Other joints as indicated.

1.02 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.03 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Qualification Data: For Installer.

D. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Mockups: Incorporate sealant joints to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:

1. Joints in mockups of Division 04 "Unit Masonry Assemblies" are to receive elastomeric joint sealants.

1.05 PROJECT CONDITIONS

E. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.

2. When joint substrates are wet.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Owner from manufacturer's full range.

2.02 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Multicomponent Nonsag Urethane Sealant ES-1:

1. Available Products:

a. Schnee-Morehead, Inc.; Permathane SM 7200.

b. Sika Corporation, Inc.; Sikaflex - 2c NS TG.

c. Sonneborn, Division of ChemRex Inc.; NP 2.

d. Tremco; Vulkem 227.

e. Tremco; Vulkem 322 DS.

f. Or approved equal.

2. Type and Grade: M (multicomponent) and NS (nonsag).

3. Class: 25.

4. Uses Related to Exposure: T (traffic) and NT (nontraffic).

5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

a. Use O Joint Substrates: Aluminum coated with a high-performance coating, mill, galvanized and painted steel, concrete, and concrete masonry units.

C. Multicomponent Pourable Urethane Sealant ES-2:

1. Available Products:

a. Pecora Corporation; Dynatrol II-SG.

b. Sika Corporation, Inc.; Sikaflex - 2c SL.

c. Sonneborn, Division of ChemRex Inc.; SL 2.

d. Or approved equal.

2. Type and Grade: M (multicomponent) and P (pourable).

3. Class: 25.

4. Uses Related to Exposure: T (traffic) and NT (nontraffic).

5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

a. Use O Joint Substrates: Concrete.

2.03 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type B (bicellular material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Available Products:

1. Sonneborn Soft Backer-Rod.

2. Nomaco Sof Rod.

3. Or approved equal.

4. Expansion Joint Filler:

5. Available Products:

6. Sonneborn Expansion-Joint Filler.

7. Nomaco Nopra Board.

8. Or approved equal.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.04 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include but are not limited to the following:

a. Concrete.

b. Masonry.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include but are not limited to the following:

a. Metal.

b. Glass.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer**,** based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.

5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.

a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.04 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.06 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application JS-1: Exterior vertical construction joints in cast-in-place concrete.

1. Joint Sealant: ES-1.

2. Joint-Sealant Color: As selected by the Owner from manufacturer's full range.

B. Joint-Sealant Application JS-2: Exterior horizontal nontraffic and traffic isolation and contraction joints in cast-in-place concrete slabs.

1. Joint Sealant: ES-2.

2. Joint-Sealant Color: As selected by the Owner from manufacturer's full range.

C. Joint-Sealant Application JS-3: Exterior vertical control and expansion joints in unit masonry.

1. Joint Sealant: ES-1.

2. Joint-Sealant Color: As selected by the Owner from manufacturer's full range.

D. Joint-Sealant Application JS-4: Exterior vertical joints between different materials listed above.

1. Joint Sealant: ES-1.

2. Joint-Sealant Color: As selected by the Owner from manufacturer's full range.

E. Joint-Sealant Application JS-5: Exterior perimeter joints between masonry or concrete and frames of doors and louvers.

1. Joint Sealant: ES-1.

2. Joint-Sealant Color: As selected by the Owner from manufacturer's full range.

F. Joint-Sealant Application JS-6: Vertical control and expansion joints on exposed interior surfaces of exterior walls.

1. Joint Sealant: ES-1.

2. Joint-Sealant Color: As selected by the Owner from manufacturer's full range.

G. Joint-Sealant Application JS-7: Interior perimeter joints of exterior openings.

1. Joint Sealant: ES-1.

2. Joint-Sealant Color: As selected by the Owner from manufacturer's full range.

H. Joint-Sealant Application JS-8: Vertical joints on exposed surfaces of interior unit masonry and concrete walls and partitions.

1. Joint Sealant: ES-1.

2. Joint-Sealant Color: As selected by the Owner from manufacturer's full range.

I. Joint-Sealant Application JS-9: Perimeter joints between interior wall surfaces and frames of interior doors and louvers.

1. Joint Sealant: ES-1.

2. Joint-Sealant Color: As selected by the Owner from manufacturer's full range.

J. Joint-Sealant Application JS-10: Interior control, expansion, and isolation joints in horizontal traffic surfaces of concrete flooring and foundation wall.

1. Joint Sealant: ES-2.

2. Joint-Sealant Color: As selected by the Owner from manufacturer's full range.

- - END OF SECTION - -

DIVISION 8

WINDOWS AND DOORS

SECTION 08120

ALUMINUM DOORS AND FRAMES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Aluminum doors and frames for both new openings, complete with glass and glazing shall be furnished and installed as shown on the Drawings and specified herein.

B. Install hardware specified by this Division, Section 08710.

1.02 RELATED WORK

A. Unit masonry is included in Division 4, Section 04300.

B. Finish hardware is included in this Division, Section 08710.

C. Caulking, perimeter sealants and back-up materials are included in Division 7, Section 07900.

1.03 SHOP DRAWINGS AND PRODUCT DATA

A. Submit shop drawings and product data in accordance with Division 1, Section 01300.

B. Indicate pertinent dimensioning, general construction, component connections and locations, anchorage methods and locations, hardware locations, installation details and any special requirements, including anchoring of subframe to masonry.

C. Submit two samples, 2" x 2" minimum, of each type and color, and 12" long sections of extrusions or formed shapes, for selection by Architect.

1.04 QUALITY ASSURANCE

A. Special Project Warranty: Provide a written warranty signed by Manufacturer, Installer and Contractor, agreeing to replace, at no cost to the Owner, any doors or frames that fail in materials or workmanship, within the time period of acceptance, as indicated below. Failure of materials or workmanship includes excessive deflection, faulty operation of entrances, deterioration of finish or construction, in excess of normal weathering and defects in hardware, weather-stripping and other components of the work.

B. Time Period: One year from substantial completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

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

A. United States Metals and Manufacturing Corp. – South Bend, Indiana

B. Cline Aluminum Doors, Inc. – Bradenton, Florida

C. Kawneer North America - Norcross, GA

2.02 DOORS

A. Frames:

1. The frames for the aluminum doors shall be constructed of extruded aluminum rectangular tubular sections and extruded aluminum profiles as shown on the drawings having sharp corners and a wall thickness of not less than 0.125 in. and shall be of the types and sizes indicated. The head and jamb frame members shall be provided with integral weather-stripping, or an acceptable equivalent product.

2. The frames for the aluminum doors shall be mortised and reinforced for strike plates.

3. Frames shall have Class I (0.7 mil coating) anodic finish color as selected by Architect AA-M10C22A 42.

B. Doors: Shall be U.S. Metals D9 Series heavy duty flush aluminum doors or Cline Series 100BE heavy duty flush aluminum doors, or approved equal.

1. The face sheets shall be of color and pattern, as selected, one piece .040" aluminum alloy facing laminated to .125" tempered hardboard.

2. FRP standard texture panel finishes. Contractor to provide color chart for custom color choices to be determined by the Owner..

3. Doors shall be glazed at the factory. Manufacturer shall utilize shipping cartons to prevent glass breakage.

2.03 FABRICATION

A. Fabricate aluminum doors and frames to allow for clearances and shim spacing around perimeter of assemblies to enable installation. Provide for thermal movement.

B. Provide anchorage devices to securely and rigidly fit door and frame assemblies in place.

C. Accurately and rigidly fit together joints and corners. Match components ensuring continuity of line and design. Ensure joints and connections are flush, hair line and weatherproof.

D. Provide for moisture entering joints and condensation occurring within frame construction to drain to exterior.

E. Make provision for hardware and provide required internal reinforcing.

F. Sizes and Profiles: The required sizes for door and frame units, and profile requirements are shown on the drawings, and herein specified. The details shown are based upon standard details by one or more manufacturers. It is intended that similar details by other manufacturers will be accepted, provided they comply with size requirements and with minimum/maximum profile requirements as shown.

G. Co-ordination of Fabrication: Check the actual frame or door openings in the construction work by accurate field measurements before fabrication and show recorded measurements on final shop drawings. Co-ordinate fabrication schedule with construction progress, as directed by Contractor, and avoid delays of work.

H. Complete the cutting, fitting, forming, drilling and grinding of all metal work prior to the cleaning, finishing, treatment and application of coatings. Remove burrs from cut edges, and ease edges and corners to a radius of approximately 1/64".

I. Conceal fasteners, where possible, except as otherwise noted.

J. Reinforce the work as necessary for performance requirements, and for support to the structure. Separate dissimilar metals with bituminous paint or performed separators which will prevent corrosion. Separate metal surfaces at moving joints with non-metallic separators to prevent "freeze-up" of joints.

2.04 MATERIALS AND ACCESSORIES

A. Aluminum Members: Provide alloy and temper as recommended by manufacturer for strength, corrosion resistance and application of required finish and control of color: ASTM B 221 for extrusions ASTM B 209 for sheet/plate, with a minimum wall thickness of 0.125".

B. Fasteners: Provide aluminum, non-magnetic stainless steel or other non-corrosive metal fasteners, guaranteed by the manufacturer to be compatible with the doors, frames, stops, panels, hardware, anchors, and other items being fastened. For exposed fasteners (if any), provide Phillips heat flat head screws with finish matching the item to be fastened. Do not use exposed fasteners, except where unavoidable for the assembly of units or unavoidable for the fastenings of hardware. Provide only recessed countersunk, tamper proof screws in glazing stops.

C. Reinforcement and Brackets: Manufacturer's standard formed or fabricated steel units, of shapes, plates, or bars, with 2.0 ounce hot-dip zinc coating, complying with ASTM A 123, applied after application.

D. Expansion Anchor Devices: Lead shield or toothed steel, drill-in expansion bolt anchors.

E. Bituminous Coating: Cold applied asphalt mastic complying with SSPC-PS 12, compounded for 30-mil thickness per coat.

F. Glazing Gaskets: For glazing factory-installed glass and for gaskets which are factory-installed in "captive" assembly of glazing stops provide manufacturer's standard stripping of molded neoprene, complying with ASTM D 2000 (Designation 2BC415 to 3BC620), or molded PVC complying with ASTM C 509, Grade 4.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that all demolition and preparation work has been completed.

B. Verify field measurements for new aluminum frames, and doors are correct.

C. Verify compliance with manufacturer's requirements.

D. Beginning installation means acceptance of conditions.

3.02 INSTALLATION

A. Installation of aluminum door(s) and frame(s) shall be by experienced, skilled workmen in accordance with manufacturer's recommendations. Ensure assemblies are plumb, level and free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

B. Use sufficient anchorage devices to securely and rigidly fasten door and frame assemblies to building.

C. Install hardware in accordance with manufacturer's recommendations, using proper templates. Refer to this Division, Section 08700 for installation requirements.

D. Install perimeter sealant and related backing materials in accordance with workmanship and installation requirements indicated in Division 7, Section 07900.

E. Set units plumb, level and true to line, without warp or rack of doors or frames. Anchor securely in place. Separate aluminum and other corrodible metal surfaces, from sources or corrosion or electrolytic action at points of contact with other materials with bituminous coatings, or other means as approved by Architect.

F. Clean aluminum surfaces promptly after installation of doors and frames, exercising care to avoid damage to the protective coating (if any). Remove excess glazing and sealant compounds, dirt and other substances.

G. Provide protective treatment and other precautions required through the remainder of the construction period, to ensure that the doors and frames will be without damage or deterioration (other than normal weathering) at the time of acceptance.

- END OF SECTION -

SECTION 08305

ACCESS DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior steel and aluminum floor doors and frames.

2. Exterior aluminum vault doors and frames in concrete.

3. Galvanized and stainless steel LadderUp® safety posts.

1.2 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements are specified herein:

1. Underwriters Laboratories (UL)

   Fire Hazard Classifications.

2. Factory Mutual Engineering Corporation (FM)

   Roof Assembly Classifications.

3. American Society for Testing and Materials (ASTM)

   a. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate

   b. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes

4. OSHA - 29 CFR 1910.23

1.3 SUBMITTALS

A. In addition to the submittals identified in the General Provisions, the following items shall be submitted:

1. For each type of door and frame indicated, include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.

2. Provide shop drawings showing fabrication and installation details of customized doors and frames. Include plans, elevations, sections, details, and attachments to other Work.

3. Provide samples for each door face material, at least 3 by 5 inches in size, in specified finish.

4. Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.

1.4 QUALITY ASSURANCE

A Obtain doors and frames through one source from a single manufacturer.

B. Obtain Owner's Representative's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

PART 2 PRODUCTS

2.1 **MANUFACTURERS**

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Interior and Exterior Floor/Vault Doors:
   a. Bilco Company
   b. Halliday Products Inc.
   c. Thompson Fabricating LLC
   d. Or approved equal.

2.2 MATERIALS

A. Aluminum sheet for cover shall be ¼-inch aluminum diamond plate. Aluminum sheet for frame shall be ¼-inch, extruded aluminum with bend-down anchor tabs around the perimeter. Cover and frame shall meet ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of alloy 5005-H15; with minimum thickness indicated representing specified thickness according to ANSI H35.2.

B. Aluminum-alloy rolled tread plate shall meet ASTM B 632/B 632M, alloy 6061-T6.

C. Steel sheet for cover shall be ¼-inch steel diamond plate. Steel sheet for frame shall be ¼-inch steel plate. Cover and frame shall meet ASTM A36.

2.3 PAINT

A. Provide primers that comply with Section "Painting."

B. Shop primer for ferrous metal shall be a fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

C. Shop primer for metallic-coated steel shall be an organic zinc-rich primer complying with SSPC-Paint 20 and compatible with topcoat.

D. Galvanizing repair paint shall be a high-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.

2.4 DOORS AND FRAMES

A. Doors shall withstand a live load of 300 psf with a maximum allowable deflection of 1/150th of the span. Frame shall have an integral drainage channel with a minimal cross-sectional area 7 square inches for water drainage. Coordinate frame depths with exact thicknesses of concrete slabs as indicated on the Contract Drawings. A 1-1/2-inch drainage coupling shall be provided on the exterior vertical leg of the frame at the front right corner, opposite the hinged side. Doors shall be equipped with heavy forged brass hinges having 3/8-inch minimum diameter stainless steel pins and pivot so that the cover does not protrude into the channel frame. A type 316 stainless steel snap lock with gasketed cover plug and removable handle shall be provided. A stainless steel torsion bar mechanism, acting through cams, shall be provided for smooth, easy and controlled operation throughout the entire arc of opening and closing. Operation shall not be affected by temperature. The door shall lock automatically in the vertical position by means of a heavy steel automatic hold open arm with release handle. Aluminum shall be mill finish, with bituminous coating applied to exterior of frame by manufacturer. Hold open arm and lock strike shall be zinc plated and chromate steel. All other hardware shall be 316 stainless steel. Manufacturer shall provide a peel-off protective covering on the top surface of the door leaf and frame. Custom sizes shall be provided as required. Single and double door types as shown and listed.

B. Provide LadderUp® safety post for access doors as listed on drawing schedules. For steel doors, use a hot dip galvanized safety post; for aluminum doors, use a stainless steel safety post.

C. Provide hatch grate that is a hinged and lockable aluminum grating panel that is easily installed beneath access covers regardless of the access cover manufacture. The grate shall provides additional protection against fall through accidents when the cover is left in the open position. The unit shall be ockable with an owner supplied padlock and incorporates a spring assisted lifting handle that positions the handle near the slab level when the access cover is in the open position. The grate shall incorporates a T-316 stainless steel hold open arm with aluminum latch and with T-316 stainless steel mounting hardware for either concrete or frame only installations

2.5 FABRICATION

A. Provide access door assemblies manufactured as integral units ready for installation.

B. For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. For steel doors and frames, grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. As-fabricated finish shall be AA-M10 (Mechanical Finish: as fabricated, unspecified).

D. Class I, clear anodic finish shall be AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 EXECUTION

3.1 PREPARATION

Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

3.4 FLOOR DOOR SIZES

Refer to Contract Drawings for sizes.

- - END OF SECTION - -

SECTION 08710

DOOR HARDWARE

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Commercial door hardware for the following:

a. Pump Station Entrance Door.

1.2 SUBMITTALS

A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Other Action Submittals:

1. Door Hardware Sets: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.

b. Content: Include the following information:

1) Identification number, location, hand, fire rating, and material of each door and frame.
2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
3) Complete designations of every item required for each door or opening including name and manufacturer.
4) Fastenings and other pertinent information.
5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
6) Explanation of abbreviations, symbols, and codes contained in schedule.
7) Mounting locations for door hardware.
8) Door and frame sizes and materials.

c. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.

2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final

keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.

1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
2. Installer shall have warehousing facilities in Project's vicinity.
3. Scheduling Responsibility: Preparation of door hardware and keying schedules.

B. Source Limitation: Obtain each type and variety of door hardware from a single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.5 COORDINATION

A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.6 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements.

C. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 HINGES

A. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

B. Hinge Weight: Heavy-weight.

C. Hinge Base Metal: Stainless steel, with stainless-steel pin.

D. Hinge Options:

1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors.
2. Corners: Square.

E. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.

F. Butts and Hinges: BHMA A156.1. Listed under Category A in BHMA's "Certified Product Directory."

G. Template Hinge Dimensions: BHMA A156.7.

H. Manufacturers:

1. Hager Companies.
2. McKinney Products Company; an ASSA ABLOY Group company.
3. Stanley Commercial Hardware; Div. of The Stanley Works.
4. Or approved equal.

2.3 LOCKS AND LATCHES

A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with ANSI A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.

B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

C. Lock Trim:

1. Levers: Wrought, Forged, or Cast.

2. Escutcheons: Wrought, Forged, or Cast.

3. Dummy Trim: Match lever lock trim and escutcheons.

D. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
1. Mortise Locks: Minimum 3/4-inch latchbolt throw.

E. Rabbeted Meeting Doors: Provide special rabbeted front and strike on locksets for rabbeted meeting stiles.

F. Backset: 2-3/4 inches, unless otherwise indicated.

G. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:

1. Strikes for Bored Locks and Latches: BHMA A156.2.
2. Strikes for Mortise Locks and Latches: BHMA A156.13.
3. Strikes for Interconnected Locks and Latches: BHMA A156.12.
4. Strikes for Auxiliary Deadlocks: BHMA A156.5.

H. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
1. Mortise Locks: BHMA A156.13.

I. Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13, Grade 1; Series 1000.

1. Manufacturers:

a. Best Access Systems; Div. of The Stanley Works.
b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
d. Or approved equal.

2.4 DOOR BOLTS

A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
1. Mortise Flush Bolts: Minimum 3/4-inch throw.

B. Dustproof Strikes: BHMA A156.16, Grade 1.

C. Manual Flush Bolts: BHMA A156.16, Grade 1; designed for mortising into door edge.

1. Manufacturers:
a. Burns Manufacturing Incorporated.
b. Hager Companies.
c. IVES Hardware; an Ingersoll-Rand Company.
d. Or approved equal.

2.5 EXIT DEVICES

A. Exit Devices: BHMA A156.3, Grade 1

B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with ANSI A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf .

C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

E. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

1. Operation: Rigid.

F. Outside Trim: Lever with cylinder; material and finish to match locksets, unless otherwise indicated.

1. Match design for locksets and latchsets, unless otherwise indicated.

2.6 LOCK CYLINDERS

A. Standard Lock Cylinders: BHMA A156.5, Grade 1.

B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Seven
2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.

C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

D. Construction Keying: Comply with the following:

1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

a. Replace construction cores with permanent cores as directed by Owner.

E. Manufacturers:
1. Best Access Systems; Div. of The Stanley Works.
2. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
3. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
4. Or approved equal.

2.7 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:

1. Existing System: Master key or grand master key locks to Owner's existing system.

B. Keys: Nickel silver.

1. Quantity: In addition to one extra key blank for each lock, provide the following:
a. Cylinder Change Keys: Three.
b. Master Keys: Five.

2.8 CLOSERS

A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with ANSI A117.1.

1. Comply with the following maximum opening-force requirements:
a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.

B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.

C. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

D. Surface Closers: BHMA A156.4, Grade 1. Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.

1. Manufacturers:
a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
b. LCN Closers; an Ingersoll-Rand Company.
c. Norton Door Controls; an ASSA ABLOY Group company.
d. Or approved equal.

2.9 PROTECTIVE TRIM UNITS

A. Size: 1-1/2 inches less than door width on push side by 8" high.

B. Fasteners: Manufacturer's standard stainless steel machine or self-tapping screws.

C. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from the following material:

1. Material: 0.050-inch thick stainless steel.

2. Manufacturers:
   a. Burns Manufacturing Incorporated.
   b. IVES Hardware; an Ingersoll-Rand Company.
   c. Rockwood Manufacturing Company.
   d. Or approved equal.

2.10 DOOR GASKETING

A. Standard: BHMA A156.22.

B. General: Provide continuous weather-strip gasketing on exterior doors. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

C. Air Leakage: Not to exceed 0.50 cfm per foot of crack length for gasketing, as tested according to ASTM E 283.

D. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

E. Gasketing Materials: ASTM D 2000 and AAMA 701/702.

F. Manufacturers:

1. National Guard Products.
2. Pemko Manufacturing Co.
3. Reese Enterprises.
4. Or approved equal.

2.11 THRESHOLDS

A. Standard: BHMA A156.21.

B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with ANSI A117.1.

1. Bevel raised thresholds with a slope of not more than 1:2.

2. Comply with NFPA 101. Maximum 1/2 inch high.

C. Manufacturers:

1. National Guard Products.
2. Pemko Manufacturing Co.
3. Reese Enterprises.
4. Or approved equal.

2.12 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Steel Machine Screws: For the following applications:

a. Mortise hinges to doors.
b. Strike plates to frames.
c. Closers to doors and frames.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.

2.13 FINISHES

A. Standard: BHMA A156.18, as indicated in door hardware sets.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 Series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors and door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DOOR HARDWARE SETS

Door Hardware Set No. 1
Door No. 100; each to have the following:

No.	Item	Description	Manufacturer	Finish
3 PR	Hanging Devices	FBB 199 4½" x 4½" NRP	Stanley	32D
1	Lock and Latches	37 H7J3M	Best	630
2	Closing Devices	7500 BF H	Norton	
2	Protective Trim Units	8400	Ives	32D
1	Astragal	115 NA	National Guard Products	Clear Anodized Alum
1	Weatherstripping	110 NA	National Guard Products	Clear Anodized Alum
1	Sweep	200 NA	National Guard Products	Clear Anodized Alum
1	Threshold	8426	National Guard Products	Mill Alum
2	Flush Bolts	458	Ives	26 D

-- END OF SECTION --

DIVISION 9

FINISHES

SECTION 09900

PAINTING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Work under this section consists of surface preparation, priming, painting, and finishing work necessary to complete Work indicated or reasonably implied on Drawings.

2. Use high performance coating systems specified in this section to finish components, unless otherwise indicated. Without restricting volume or generality, work to be performed under this section may include, but is not limited to:

   a. Interior wall and ceiling surfaces
   b. Interior steel
   c. Interior concrete floors
   d. Opening frames and trims
   e. Exterior concrete and concrete masonry
   f. Exterior metal items
   g. Piping, hangers, and supports
   h. Exposed bare pipes (including color coding)
   i. Electrical conduit, junction boxes, and other equipment
   j. Shop-primed items exposed to view, including metal fabrications, equipment, lintels, metal doors and frames, access doors, hangers, and railings not scheduled to receive other finish treatments
   k. Secondary Chemical Containment areas for chemical storage tanks, chemical totes, and chemical feed pump systems

3. Painting or finishing is not needed for the following:

   a. Stainless steel piping, stainless steel equipment, stainless steel equipment supports, concrete tank interiors, fiberglass tank baffles, metal grating and stairs, aluminum railings, galvanized structural steel members. Surfaces or materials specifically scheduled or shown on Drawings to remain unfinished.
   b. Items provided with factory finish.
   c. Equipment nameplates, fire rating labels, and operating parts of equipment.

4. Materials and products having factory-applied primer shall not be considered factory finished.

B. Related Sections - All Divisions

1.02 REFERENCES

A. Publications listed herein are part of this specification to extent referenced.

B. American National Standards Institute

1. ANSI A13.1 Scheme for the Identification of Piping Systems
2. ANSI Z535.1 Safety Color Code

C. ASTM International (formerly American Society for Testing and Materials)

1. ASTM D16 Terminology Relating to Paint, Varnish, Lacquer, and Related Products
2. ASTM D4263 Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method. ASTM F 1869 - Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
3. ASTM D4442 Test Methods for Direct Moisture Content of Wood and Wood-Base Materials

International Concrete Repair Institute (ICRI) Guideline No. 310.2-1997 (formerly 03732) - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

D. National Fire Protection Association

1. NFPA 101 Life Safety Code
2. GNAPF 500-03-04 Abrasive Blast Cleaning.

E. SSPC: The Society for Protective Coatings (formerly the Steel Structures Painting Council):

1. SSPC SP-1 Specification for Solvent Cleaning
2. SSPC SP-2 Specification for Hand Tool Cleaning
3. SSPC SP-3 Specification for Power Tool Cleaning
4. SSPC SP-5 Specification for White Metal Blast Cleaning
5. SSPC SP-6 Specification for Commercial Blast Cleaning
6. SSPC SP-7 Specification for Brush-Off Blast Cleaning
7. SSPC SP-10 Specification for Near White Metal Blast Cleaning
8. SSPC SP-11 Specification for Power Tool Cleaning to Bare Metal
9. SSPC-SP 13/NACE 6 - Surface Preparation of Concrete.
10. SSPC-SP 15 Commercial Grade Power Tool Cleaning
11. SSPC-SP 16 Brush-Off Blast Cleaning of Non-Ferrous Metals
12. SSPC PA-1 Painting Application Specification
13. SSPC PA-2 Paint Thickness Measurement

1.03 DEFINITIONS

A. Terms ‘Paint’ or ‘Painting’ shall in a general sense have reference to sealers, primers, oil, alkyd, latex, polyurethane, epoxy, and enamel type coatings and application of these materials.

B. Dry Film Thickness (DFT): Thickness, measured in mils, of a coat of paint in cured state.

C. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 SUBMITTALS

A. Product Data

1. Submit manufacturer's literature describing products to be provided, giving manufacturer's name, product name, and product line number for each material.
2. Submit technical data sheets for each coating, giving descriptive data, curing times, mixing, thinning, and application requirements.

a. Provide material analysis, including vehicle type and percentage by weight and by volume of vehicle, resin, and pigment.

3. Submit manufacturer's Material Safety Data Sheets (MSDS) and other safety requirements.

B. Shop Drawings

1. Submit a complete list of products proposed for use, including identifying product names and catalog numbers.

a. Arrange in same format as Schedule of Paint Finishes below.
b. Include applicable manufacturer's data and recommendations.

C. Samples

1. Selection Samples

a. Submit color charts displaying manufacturer's full range of standard colors for initial selection by Engineer and Owner.

2. Verification Samples

a. Submit 3 samples of each coating and color selected, showing bare, prepared surface and each successive coat.
b. Samples shall be submitted on hardboard or metal as appropriate to coating system. Label samples on back, identifying manufacturer, product name, and color number.
c. Sample Size: Not less than 12" x 12" (300 mm x 300 mm)

1.05 QUALITY ASSURANCE

A. Qualifications

1. Provide products from a company specializing in manufacture of high performance coatings with a minimum of 10 years experience.
2. Applicator shall be trained in application techniques and procedures of coating materials and shall demonstrate a minimum of 2 years successful experience in such application.

a. Maintain, throughout duration of application, a crew of painters who are fully qualified to satisfy specified qualifications.

1. Single Source Responsibility

a. Materials shall be products of a single manufacturer or items standard with manufacturer of specified coating materials.
b. Provide secondary materials that are produced or are specifically recommended by coating system manufacturer to ensure compatibility of system.

B. Regulatory Requirements

1. Conform to applicable codes and ordinances for flame, fuel, smoke, and volatile organic compound (VOC) ratings requirements for finishes at time of application.

C. Pre-Installation Meetings

1. Schedule a conference and inspection to be held on-site before field application of coating systems begins.

2. Conference shall be attended by Contractor, Owner's representative, Engineer, coating applicators, and a representative of coating material manufacturer.
3. Topics to be discussed at meeting shall include:

    a. A review of Contract Documents and accepted shop drawings shall be made and deviations or differences shall be resolved.
    b. Review items such as environmental conditions, surface conditions, surface preparation, application procedures, and protection following application.
    c. Establish which areas on-site will be available for use as storage areas and working area.

4. Pre-construction conference and inspection shall serve to clarify Contract Documents, application requirements and what work should be completed before coating application can begin.
5. Prepare and submit, to parties in attendance, a written report of pre-installation conference. Report shall be submitted with 3 days following conference.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading

1. Deliver products in manufacturer's original unopened containers. Each container shall have manufacturer's label, intact and legible. Containers shall fully identify brand, type, grade, class, and other qualifying information used to describe contents.
2. Include on label for each container:

    a. Manufacturer's name
    b. Type of paint
    c. Manufacturer's stock number
    d. Color name and number
    e. Instructions for thinning, where applicable

B. Storage and Protection

1. Store materials in a protected area, away from construction activities. Restrict storage area to paint materials and related equipment.
2. Maintain temperature in area of storage between 40 degrees F (4 degrees C) and 110 degrees F (43 degrees C).
3. Comply with health and fire safety regulations.
4. Remove damaged materials from Site.

1.07 PROJECT CONDITIONS

A. Environmental Requirements

1. Apply coating materials under conditions as follows:

    a. Air temperature shall not be below 35 degrees F (2 degrees C) or above 110 degrees F (43 degrees C).
    b. Refer to specific product information sheets for minimum surface temperature requirements. Surface temperatures shall be at least 5 degrees F (15 degrees C) above dew point and in a rising mode.
    c. Relative humidity shall be no higher than 85%.
    d. For exterior spray application, wind velocity shall be less than 15 mph.

e. Atmosphere shall be relatively free of airborne dust.

1.08 SEQUENCING

A. Coordination

1. Perform work in proper sequence with work of other trades to avoid damage to finished work.
2. Where coatings are scheduled to be applied over shop-applied coatings, coordinate work of such shop applied products to ensure compatibility with field applied coating systems.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. To define requirements for materials, size, and design, this specification lists specific products manufactured by Tnemec Company, Inc. of Kansas City, Missouri, or Sherwin-Williams, Cleveland, Ohio. Materials specified herein are cited as minimum standard of quality which will be acceptable: Tnemec; Carboline; Sherwin Williams; or equal.

B. Materials specified herein shall not preclude consideration of equivalent or superior materials. Suggested equivalent materials or other substitutions shall be submitted to Engineer for consideration.

1. Requests for substitution shall include evidence of satisfactory past performance on water and wastewater treatment facilities.
2. Substitutions will not be considered that change number of coats or do not meet specified total dry film thickness.

2.02 ACCESSORIES

A. Coating Application Accessories

1. Provide application accessories as indicated in coating manufacturer's application instructions, including but not limited to cleaning agents, etching agents, cleaning cloths, sanding materials, and clean-up materials.
2. Material not specifically identified, but needed for proper application shall be of a quality not less than specified products.

2.03 SHOP FINISHING

A. Surface Preparation

1. Clean surfaces of loose scale, rust, oil, dirt, and other foreign matter, immediately prior to priming. Surfaces to be coated shall be clean, dry, smooth, and free from dust and foreign matter that will adversely affect adhesion or appearance.
2. Prior to application of primer, steel surfaces shall be prepared to receive coating system in compliance with manufacturer's recommendations and specifications of SSPC as indicated in Schedule of Coating Systems below.

B. Shop Applied Coatings

1. Steel members shall be provided with one coat of primer as indicated in Schedule of Coating Systems below. Application of first coat shall follow immediately after surface preparation and cleaning and within an eight hour working day. Cleaned areas not receiving first coat within an eight hour period shall be re-cleaned prior to application of first coat.
2. Apply materials at film thickness specified by methods recommended by manufacturer in compliance with SSPC PA-1.
3. Allow each coat of paint to dry thoroughly before applying succeeding coats.
4. Make finish topcoats smooth, uniform in color, and free of laps, runs, dry spray, over-spray, and skipped or missed areas.
5. Environmental conditions shall be in compliance with coating manufacturer's printed instructions.

2.04 SOURCE QUALITY CONTROL

A. Testing Laboratory Services

1. Documents

a. Review Contract Documents and applicable sections of referenced standards.

2. Shop Painting Inspection

a. Verify cleaning operations to surfaces are to condition specified.
b. Verify conformance of paint to specification.
c. Check for thickness of each coating, final thickness, and holidays.
d. Check touch-up for final finish.

3. Reports

a. Submit written progress reports describing tests and inspections made and showing action taken to correct non-conforming work. Report uncorrected deviations from Contract Documents.

PART 3 EXECUTION

3.01 EXAMINATION

A. Site Verification of Conditions

1. Examine areas and conditions under which application of coating systems shall be performed for conditions that will adversely affect execution, permanence, or quality of coating system application.
2. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes until moisture content of surface is below following limits:

a. Masonry Surfaces: 12% maximum
b. Vertical Concrete Surfaces: 12% maximum
c. Horizontal Concrete Surfaces: 8% maximum
d. Gypsum Board Surfaces: 12% maximum
e. Wood Surfaces: 15% maximum; in compliance with ASTM D4442

3. Correct conditions detrimental to timely and proper execution of Work.
4. Do not proceed until unsatisfactory conditions have been corrected.

5. Commencement of installation constitutes acceptance of conditions and responsibility for satisfactory performance.

3.02 PREPARATION

A. Protection

1. Take precautionary measures to prevent fire hazards and spontaneous combustion. Remove empty containers from Site.
2. Place cotton waste, cloths, and hazardous materials in containers, and remove from Site daily.
3. Provide drop cloths, shields, and other protective equipment.
4. Protect elements surrounding work of this section from damage or disfiguration.
5. As Work proceeds, promptly remove spilled, splashed, or splattered materials from surfaces.
6. During application of coating materials, post Wet Paint signs.
7. During application of solvent-based materials, post No Smoking signs.

B. Surface Preparation

1. General Requirements

a. Prior to application of primer, surfaces shall be prepared to receive specified coating system in compliance with manufacturer's recommendations and specifications of SSPC as indicated in Schedule below.
b. Clean surfaces of residual deposits of grease, scale, rust, oil, dirt, and other foreign matter, immediately prior to priming. Surfaces to be coated shall be clean, dry, smooth, and free from dust and foreign matter that will adversely affect adhesion or appearance.

2. Ferrous Metal Surfaces

a. Surfaces shall be free of residual deposits of grease, rust, scale, dirt, dust, oil, and weathered coating.
b. For shop primed surfaces, sand and scrape to remove loose and/or weathered primer and rust. Feather edges to make touch-up patches inconspicuous. Field welds and touch-ups shall be prepared to conform to original surface preparation standards as indicated in Schedule of Coating Systems below.
c. Shop applied prime coatings that are damaged during transportation, construction, extended field exposure and/or installation shall be thoroughly cleaned and touched up in field. Use repair procedures that insure complete protection of adjacent primer. Repair methods and equipment may include wire brushing, hand or power tool cleaning, pressure washing and/or dry air blast cleaning. In order to prevent injury to surrounding painted areas, blast cleaning may necessitate use of lower air pressure, small nozzle and abrasive particle sizes, short blast nozzle distance from surface, shielding and masking. If damage is too extensive to tough-up, item shall be re-cleaned and coated or painted.
d. For surfaces not shop primed, surfaces shall be cleaned in compliance with specifications of Steel Structures Painting Council as indicated in Schedule of Coating Systems below.

3. Galvanized Steel Surfaces

a. Prepare in accordance with SSPC-SP 16.
b. Sand clean and spot prime abraded areas.

4. Lightweight Metals

    a. Prepare in accordance with SSPC-SP 16..

5. Cast-In-Place and/or Precast Concrete Surfaces: Prepare concrete surfaces in accordance with manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 310.2.

    a. Allow concrete to cure for not less than 30 days prior to painting.
    b. Remove loose particles with stiff brush.
    c. Remove dirt, scale, efflorescence, powders, laitance, parting compounds, and other foreign matter.
    d. Wash stains caused by weathering or corroding metals with a sodium metasilicate solution after thoroughly wetting with clean, clear water; allow surface to thoroughly dry.
    e. Fill small surface pock marks and air holes with a suitable fill material. Thoroughly brush or rub over surface and let dry for not less than 24 hours before paint application.

6. Submerged Concrete (Void-free surface): Prepare concrete surfaces in accordance with manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 310.2.

    a. Remove oil, grease and contaminants by solvent cleaning.
    b. Brush blast entire surface to remove laitance, form coatings, provide a uniform surface texture in accordance with the ICRI 310.2 CSP required by the manufacturer.
    c. Perform blast cleaning so as to open up voids and bugholes so that holes are concave. Care should be taken to keep aggregate exposures to a minimum.
    d. Voids up to 1/2" (13 mm) in depth and/or 2" (50 mm) in diameter shall be filled and patched with a cementitious product compatible with next coat applied or Sherwin-Williams Steel-Seam FT910 or Tnemec Series 63-1500 Filler and Surfacer.

7. Masonry Surfaces (facing brick or concrete masonry units)

    a. Allow surfaces to cure for not less than 30 days prior to painting.
    b. Remove dirt, loose mortar, scale, efflorescence, or powder.

8. Cement Plaster (stucco)

    a. Allow surfaces to cure for 30 to 60 days prior to painting.
    b. Fill minor isolated hairline cracks with patching plaster and smooth off to match texture of adjacent surfaces.
    c. Remove dirt, loose material, scale, efflorescence, powder, and other foreign matter. Remove oil and grease by washing with a tri-sodium phosphate solution, rinse with clean, clear water and let thoroughly dry.
    d. For solvent based paints, wash surfaces with a 4% zinc sulphate solution, rinse with clean, clear water, and let thoroughly dry before painting.

9. Moisture Emission Test for Concrete and Masonry

    a. Test substrates for moisture prior to application of coating systems. Test shall be plastic sheet method in compliance with ASTM D4263 and, if necessary, F 1869.

10. Gypsum Wallboard Surfaces:

    a. Fill narrow, shallow cracks and small holes with spackling compound.

b. Rake deep, wide cracks and deep holes; dampen with clean, clear water and fill with thin layers of joint cement.

11. Copper Surfaces:

a. Clean surfaces in accordance with SSPC-SP 16.

12. Stainless Steel Surfaces:

a. Clean surfaces in accordance with SSPC-SP 16.

13. Concrete Floors: Prepare concrete surfaces in accordance with manufacturer's instructions, SSPC-SP 13/NACE 6, and ICRI 310.2.

a. Allow concrete to cure for 30 days prior to painting.
b. Remove contamination, dirt, dust, and other foreign matter from concrete floors.
c. Brush-Off-Blast or Vacuum Blast Clean to achieve a uniform surface profile in accordance with the ICRI 310.2 CSP required by the manufacturer...
d. After surface treatment, keep traffic off surfaces until painting.

14. Wood Surfaces

a. Sand wood surfaces and edges smooth and even before finishing or painting and between coats. Remove dust after each sanding.
b. Remove residue from knots, pitch streaks, cracks, open joints, and sappy spots. Knots shall be coated with a pigmented stain sealer prior to painting. Avoid use of shellac as an undercoat.
c. Countersink nails and fill nail holes, cracks, open joints and other defects with tinted putty or wood filler after priming is dry and before second coat.

15. Insulated Coverings, Canvas or Cotton

a. Clean using high-pressure air and solvent of type recommended by coating manufacturer.

16. Polyvinyl Chloride (PVC) Pipe

a. Remove ink markings by wiping down with clean-lint-free cloths saturated denatured alcohol.

3.03 APPLICATION

A. General Requirements

1. Apply coating systems in compliance with manufacturer's instructions and using application method best suited for obtaining full, uniform coverage of surfaces to be coated.

2. Apply primer, intermediate, and finish coats to comply with wet and dry film thickness and spreading rates for each type of material as recommended by manufacturer.

a. Application rates in excess of those recommended and fewer numbers of coats than specified shall not be accepted.

3. Number of coats specified shall be minimum number acceptable. Apply additional coats as needed to provide a smooth, even application.

    a. Closely adhere to re-coat times recommended by manufacturer. Allow each coat to dry thoroughly before applying next coat. Provide adequate ventilation for tank interior to carry off solvents during drying phase.

4. Employ only application equipment that is clean, properly adjusted, and in good working order, and of type recommended by coating manufacturer.
5. After surface preparation, interior weld seams shall be brush applied.
6. Make edges of paint adjoining other materials or colors sharp and clean, without overlapping.
7. Finish tops, bottoms and edges of doors same as faces of doors.
8. Piping and Conduit Exposed to View

    a. Finish in compliance with requirements for unprimed ferrous metal items.
        i) Use colors specified in ANSI Z13.1 and Z535.1 or the Ten States Standards Guide.
    b. Identification markings will be provided by others.

9. Access Panels, Electrical Panels, and Cover Plates:

    a. Finish in compliance with requirements for shop-primed ferrous metal items, including doors, door backs and sight-exposed cabinet surfaces, color matching adjacent surfaces unless otherwise indicated; do not allow coatings on identification plates, tags, or markings.

3.04 REPAIR/RESTORATION

A. At completion of Work, touch-up and restore finishes where damaged.

B. Defects in Finished Surfaces

1. When stain, dirt, or undercoats show through final coat, correct defects and cover with additional coats until coating is of uniform finish, color, appearance and coverage.
2. Correct defects visible from a distance of 5 feet. Runs shall not be permitted.

C. Touch-up of minor damage shall be acceptable where result is not visibly different from surrounding surfaces. Where result is visibly different, either in color, sheen, or texture, recoat entire surface.

3.05 FIELD QUALITY CONTROL

A. Required Inspections and Documentation

1. Documents

    a. Review Contract Documents and applicable sections of referenced standards.

2. Field Painting Inspection:

    a. Verify cleaning operations to surfaces are to condition specified.
    b. Verify conformance of paint to specification.
    c. Check for thickness of each coating, final thickness, and holidays.
    d. Check touch-up for final finish.

3. Reports

a. Submit written progress reports describing tests and inspections made and showing action taken to correct non-conforming work. Report uncorrected deviations from Contract Documents.

B. Manufacturer's Field Service

1. Coatings manufacturer shall be available to provide on-site inspections, technical assistance, and guidance for application of coating system as needed.

3.06 CLEANING

A. At completion of day's work, remove from Site rubbish and accumulated materials.

B. Clean paint spots and other soiling from prefinished surfaces and surfaces with integral finish. Use solvents which will not damage finished surface.

C. Leave storage area clean and in same condition indicated for equivalent spaces in Project.

3.07 PROTECTION

A. Protect work against damage until fully cured. Provide signs identifying wet surfaces until surfaces are adequately cured.

3.08 WASTE MANAGEMENT

A. General Requirements

1. Place materials defined as hazardous or toxic waste in designated containers.
2. Return solvent and oil soaked rags for contaminant recovery and laundering or for proper disposal.
3. Do not dispose of paints or solvents by pouring on ground. Place in designated containers for proper disposal.
4. Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

3.09 SCHEDULE OF COATING SYSTEMS

A. Previously Painted Surfaces (existing facility). NOT USED

B. Carbon Steel (structural steel, miscellaneous metal, tanks, pipes, and equipment)

1. Exterior Steel - Non-Immersion
   a. Shop Surface Preparation: SSPC SP6 Commercial Blast Cleaning
   b. Shop and Spot Field Primer Coat: Corothane I Galvapac or Series 91H20
      i) Dry Film Thickness: 2.5 to 3.5 mils
   c. Full Field Intermediate Coat: Macropoxy 646 or Series N69-color Hi-Build Epoxoline
      i) Dry Film Thickness: 3.0 to 5.0 mils
   d. Finish Coat: Acrolon Ultra, Hi-Solids Polyurethane, or Series 1075-color Endura-Shield
      i) Dry Film Thickness: 2.5 to 5.0 mils
   e. Total Dry Film Thickness: 8.0 to 13.5 mils.

1. Interior Steel - Non-Immersion (moderate chemical and dry exposure) for Structural Steel, pumps, valves, mechanical equipment, etc.)

    a. Shop Surface Preparation: SSPC SP6 Commercial Blast Cleaning
    b. Shop Primer Coat: Corothane I Galvapac or Series 91H20
        i) Dry Film Thickness: 2.5 to 3.5 mils
    c. Full Field Prime Coat: Macropoxy 646 or Series N69-color Hi-Build Epoxoline
        i) Dry Film Thickness: 3.0 to 5.0 mils
    d. Finish Coat: Macropoxy 646 or Series N69-color Hi-Build Epoxoline
        i) Dry Film Thickness: 3.0 to 5.0 mils
    e. Total Dry Film Thickness: 7.5 to 13.5 mils.

2. Interior Steel - Immersion – Potable Water - NOT USED

5. Exterior Steel – Immersion, Clarifier Rake arms etc., Non-Potable:
    a. Shop Surface Preparation: SSPC SP10 Near White Blast Cleaning
    b. OPTIONAL Shop Primer Coat: Copoxy, Dura-Plate 235, or Series N69
        i) Dry Film Thickness: 3.0 to 5.0 mils
    c. Field Surface Preparation: SSPC-SP 10 or Pressure Wash Shop Primer and sweep blast to remove surface contamination. SSPC SP15 any damaged primer or welded connections. Spot prime with shop primer.
    d. Full Field Prime Coat: Sher-Glass FF or Series 104
        i) Dry Film Thickness: 8.0 to 12.0 mils
    e. Finish Coat Sher-Glass FF or Series 104
        i) Dry Film Thickness: 8.0 to 12.0 mils
    f. Total Dry Film Thickness: 16.0 to 24.0 mils.

6. Interior or Exterior Steel - Immersion; Non-Potable – NOT USED?
   Note: For exposures to hydrogen sulfide, sulfuric acid and industrial waste condensates.

    a. Surface Preparation: SSPC SP5 White Metal Blast Cleaning
        i) Minimum Anchor Pattern: 3.0 mils
    b. Primer Coat: Cor-Cote SC or Series 435
        i) Dry Film Thickness: 15.0 to 20.0 mils
    c. Finish Coat: Cor-Cote SC or Series 435
        i) Dry Film Thickness: 15.0 to 20.0 mils
    d. Total Dry Film Thickness: 30.0 to 40.0 mils

7. Interior or Exterior Steel - NOT USED

C. Mill Coated Ductile Iron Pipe; Non-Potable

1. Exterior or Interior - Non-Immersion:

    a. Shop Surface Preparation: NAPF 500-03-04 with the exception that ALL rust and mold coating be removed. Only tightly adherent annealing oxide may remain.
    b. Shop Primer Coat: Copoxy, Macropoxy 646, or Series N69-1211
        i) Dry Film Thickness: 3.0-5.0 dry mils
    c. Field Surface Preparation: Pressure Wash Shop Primer to remove surface contamination. SSPC SP3 any damaged primer or welded connections. Spot prime with shop primer.
    d. Full Field Intermediate Coat: Macropoxy 646 or Series N69-color Hi-Build Epoxoline
        i) Dry Film Thickness: 3.0 to 5.0 mils
    e. Exterior Finish Coat: Acrolon Ultra, Hi-Solids Polyurethane, or Series 1075 Endura-Shield
        i) Dry Film Thickness: 2.5 to 5.0 mils

f. Interior Finish Coat: Macropoxy 646 or Series N69-color Hi-Build Epoxoline
i) Dry Film Thickness: 3.0 to 5.0 mils
g. Total Dry Film Thickness: 8.0 to 13.5 mils

2. Exterior or Interior - Immersion; Potable – NOT USED

D. Galvanized Steel - Pipe, Metal Deck, and Miscellaneous Fabrications

1. Exterior

a. Surface Preparation: SSPC-SP16.
b. Spot Prime Coat: Corothane I Galvapac or Series 91H20 (galvi touch-up only)
i) Dry Film Thickness: 2.5 to 3.5 mils
c. Full Intermediate Coat: Macropoxy 646 or Series N69 Hi-Build Epoxoline
i) Dry Film Thickness: 3.0 to 4.0 mils
d. Full Finish Coat: Acrolon Ultra, Hi-Solids Polyurethane, or Series 1075 Endurashield
i) Dry Film Thickness: 2.5 to 5.0 mils
e. Total Dry Film Thickness: 8.0 to 12.5 mils

2. Interior

a. Surface Preparation: SSPC-SP16.
b. Primer Coat: Corothane I Galvapac or Series 91H2O (touch-up only)
i) Dry Film Thickness: 2.5 to 3.5 mils
c. Full Intermediate Coat: Macropoxy 646 or Series N69-color Hi-Build Epoxoline
i) Dry Film Thickness: 3.0 to 4.0 mils
d. Finish Coat: Macropoxy 646 or Series N69-color Hi-Build Epoxoline
i) Dry Film Thickness: 3.0 to 4.0 mils
e. Total Dry Film Thickness: 8.5 to11.5 mils

E. Concrete (cast-in-place and/or precast concrete surfaces)

1. Do not paint exterior cast-in-place or precast concrete structures.

3. Interior - Non-Immersion

a. Surface Preparation: SSPC-SP 13/NACE 6 to achieve a surface profile of ICRI CSP 2 or 3
b. First Coat: Pro-Industrial Waterborne Catalyzed Epoxy or Series 113/114
i) Dry Film Thickness: 2.0 to 4.0 mils
c. Second Coat: Pro-Industrial Waterborne Catalyzed Epoxy or Series 113/114 i) Dry Film Thickness: 3.0 to 4.0 mils
d. Total Dry Film Thickness: 5.0 to 8.0 mils.

F. Concrete Floors (Secondary Chemical Containment)

1. Pigmented Finish

a. Surface Preparation: SSPC-SP 13/NACE 6 witha surface profile of ICRI CSP 4 or 5
b. First Coat: Corobond 100 or Series 201 Primer
i) Dry Film Thickness: 4.0 to 6.0 mils
a. Second Coat: Cor-Cote HCR FF or Series 270 Stranlok.
i) Dry Film Thickness: 15.0 – 20,0 mils.
d. Finish Coat: Cor-Cote HCR FF or Two coats of Series 282 Gray Tneme-Glaze
i) Dry Film Thickness: 15.0 to 20.0 mils

e. Total Dry Film Thickness: 34.0 to 46.0 mils
f. For non-skid surface, add or broadcast silica sand 50 to 70 mesh at 5 pounds per gallon, or as recommended by manufacturer to second coat.

2. Pigmented Epoxy: Lab floors

a. Surface Preparation: Brush-off blast or vacuum blast cleaning
b. First Coat: General Polymers 3579 Primer or Series 280 (color)
i) Dry Film Thickness: 8.0 to 10.0 mils
c. Second Coat: General Polymers 3745 Topcoat or Series 280 (color)
i) Dry Film Thickness: 8.0 to 10.0 mils
d. Total Dry Film Thickness: 16.0 to 20.0 mils

G. Concrete Masonry Unit (CMU)

1. Exterior – Exposed

a. Surface Preparation: Surface shall be clean and dry
b. First Coat: Loxon XP or Series 156 Envirocrete
i) Dry Film Thickness: 6.0 to 8.0 mils (100 to 134 square feet/gallon)
c. Second Coat: Loxon XP or Series 156-color Enviro-Crete
i) Dry Film Thickness: 6.0 to 8.0 mils (100 to 134 square feet/gallon)
d. Total Dry Film Thickness: 12.0 to 16.0 mils

2. Interior: CMU

a. Surface Preparation: Surface shall be clean and dry
b. First Coat: Cement Plex 875 or Series 130 Envirofill
i) Dry Film Thickness: 14.0 to 18.0 mils (60 to 80 square feet/gallon)
c. Second Coat: Pro-Industrial Waterborne Catalyzed Epoxy or Series 113/114
i) Dry Film Thickness: 2.0 to 4.0 mils
d. Third Coat: Pro-Industrial Waterborne Catalyzed Epoxy or Series 113/114
i) Dry Film Thickness: 3.0 to 4.0 mils
e. Total Dry Film Thickness: 5.0 to 8.0 mils above block filler.

H. Interior Wall and Ceiling Surfaces

1. Gypsum Wallboard

a. Surface Preparation: Surface shall be clean and dry
b. First Coat: PrepRite ProBlock Interior/Exterior Latex Primer/Sealer or Series 51-792 PVA
i) Dry Film Thickness: 1.0 to 1.5 mils
c. Second Coat: Pro-Industrial Waterborne Catalyzed Epoxy or Series 113 Tufcoat
i) Dry Film Thickness: 2.0 to 4.0 mils
d. Finish Coat: Pro-Industrial Waterborne Catalyzed Epoxy or Series 113 Tufcoat
i) Dry Film Thickness: 3.0 to 4.0 mils
e. Total Dry Film Thickness: 6.0 to 9.5 mils

I. Wood

1. Interior or Exterior:

a. Surface Preparation: Surface shall be clean and dry

b. First Coat: PrepRite ProBlock Interior/Exterior Latex Primer/Sealer or or Series 10-99W Undercoater at 1.0 - 3.5 mils dft.
   i) Dry Film Thickness: 2.0 to 3.5 mils
c. Second Coat: Pro-Industrial High Performance Acrylic, KemBond HS, or Series 2H-Color Enduratone
   i) Dry Film Thickness: 2.5 to 3.5 mils
d. Third Coat: Pro-Industrial High Performance Acrylic, KemBond HS, or Series 2H-Color Enduratone
   i) Dry Film Thickness: 2.5 to 3.5 mils
e. Total Dry Film Thickness: 6.0 to 11.5 mils

J. PVC Pipe

1. Exterior or Interior

a. Surface Preparation: Surface shall be clean and dry; scarify surface uniformly.
b. First Coat: Macropoxy 646 or Series N69-color Hi-Build Epoxoline
   i) Dry Film Thickness: 2.0 to 3.0 mils
c. Exterior Finish Coat: Acrolon Ultra, Hi-Solids Polyurethane, or Series 1075 Endura-Shield
i) Dry Film Thickness: 2.0 to 3.0 mils
Interior Finish Coat: Macropoxy 646 or Series N69-color Hi-Build Epoxoline
   i) Dry Film Thickness: 2.0 to 3.0 mils
d. Total Dry Film Thickness: 4.0 to 6.0 mils

K. Insulated Pipe

1. Interior

a. Surface Preparation: Surface shall be clean and dry.
b. First Coat: DTM Acrylic Primer/Finish or Series 6-Color Tneme-Cryl
   i) Dry Film Thickness: 2.0 to 3.0 mils
e. Second Coat: DTM Primer/Finish or Series 6-Color Tneme-Cryl
   i) Dry Film Thickness: 2.0 to 3.0 mils
f. Total Dry Film Thickness: 4.0 to 6.0 mils

L. Fiberglass Reinforced Plastic Pipe

1. Exterior

a. Surface Preparation: Surface shall be clean and dry; lightly sand surface using 120-grit sandpaper.
b. First Coat: Macropoxy 646 or Series N69 Epoxoline
   i) Dry Film Thickness: 3.0 to 5.0 mils
c. Second Coat: Acrolon Ultra, Hi-Solids Polyurethane, or Series 1075 Endurashield
   i) Dry Film Thickness: 2.0 to 3.0 mils
d. Total Dry Film Thickness: 5.0 to 8.00 mils

3.11 SCHEDULE OF COLOR SYSTEM MATERIAL IDENTIFICATION

A. Colors as follows have been used successfully in wastewater treatment facilities for identification of various materials contained in tanks and pipes. SEE ATTACHED Ten States Identification with Sherwin-Williams Colors. A legend showing the name and contents of each pipe and an arrow showing the direction of flow shall be located on each pipe listed in the Piping Identification

Schedule. The legends shall be stenciled on the pipes and shall be located on straight runs and at each valve, piece of equipment, branches, changes in direction, and where pipes pass through walls or floors and as directed by the Engineer. The size and location of the legend shall be in general accordance with American National Standards Institute Scheme for Identification of Piping Systems, A13.1-1975 and the Recommended Standards for Wastewater Facilities prepared by the Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers (10 States' Standards). Engineer shall select the desired shades of the process piping color. Pumps, meters, etc. associated with the process piping shall also be painted the same color as the lines in which they are a part as selected by the Engineer.

COLOR CODING SCHEDULE

Service	**Generic Color**	**Color Identification**
Fire Protection (including hydrants)	red	SC09 Safety Red
Plant Water (including hydrants)	dark green	EN09 Balsam
Alum or Primary Coagulant	orange	SC03 Safety Orange
Liquid Sodium Bisulfite	yellow with green band	SC01 Safety Yellow with SC07 Safety Green band
Sodium Hypochlorite	yellow	SC01 Safety Yellow
Polymers or Coagulant Aids	light purple	YB44 Purple Mauve
Potassium Permanganate	violet	SC08 Safety Purple
Compressed Air	green	SC07 Safety Green
Digester Gas	red	SC05 Monterrey Tile
Other Lines	light gray	IN01 Light Gray
Scum	brown	EN05 Weathered Bark
Return Activated Sludge	brown	EN05 Weathered Bark
Waste Activated Sludge	brown	EN05 Weathered Bark
Thickened Sludge	brown	EN05 Weathered Bark
Other Sludge	brown	EN05 Weathered Bark
Seal Water	dark green	EN09 Balsam
Filtrate	black	IN06 Black
Digester Supernatant	brown	EN05 Weathered Bark
Natural Gas	red	SC05 Monterrey Tile
Drains	black	IN06 Black
Cold City Water	dark blue	SC06 Safety Blue
Hot City Water	light blue	GB03 Delft Blue
Hoists/Trolleys	yellow	SC01 Safety Yellow

B. Sample, drain, overflow, vent, metering, blowoff, and other associated lines shall be painted the same code color as the piping system they serve.

C. Existing surfaces, items of existing equipment, and piping which will require refinishing as a result of demolition and alteration work shall be repainted using the appropriate paint. Repainting shall not be limited to spot touch-up but shall include the painting of entire surfaces where demolition or alteration work has taken place.

D. Insulated pipe jacketed with aluminum or stainless steel shall not be painted, but uninsulated valves and fittings on such lines shall be color coded in accordance with existing scheme utilized by the plant. Such piping shall be identified by bands of proper code color and by legend.

E. Plumbing and HVAC lines, and electrical conduit exposed in finished areas, shall not be color coded but shall be painted the same color as the background to which they are adjacent, or as approved by engineer.

F. Items of equipment connected to color coded systems shall be painted the same color as the system they serve.

-- END OF SECTION --

SECTION 09995

PAINTING AND COATING OF WASTEWATER PUMP STATION WET WELL AND EQUIPMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Surface preparation shall consist of commercial blast cleaning in accordance with SSPC-SP 6 for the exposed metal, support brackets, and/or ductile iron pipe in the wet well, and a commercial brush blast cleaning to remove all loose debris, concrete, rust, grease, etc. for the concrete surfaces to be coated.

B. Painting shall consist of applying a plural-compound coating to the surfaces to achieve the required finish covering.

1.02 REQUIREMENTS

The Contractor shall furnish all materials, labor, equipment, and appliances and shall do all surface preparation and field painting as specified herein. The surface of the wet well and all pipe shall be dry and moisture free in accordance with the coating manufacturer's recommendation. The entire wet well interior shall be kept dry at all times during the coating process.

1.03 REFERENCES

A. AWWA D102 (Latest Revisions) Standards.

B. Kentucky State Board of Health.

C. U.S. Environmental Protection Agency.

D. KY Natural Resources and Environmental Protection Cabinet.

E. National Sanitation Foundation (NSF) Standard #61.

F. ASTM D 16 – Terminology Relating to Paint, Varnish, Lacquer, and Related Products

G. ASTM D 4263 – Indicating Moisture in Concrete by the Plastic Sheet Method

H. ASTM F 1869 – Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

I. AWWA C 652 – Disinfection of Water Storage Facilities.

J. AWWA D 102 – Painting Steel Water Storage Tanks.

K. SSPC-SP 3 – Power Tool Cleaning.

L. SSPC-SP 6/NACE 3 – Commercial Blast Cleaning.

M. SSPC-SP 10/NACE 2 – Near White Metal Blast Cleaning.

N. SSPC-SP 11 – Power Tool Cleaning t Bare Metal.

O. SSPC-SP 13/NACE 6 – Surface Preparation of Concrete

1.04 SUBMITTAL

A. Color chips of finish coatings.

B. Manufacturer's name and number for each product to be used.

C. Performance data for substitute products.

D. Color Selection Charts.

1.05 QUALITY CONTROL

A. The Contractor shall do a complete painting job throughout the work in accordance with these Specifications, the paint manufacturer's current surface preparation and application instructions, and with generally accepted practices for work of high quality.

B. All paints and painting materials not specifically specified shall be high-grade products of nationally known manufacturers of established good reputation, and shall be suitable for the intended use. Materials listed in the painting schedule without reference to a specification number, or materials not further described hereinafter, shall be products that have had a minimum of two years' satisfactory field service.

C. All paint shall be applied under favorable conditions by skilled painters to produce smooth even coatings of all interior and exterior surfaces.

D. Contractor to complete Holiday Detection, for all interior surfaces, in accordance with NACE International RPO188. Three copies of the results, noting any deficiencies, shall be transmitted to the Engineer.

E. Manufacturer’s Qualifications:

1. Specialize in manufacture of coatings with a minimum of 10 years 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.

F. Applicator’s Qualifications:

1. Experienced in application of specified coatings for a minimum of 5 years on projects of similar size and complexity of this work.
2. Applicator’s Personnel: Employ persons trained for application of specified coatings.

PART 2 - PRODUCTS

2.01 MATERIALS

A. The paints to be used in the work shall be products of the Sherwin Williams Company, Cleveland, OH, Carboline Company, St. Louis, MO or acceptable equivalent products. The types of paint products to be used in the work shall be identified by the manufacturer's name and/or number and brought to the job site in the original sealed containers of the manufacturer. All paints and paint products used on the project shall be from the same manufacturer.

B. The products of the manufacturers other than those herein named, which are acceptable equivalents to the products specified, may be substituted, except that, insofar as possible, all paints applied to a surface shall be products of one manufacturer. Data showing equivalent performance of each paint product to be substituted for the ones specified shall be submitted in writing to the Engineer for review at least 30 calendar days before the painting is to begin, and no painting shall proceed until the substituted products have been accepted.

C. All paints and painting materials not particularly specified shall be high-grade products of nationally known manufacturers of established good reputation, and shall be suitable for the intended use. Materials listed in the painting schedule without reference to a specification number, and not further described hereinafter, shall be products that have had a minimum of two years' satisfactory field service.

D. All paints shall comply with the latest EPA regulations concerning volatile organic compounds (VOC).

2.02 COLORS AND FINISHES

A. The colors of finish coatings shall be selected by the Engineer from color chips submitted by the Contractor for review. The color selection shall be in the form of a color schedule indicating the colors to be used on the various surfaces. The colors used in the final work shall be in accordance with the color schedule and shall match the selected color chips.

B. In order to provide contrast between successive coats, each coat shall be of such tint as will distinguish it from preceding coats.

2.03 STORING AND MIXING

All painting materials shall be stored and mixed in a single place. The Contractor shall not use any plumbing fixture or pipe for mixing or for disposal of any refuse material. The Contractor shall carry to his mixing room all water necessary, and shall dump all waste outside of the structure into a suitable receptacle so as not to create hazards or damage. The Contractor will be held responsible for all damage due to his failure to observe these provisions.

2.04 MANHOLE COATING AND SEALING MATERIALS - HARBOR VILLAGE WET WELL ONLY

1. Liner Mix

   a. A cement-based, fiber-reinforced calcium aluminate mortar specifically designed to prevent infiltration and restore structural integrity, and to be spray applied to form the structural/structurally enhanced monolithic cementitious liner covering all interior wet well surfaces.

   b. Material shall be premixed and specially formulated to withstand hydrogen sulfide bacterial corrosion and abrasion in municipal sanitary sewer systems.

   c. Material shall have the following minimum requirements at 28 days.

Compressive Strength	ASTM C-109	5000 psi
Flexural Strength	ASTM C-293	700 psi
Tensile Strength	ASTM C-496	> 600 psi
Shrinkage @ 90% Humidity	ASTM C-596	0 %
Sulfide Resistance	ASTM C-267	No Attack >pH2

   d. The product shall be as manufactured by Strong Systems, Inc., Permacast Process provided by AP/M Permaform, and Renderoc SP15 provided by Fosroc, Inc., or approved equal.

3. Manhole Joint/Hole Sealer

Acrylamide Base Gel: The Acrylamide base gel shall be based on a two-part chemical grout that is mixed within the isolated area formed by the grouting rig or packer and shall be AV-100 Acrylamide chemical grout as manufactured by Avanti International, or equal approved by the OWNER.

4. Water

Water shall be clean and potable.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. General: Before any surface is painted, it shall be cleaned carefully of all dust, dirt, grease, loose rust, mill scale, old weathered paint unsuitable for top coating, efflorescence, oil, moisture, or other foreign matter and conditions detrimental to coating bond and life. All necessary special preparatory treatment shall then be applied in strict accordance with the paint manufacturer's written instructions. Where required, imperfections and holes in surfaces to be painted shall be filled in an acceptable manner.

B. Abrasive Blast Cleaning: All exterior metal surfaces and concrete surfaces shall be cleaned to a "commercial" finish corresponding to SSPC-SP6 "Commercial Blast Cleaning". A surface profile of 1.5 to 2.5 mils shall be achieved on all abrasive blasted surfaces. Abrasive blasted surfaces shall be painted at the end of each working day and not allowed to remain unpainted until the next working day.

C. All abrasive blasting work to be conducted on areas not previously abrasive blasted which are adjacent to areas that have previously been blasted and painted shall be done in a manner so that a minimum of six (6) inches of the painted surface is removed and will receive a fresh coat of paint at the same time as the newly blasted surface. This method shall be used for all interior and exterior surfaces.

D. Coordination: Surface preparation and painting shall be so programmed that dust and other contaminates from the cleaning process will not fall on wet, newly painted surfaces.

E. All surface preparation work shall comply with all NSF/ANSI Standard 61 and all state and local EPA regulations governing lead based paint removal and the levels of lead and silica to which the public can be exposed.

F. All internal piping in vaults shall be abrasive blasted to a "commercial" finish corresponding to SSPC-SP6 "Commercial Blast Cleaning".

G. All surface preparation work shall comply with all state and local EPA regulations governing lead based paint removal and the levels of lead and silica to which the public can be exposed.

H. All surface areas found to have contamination or loose primer coating, (visible oil, grease or dirt) shall be spot cleaned to remove contaminants or loose coatings- SSPC SP7/NACE No. 4

3.02 APPLICATION

A. Paint shall be used and applied as recommended by the manufacturer without being extended or modified and with particular attention to the correct preparation and condition of surfaces to be painted.

B. Surfaces which have been cleaned, pretreated, or otherwise prepared for painting shall be

painted with the first field coat as soon as practicable after such preparation has been completed, but in any event prior to any deterioration of the prepared surface.

C. Unless otherwise specified, stainless steel surfaces throughout the work shall not be painted.

D. Hardware accessories, machine surfaces, plates, lighting fixtures, and similar items in place prior to surface preparation and painting, and not intended to be painted, shall be removed during painting operations and repositioned upon completion of each area or shall otherwise be protected.

E. Paints or other finish shall not be applied to wet or damp surfaces, or when the relative humidity exceeds 80% except in accordance with the instructions of the manufacturer. Exterior painting shall not be done during cold, rainy, or frosty weather, or when ambient temperature or painting surface temperature is likely to drop to 40 degrees F. Painting shall not be done unless the painting surface temperature is at least 5 degrees F above the dew point. Temperature requirements of paint manufacturer are to be observed when minimum is greater than 40 degrees F. Painting of surfaces while they are exposed to the sun shall be avoided.

F. All paint shall be applied under favorable conditions by skilled painters and shall be brushed or rolled out carefully to a smooth, even coating without runs or sags. Each coat of paint shall be allowed to dry thoroughly, not only on the surface but throughout the thickness of the paint film before the next coat is applied.

G. Finish surfaces shall be uniform in finish and color, and free from flash spots and brush marks. In all cases, the paint film produced shall be satisfactory in all respects to the Engineer.

H. Spraying with adequate apparatus may be substituted for brush application of those paints and in those locations for which spraying is suitable.

I. The Contractor shall not only protect his work at all times, but shall also protect all adjacent work and materials. Upon completion of the work, he shall clean up all paint spots, oil, and stains from floors, glass, hardware, and similar finished items.

3.03 RATES OF APPLICATION

A. Paint shall be applied so as to obtain the coverage per gallon and the dry film thickness recommended by the manufacturer or as specified herein. The Contractor shall record, in a manner satisfactory to the Engineer, the quantities of paint used for successive coats on the various parts of the work.

B. If paints are thinned for spraying, the film thickness after application shall be of the same as for unthinned paint applied by brush. Thinning of paint for spraying shall be in accordance with the paint manufacturer's recommendations. Deficiencies in film thickness shall be corrected by the application of another coat of paint. Excessive application rates will not be allowed. The Contractor shall submit to the Engineer, immediately upon completion of the job, certification from the paint manufacturer indicating that the quantity of each coating purchased was sufficient to properly coat all surfaces. Such certification shall make reference to the square footage figures provided to the manufacturer and the Engineer by the Contractor.

C. The paint applicator shall have available on the project site a paint film thickness measuring device capable of measuring 0-59 mils with accuracy of +/- 2% + 0.1 mil, operating temperature range 5 degrees C to 50 degrees C and meet ASTM B499 and ISO 2178 specifications.

3.04 PAINT TYPES AND SCHEDULE

The following types of paints shall be used throughout the work on items and surfaces indicated. All paints and painting schedules shall be in accordance with AWWA D102 (latest revisions).

A. **Concrete Wet Well Structures, Wet Well DIP Piping & Support Brackets, Harbor Village PS Manhole, and Miscellaneous Concrete Surface Painting:** The Contractor shall furnish all materials and labor to

paint the piping and concrete surfaces in the wet well. There shall be no paint applied until the abrasive blasting is complete and approved by the Owner prior to applying new paint. The painting shall conform to the following:

1. Field Finish Coat: Apply one coat of Sherman-Williams Aromatic Polyurea, Envirolastic AR520PW, Carboline Reactamine 760 or approved equal, at a dry film thickness rate of 40.0 to 60.0 mils. Maximum coverage rates shall not exceed manufacture's recommendations.

NOTE: THE COMBINED COATS SHALL HAVE A MINIMUM DRY THICKNESS OF 40.0 MILS.

B. **Harbor Village PS Valve Vault Piping and Fittings:** The Contractor shall furnish all materials and labor to paint the piping and fittings in the Harbor Village PS prior to installation in the wet well. There shall be no paint applied until the abrasive blasting is complete and approved by the Owner prior to applying new paint. The painting shall conform to the following:

1. First Finish Coat: Apply one coat of Tnemec Series N140-15BL Potapox Plus (mixed 1 to 1, by volume), Sherwin-Williams Macropoxy 646 / 846 NSF, Carboline Carboguard 890, or Induron PE 54 to a minimum of 4.0 to 5.0 mils dry thickness.

2. Final Finish Coat: Apply one coat of Tnemec Series 140-11WH Potapox Plus (mixed 1 to 1, by volume), Sherwin-Williams Macropoxy 646 / 846 NSF, Carboline Carboguard 890, or Induron PE 54 to a minimum of 4.0 to 5.0 mils dry thickness.

NOTE: THE COMBINED COATS SHALL HAVE A MINIMUM DRY THICKNESS OF 8.0 MILS.

3.05 CURING FOR INTERIOR PAINTED SURFACE

A. Drying Schedule for 100% solids paint @ 30.0 mils wet @ 73° F and 50% relative humidity:

To touch..... 1 Hour
To recoat
Minimum ..... 2 Hours
Maximum..... 18 hours

Immersion (water) ..... 12 hours
To cure ..... 24 hours

3.06 GUARANTY

The Contractor, in signing his proposal, guarantees to repair any and all defects due to workmanship, i.e. sags, drips, cracks, separation, or unsuitable material which appear in the structures or coating system during the period of three years after the date of acceptance.

3.07 CLEANUP

All construction material and debris shall be removed from the site upon completion of work.

- END OF SECTION -

DIVISION 10

SPECIALTIES

SECTION 10000

UNDERGOUND LP GAS SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Underground LP Gas Systems must be installed in accordance with the provisions of NFPA Standard for the Storage and Handling of Liquefied Petroleum Gases, NFPA National Fuel Gas Code and all applicable federal, state and local codes and regulations covering these installations. One tank shall be installed at the Wrights Lane Pump Station.

1.02 DESIGN

A. All engineering services shall be provided by the supplier of the Underground LP Gas System. The underground containers, valves, regulators etc. shall be in accordance with ASME standards and installed in accordance with NFPA 58 standards and/or the authority having jurisdiction. The standard details and these specifications are provided as a guide for materials and installation, but all shall be manufactured and installed within the standards previously described.

PART 2 - PRODUCTS

2.01 MATERIALS

A. 500 Gallon ASME steel tank by gas provider with suitable coating as recommended by NFPA and by the coating manufacturer for underground installation.

B. Two magnesium anodes shall be installed with the tank as shown on the detail drawings.

C. Anode test station shall be provided for periodic testing of the anodes. The station shall be located outside the area of vehicular traffic.

D. Regulators and valves shall be housed in a steel protective casing.

E. Length and width of excavation shall be at least 24” greater than the dimensions of the tank

F. All backfill within 12” of the storage tank shall be completed with sand only.

G. If tank is located in a high water table and flotation of the tank is likely, secure tank to a reinforced concrete base with a minimum of 8 cubic yards of concrete.

H. Tank shall be a minimum of 18” below grade if exposed to vehicular traffic, a minimum of 6” below grade in non-vehicular areas.

I. The tank shall be set on a substantially level grade with a minimum of a twelve inch sand base.

J. The container shall be filled immediately to minimize possible shifting due to floatation or introduction of moisture in the unpressurized tank.

K. All connections to containers installed underground shall be located within the

housing dome.

L. Pressure test and leak test the system in accordance with generally accepted industry practices per NPGA Safety Bulletin 403.

END OF SECTION

DIVISION 11

EQUIPMENT

SECTION 11310

SUBMERSIBLE SEWAGE PUMPS

(SUPPLIED BY OWNER - INSTALLED BY CONTRACTOR)

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall install, and test all pumping units and their appurtenances as indicated on the drawings and as herein specified. These specifications direct attention to certain features of the pumping units, but do not purport to cover all the details of their design. The equipment furnished shall be designed, constructed, and erected in conformity with accepted high quality standards.

B. Pump Data:

1. All pumps shall be the product of one manufacturer.

2. Electrical controls and starting equipment not specified herein are specified under the appropriate electrical sections.

3. Pumping units shall be equipped with the necessary accessories, including lifting attachments, hoists, lubricators, and drainage connections.

1.02 RELATED WORK

A. Division 1 - General Requirements.

B. Division 16 - Electrical.

1.03 REFERENCES

The chemical and physical properties of all materials and the design, performance characteristics and methods of construction of all items of equipment shall be in accordance with the requirements of the latest issue of the various applicable Standard Specifications. These Standard Specifications have been prepared by authorities, which are recognized by the Mechanical Trades. The names of these authorities are listed below together with the abbreviation of their names as they may appear in these Specifications:

A. American National Standards Institute (ANSI).

B. American Water Works Association (AWWA).

C. American Society for Testing and Materials (ASTM).

D. National Fire Protection Association (NFPA).

E. National Association of Fan Manufacturers (NAFM).

F. American Society of Mechanical Engineers (ASME).

G. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).

H. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

1.04 QUALITY ASSURANCE

Standards, codes, rules, and regulations as established and listed herein, as amended, latest edition, govern the work.

1.05 TEMPORARY SERVICES

A. The equipment when installed may require the use of temporary heating and electrical services, subject to an agreement between the Contractors involved and the General Contractor, and with the consent of the Engineer. Should the permanent systems be used for this purpose, these Contractors shall pay for all temporary connections required and all replacements, without cost to the Owner, leaving same in "as new" condition.

B. Permission to use the permanent equipment does not relieve the Contractors who utilize this equipment from the responsibility for damage to the building construction and/or equipment which might result because of its use.

1.06 SUBMITTALS

A. The Contractor shall submit the following: for equipment not purchased by the Owner and the equipment manufacturer shall submit the same for those pieces of equipment purchased by the Owner:

B. Detailed shop drawings for all equipment and where applicable color and finish of each.

C. Submission of certified shop and erection drawings and data regarding pump and motor characteristics and performance. The data shall include performance curves based on actual shop tests of pumping units, which show that the units meet the specified requirements for head, capacity, efficiency, and horsepower for the various capacities specified. Except as hereinafter specified certified tests of mechanically duplicate units will be acceptable. Curves shall be submitted on 8-1/2" by 11" sheets. For units of the same size and type, only curves for a single unit need be provided; however, serial numbers for the multiple units shall be listed on the curve sheet. Shop drawings for accessory equipment shall also be submitted.

D. Submit two (2) copies of welding procedure specifications to the Engineer together with proof of qualification as outlined and required by most recent issue of Code having jurisdiction before any welding is performed. Also, submit two (2) copies of all operator's qualification record in conformance with provisions of Code having jurisdiction. Record shall show that operator was tested under proven procedure specifications submitted. One copy of the above shall be given to the resident project representative to be kept on file at the job site. Standard procedure specifications and welders qualified by National Certified Pipe Welding Bureau shall be considered as conforming to requirements.

E. Shop drawings, descriptive literature, and schedules on:

1. Accessory Equipment
2. General Specialties
3. Water Supply Specialties
4. Drainage Specialties
5. Insulation
6. Valves
7. Controls
8. Piping
9. Electrical

PART 2 - PRODUCTS

2.01 SUBMERSIBLE CENTRIFUGAL PUMPS - NON CLOG

A. General:

1. Provide submersible non clog sewage pumps suitable for continuous duty operation underwater without loss of watertight integrity to a depth of 65 feet. Each pump shall be capable of handling raw, unscreened domestic sewage consisting of water, fibrous materials, and up to 3 inch diameter spherical solids. The pump (s) shall be capable of handling liquids with temperatures to 104 degrees F continuous, 160 degrees F intermittent. Pump system design shall include a guide rail system be such that the pump will be automatically connected to the discharge piping when lowered into place on the discharge connection. The pump shall be easily removable for inspection or service, requiring no bolts, nuts, or other fasteners to be disconnected, or the need for personnel to enter the wet well. The motor and pump shall be designed, manufactured, and assembled by the same manufacturer.

2. Bearings shall be oil-lubricated and designed for 50,000 hours operating at minimum flow. Product shall be furnished with oil filled Inverter Duty Motors per NEMA MG-1, Part 31 with stator winding of the open type with Class H spike resistant magnet wire and a minimum 1.2 service factor. The pump shall be FM and CSA Certified as Class I Group C&D Div1 Explosion-Proof with a T4 temperature rating.

B. Manufacturer: Crane/Barnes, Piqua, Ohio - (Base Bid Pump - Basis of Design)
ABS Pumps - Sanford, FL
Gorman-Rupp Company – Mansfield, OH
Or Approved Equal

C. Pump Characteristics: Pumps shall conform to the following requirements:

PUMP SCHEDULE

TYPE	PUMP STATION	MAX. HP	NO. OF PUMPS	OPERATING CONDITIONS			
				SHUT-OFF HEAD	DESIGN FLOW @ TDH	MAX. FLOW @ TDH	Minimum Pump Efficiency
Submersible Non-clog	Harbor Village Pump Station	7.5	3	58 FT	300 GPM @ 42.9'	600 GPM @ 31'	55%

D. Pump Construction:

a. The volute, seal plate, adapter, motor housing, and motor housing cap shall be constructed of high quality, ASTM A-48 Class 30 cast iron. Impeller shall be furnished in ASTM A-536 ductile iron with a keyed, tapered shaft bore. Pump (s) shall be coated with two coats of DuPont Corlar® amido amine modified polymer satin gloss epoxy with a total 10 mil minimum thickness in the manufacturer's standard color. All exposed hardware shall be 300 series stainless steel including the lifting bail. The pump construction shall contain no points of critical clearance nor require periodic adjustment or replacement to maintain operating efficiency. Discharge connection shall be a standard 125 pound 4 inch flange, slotted to accommodate 4" ANSI or 100mm ISO flanges. The pump shaft shall be 416 stainless steel with a tapered impeller fit to reduce rotor imbalance and minimize stress risers associated with stepped shafts. All gaskets shall be of the angular gland compression o-ring type

eliminating critical slip fits and the possibility of damage during service associated with sliding o-ring sealing arrangements.

b. The impeller shall be of a dual vane design with pump out vanes on the back side. The impeller shall be dynamically balanced to ISO G6.3 specifications. The matching volute shall be provided with a replaceable bronze wear ring at the inlet.

c. The tandem mechanical shaft seals shall be of the single spring design operating in an intermediate oil-filled seal cavity. Pump-out vanes in the back of the impeller shroud shall be large enough to efficiently expel solids away from the seal area. The materials of construction shall be silicon carbide vs. silicon carbide for the pump-end seal and carbon vs. ceramic for the motor-end seal, lapped and polished to a tolerance of one light band, 300 series stainless steel hardware, and Buna-N elastomeric parts. The pump-end seal shall be pinned in place to prevent rotation of the stationary seat and shall seal to the pump housing via an o-ring to maximize heat transfer. Cup mounted seats shall not be considered equal. The seal shall be commercially available and not a pump manufacturer's proprietary design. A moisture sensor detection system consisting of two probes shall be integrated within the oil-filled seal chamber, which is isolated from the motor chamber. Units sensing moisture within the motor chamber are not considered acceptable. Moisture sensing devices utilizing one probe and grounding through the pump case or utilizing a float device are not acceptable. The leads for the moisture detector shall be contained within the power cable.

d. The pump motor shall be sized to be non-overloading throughout the entire pump curve. The rotor and stator assembly shall be of the standard frame design and the stator pressed into the motor housing for mechanical stability. The motor shall be constructed with the windings operating in a sealed environment containing clean dielectric oil. Manufacturer to supply submergence requirements for continuous operation.

e. Motors shall be dielectric oil filled for optimal thermal management and maximum bearing life. Air-filled motors with grease-filled bearings shall not be acceptable. The motor windings shall be of Class H, spike-resistant insulation. The motor shall meet the NEMA Design B standard and be Inverter Duty Rated per NEMA MG1, part 31.

f. The pump shaft shall be of 416 stainless steel, keyed and tapered for the matching impeller. The lower bearing shall be of the double row ball type, locked in position to accept radial and axial thrust loads, and the upper bearing of the single ball type for radial loads. Bearings shall operate in an oil bath environment for superior lubrication, cooling and life.

2. Three Phase Motor

a. Three thermal sensors (one per phase) shall be embedded in the end coil of the stator windings, wired in series and used to monitor stator temperatures. This shall be used in conjunction with an external motor overload protection device and wired to the control panel through the single power cable.

b. The pump shall be equipped with 50 ft. of a CSA-qualified submersible power cable constructed in accordance with type W guidelines and shall include the moisture and temperature sensor leads. For 30 HP and less, the cable entry system shall consist of a voltage-selectable expanding rubber plug held in place by a cast stainless steel plate indicating voltage and max amps. For higher HP, cord connection shall be through a flared stainless steel compression plate and a double gland with an internal stress relief bracket to a terminal strip for easy connection without opening the motor enclosure.

E. Station Power Requirements

Site power furnished to each station shall be as indicated below and maintained within industry standards. Voltage tolerance shall be plus or minus 10 percent.

STATION POWER SCHEDULE

PUMP STATION	Phase	Hertz	Voltage	No. of Wires	Pump Motor Voltage & Phase
Harbor Village Pump Station	Three (3)	60	480	4	460 / 3 Ø

F. Guide Rail system:

a. Design shall include two (2) 304SS schedule 40 guide rails sized to mount directly to the quick discharge connector, QDC, at the floor of the wet well and to a guide rail bracket at the top of the wet well below the hatch opening, (refer to project drawings.) Intermediate guide brackets shall be supplied for rail lengths over 15 feet.

b. Guide rails shall be part of the pump package and shall be stainless steel.

c. The QDC shall be manufactured of cast iron, A48 Class 30. It shall be designed to adequately support the guide rails, discharge piping, and pumping unit under both static and dynamic loading conditions with support legs that are suitable for anchoring it to the wet well floor. The face of the inlet QDC flange shall be perpendicular to the floor of the wet well. The discharge flange of the QDC shall conform to ANSI B16.1 Class 125.

d. The pump design shall include an integral self-aligning sliding bracket. Sealing of the pumping unit to the QDC shall be accomplished by a single, linear, downward motion of the pump. The entire weight of the pump unit shall be guided to and wedged tightly against the inlet flange of the QDC, making metal to metal contact with the pump discharge forming a seal without the use of bolts, gaskets or o-rings. Operation shall be non-sparking by design.

e. Lifting chain stainless steel shall be provided, suitable for removing and installing the pump unit.

G. Variable Frequency Drive Controller:

A Variable Frequency Drive Controller shall be furnished with each control panel to accomplish the pump rate as specified and shall be as described in Division 16.

H. Controls and Control Panels:

The Contractor shall furnish the controls and control panels from the pump manufacturer for the purpose of single source responsibility. The design and features of the controls and control panels shall be as shown on the Drawings and as specified in Division 16.

I. Pump Test:

1. The pump manufacturer shall perform the following inspections and tests on each pump before shipment from factory:

a. Impeller, motor rating and electrical connections shall first be checked for compliance to the customer's purchase order.

b. A motor and cable insulation test for moisture content or insulation defects shall be made.

c. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.

d. The pump shall be run for 30 minutes submerged a minimum of six (6) ft. under water.

e. After the operational test is run then the insulation test shall be performed again.

2. A written report stating the foregoing steps have been done must be supplied with each pump at the time of shipment (upon request).

The pump cable end shall be sealed with a high quality protective covering, to make it impervious to moisture or water seepage prior to electrical installation.

PART 3 - EXECUTION

3.01 FACTORY PUMP TESTS

A. The Contractor shall furnish sworn certificates to the effect that the pump casings have passed the hydrostatic pressure tests.

B. Pump tests shall be conducted on all pumps. During each test, the pump shall be run at all specified head conditions for a sufficient time to permit accurate determination of discharge, head, and power input. A performance curve from the production line test showing head versus flow shall be included in the Installation and Operation Manual shipped with each pump.

C. Certified copies of the pump test data shall be furnished to the Engineer for review and approval prior to shipment of the pumps. All tests shall be run in accordance with the Standards of the Hydraulic Institute.

3.02 MOTOR TESTS

Each motor shall be given the standard commercial tests in the shop of the motor manufacturer, and certified copies of the tests results submitted to the Engineer for review prior to installation of the motors.

3.03 FIELD ACCEPTANCE TESTS

A. After installation of the pumping equipment, and after inspection, operation, testing and adjustment have been completed by the manufacturer's representative, each pump shall be given a running test in the presence of the Engineer during which it shall determine its ability to operate without vibration or overheating, and to deliver its rated capacity under the specified conditions.

B. During the tests, observations shall be made of head, capacity, and motor input. All defects or defective equipment revealed by or noted during the tests shall be corrected or replaced promptly at the expense of the Manufacturer, and if necessary, the tests shall be repeated until results acceptable to the Engineer are obtained. The Contractor shall furnish all labor, piping, equipment, and materials necessary for conducting the tests.

C. All adjustments necessary to place the equipment in satisfactory working order shall be made at the time of the above tests.

D. If sufficient sewage or sludge is NOT available for the test, the Contractor shall provide water for testing, if so directed.

E. Water for testing shall be furnished by the Contractor.

F. In the event that the Contractor is unable to demonstrate to the satisfaction of the Engineer, that the units will satisfactorily perform the service required and that they will operate free from vibration and heating, the pumping units will be rejected.

G. The field verification and/or draw down tests shall be conducted on each individual pump and shall include measuring or determining the items listed below. Additional, each pump station shall be tested operating in combination with the other pump station or stations connected to the same force main manifold. Data shall be recorded for each pump during the field test.

1. Flow rate

2. Total head on the pump

3. Power input

4. Static head on the pump

H. The pump stations shall be tested according to the following operational scenarios with a single pump running and with two parallel pumps running.

PUMP STATION TESTED	**Pump(s) Operating**	**ADDITIONAL PUMP STATIONS OPERATING**	**Pump(s) Operating**
Harbor Village Pump Station	Pump No. 1	None	-
Harbor Village Pump Station	Pump No. 2	None	-
Harbor Village Pump Station	Pump No. 1 & No. 2	None	-
Harbor Village Pump Station	Pump No. 1	Wrights Lane PS	Pump No. 1
Harbor Village Pump Station	Pump No. 1 & No. 2	Wrights Lane PS	Pump No. 1
Harbor Village Pump Station	Pump No. 1	Wrights Lane PS & Marks PS	Pump No. 1
Harbor Village Pump Station	Pump No. 1 & No. 2	Wrights Lane PS & Marks PS	Pump No. 1

3.04 SPARE PARTS

A. The following spare parts, all of which shall be identical and interchangeable with similar parts installed in the work, shall be provided for the submersible pumps and shall be as recommended by the manufacturer; however, at a minimum shall include the following for each pump:

1. One set of 0-rings.

2. One set of mechanical seals.

3. One set of wear rings.

B. Spare parts shall be packed in suitable boxes or containers bearing labels clearly designating the contents and the piece of equipment for which they are intended.

C. Spare parts shall be delivered at the same time as the equipment to which they pertain. The parts shall be properly stored and safeguarded until completion of the work, at which time they shall be delivered to the Owner. See Section 01750 for further requirements.

3.07 OPERATION AND MAINTENANCE MANUALS

Manuals shall be provided.

3.08 WARRANTY

The pump manufacturer shall warrant the units being supplied to the Owner against defects in workmanship and material for a period of five (5) years or 10,000 hours. Under normal use, operation and service. The warranty shall be in printed form and apply to all similar units.

- END OF SECTION -

SECTION 11315

FACTORY-BUILT BASE MOUNTED SELF-PRIMING PUMPS AND STANDBY LPG ENGINE

(SUPPLIED BY OWNER - INSTALLED BY CONTRACTOR)

PART 1 - GENERAL

1.01 SECTION INCLUDES

Work under this section includes, but is not limited to, furnishing and installing one (1) factory built duplex pump station as indicated on the project drawings, herein specified, as necessary for proper and complete performance.

1.02 REFERENCES

Publications listed below form part of this specification to extent referenced in the text by basic designation only. Consult latest edition of publication unless otherwise noted.

A. American National Std. Institute (ANSI) / American Water Works Association (AWWA)

1. ANSI B16.1 - Cast Iron Pipe flanges and Flanged Fittings
2. ANSI/AWWA C115/A21.15 - Cast Ductile Iron Pipe with Threaded Flanges
3. ANSI 253.1 - Safety Color Code for Marking Physical Hazards
4. ANSI B40.1 - Gages, Pressure and Vacuum
5. AWWA C508 - Single Swing Check Valves.

B. American Society for Testing and Materials (ASTM)

1. ASTM A48 - Gray Iron Castings
2. ASTM A126 - Valves, Flanges and Pipe Fittings
3. ASTM A307 - Carbon Steel Bolts and Studs
4. ASTM A36 - Structural Steel

C. Institute of Electrical and Electronics Engineers (IEEE)

1. ANSI/IEEE Std 100 - Standard Dictionary of Electrical Terms
2. ANSI/IEEE Std 112 - Test Procedure for Polyphase Induction Motors
3. IEEE Std 242 - Protection of Industrial and Control Power Systems

D. National Electrical Code (NEC)/National Electrical Manufacturers Association (NEMA)

1. NEC - National Electric Code
2. NEC 701 - National Electric Code Article 701
3. NEMA Std MG1 - Motors and Generators

E. Miscellaneous References

1. Ten-State Standards - Recommended Standards for Sewage Works
2. Hydraulic Institute - Std for Centrifugal, Rotary and Reciprocating Pumps
3. NMTBA and JIC Std - National Machine Tool Builders Association and Joint Industrial Council Standards

1.03 SYSTEM DESCRIPTION

A. Contractor shall furnish and install one factory built, automatic pump station. The station shall be complete with all equipment specified herein, factory assembled on a common steel baseplate.

B. The principal items of equipment shall include two self-priming, horizontal, centrifugal, v-belt motor driven sewage pumps, one air cooled standby engine, valves, and piping. A pump motor control panel with thermal-magnetic circuit breakers, magnetic motor starters, automatic liquid level control systems for normal and standby operation, and internal wiring.

C. Factory built pump station design, including materials of construction, pump features, valves and piping, and motor controls shall be in accordance with requirements listed under PART 2 - PRODUCTS of this section.

1.04 PERFORMANCE CRITERIA

A. Pumps must be designed to handle raw, unscreened, domestic sanitary sewage and landfill leachate. Pumps shall have flanged suction connection, and flanged discharge connection as indicated on the drawings. Each pump shall be selected to perform under following operating conditions:

Wrights Lane Pump Station –

Initial Conditions:	
Capacity (GPM)	500
Total Dynamic Head (FT)	190’
Total Dynamic Suction Lift(FT)	17
Maximum Repriming Lift (FT)	16
Maximum Static Suction Lift (FT)	16
Total Discharge Static Head (FT)	125
Maximum Motor HP	75 HP, 3Ø, 460 V, 60 HZ, Inverter Duty
Pump Efficiency	60%

Future Conditions:	
Capacity (GPM)	820
Total Dynamic Head (FT)	220’
Maximum Motor HP	75 HP, 3Ø, 460 V, 60 HZ, Inverter Duty

B. Station Power Requirements: Site power furnished to each station shall be as indicated below and maintained within industry standards. Voltage tolerance shall be plus or minus 10 percent.

STATION POWER SCHEDULE

PUMP STATION	Voltage Phase	Hertz	Voltage	No. of Wires
Wrights Lane PS	Three (3)	60	480	4

1.05 SUBMITTALS

A. Product Data

1. Prior to fabrication, pump station manufacturer shall submit seven copies of submittal data for review and approval.

2. Submittal shall include shop drawings, electrical ladder logic drawings, and support data as follows: Catalog cuts sheets reflecting characteristics for major items of equipment, materials of construction, major dimensions, motor and v-belt drive data, pump characteristic curves showing the design duty point capacity (GPM), head (FT), net positive suction head required (NPSHr), and hydraulic brake horsepower (BHP). Electrical components used in the motor branch and liquid level control shall be fully described.

B. Shop drawings shall provide layout of mechanical equipment and anchor bolt locations for equipment baseplate. The electrical ladder logic drawings shall illustrate motor branch and liquid level control circuits to extent necessary to validate function and integration of circuits to form a complete working system.

C. Operations Maintenance Manuals

1. Installation shall be in accordance with written instructions provided by the pump station manufacturer. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping and valves, but lack experience on exact equipment supplied.

2. Documentation shall be specific to the pump station supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the station manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall station design, shall be provided by those supplying the equipment. Instructions shall include the following as a minimum:

a. Functional description of each major component, complete with operating instructions.

b. Instructions for operating pumps, engine and pump controls in all modes of operation.

c. Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.

d. Support data for commercially available components not produced by the station manufacturer, but supplied in accordance with the specifications, shall be supported by literature from the prime manufacturer and incorporated as appendices.

e. Electrical schematic diagram of the pump station circuits shall be in accordance with NFPA70. Schematics shall illustrate, to the extent of authorized repair, pump motor branch, control and alarm system circuits including interconnections. Wire numbers and legend symbols shall be shown. Schematic diagrams for individual components, not normally repairable by the station operator, need not be included. Details for such parts shall not be substituted for an overall system schematic. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall system diagram.

f. Mechanical layout drawing of the pump station and components, prepared in accordance with good commercial practice, shall provide installation dimensions and location of all pumps, motors, engine, valves and piping.

3. Operation and maintenance instructions which rely on vendor cut-sheets and literature which include general configurations, or require operating personnel to selectively read portions of the manual shall not be acceptable. Operation and maintenance instructions must be specific to equipment supplied in accordance with these specifications.

1.06 QUALITY ASSURANCE

A. Upon request from the engineer, the pump station manufacturer shall prove financial stability and ability to produce the station within the specified delivery schedules. Evidence of facilities, equipment and expertise shall demonstrate the manufacturer's commitment to long term customer service and product support.

B. Pump Performance Certifications

1. All internal passages, impeller vanes, and recirculation ports shall pass a 3" spherical solid. Smaller internal passages that create a maintenance nuisance or interfere with priming and pump performance shall not be permitted. Upon request from the engineer, certified drawings showing size and location of the recirculation port(s) shall be submitted for approval.

2. Reprime Performance

a. Consideration shall be given to the sanitary sewage service anticipated, in which debris is expected to lodge between the suction check valve and its seat, resulting in the loss of the pump suction leg, and siphoning of liquid from the pump casing to the approximate center line of the impeller. Such occurrence shall be considered normal, and the pump must be capable of automatic, unattended operation with an air release line installed.

b. During unattended operation, the pump shall retain adequate liquid in the casing to insure automatic repriming while operating at its rated speed in a completely open system. The need for a suction check valve or external priming device shall not be required.

c. Pump must reprime 23’ vertical feet at the specified speed and impeller diameter. Reprime lift is defined as the static height of the pump suction above the liquid, while operating with only one-half of the liquid remaining in the pump casing. The pump must reprime and deliver full capacity within five minutes after the pump is energized in the reprime condition. Reprime performance must be confirmed with the following test set-up:

(1) A check valve to be installed down stream from the pump discharge flange. The check valve size shall be equal (or greater than) the pump discharge diameter.

(2) A length of air release pipe shall be installed between pump and the discharge check valve. This line shall be open to atmosphere at all times duplicating the air displacement rate anticipated at a typical pump station fitted with an air release valve.

(3) The pump suction check valve shall be removed. No restrictions in the pump or suction piping will prevent the siphon drop of the suction leg. Suction pipe configuration for reprime test shall incorporate a 2 feet minimum horizontal run, a 90° elbow and vertical run at the specified lift. Pipe size shall be equal to the pump suction diameter.

(4) Impeller clearances shall be set as recommended in the pump service manual.

(5) Repeatability of performance shall be demonstrated by testing five consecutive reprime cycles. Full pump capacity (flow) shall be achieved within five minutes during each cycle.

(6) Liquid to be used for reprime test shall be water.

d. Certified reprime performance test results, prepared by the manufacturer, and certified by a registered professional engineer, shall be submitted for approval prior to shipment.

C. Factory System Test

1. Before shipment, the station shall be tested at the factory at simulated field conditions to assure that the unit meets the specified design and to check for leaks and excessive vibration, for correct operation of the automatic control system; and of all auxiliary equipment.

2. All components including the pumps, motors, engine, valves, piping and controls will be tested as a complete working system at the manufacturer's facility. Tests shall be conducted in accordance with Hydraulic Institute Standards at the specified head, capacity, rated speed and horsepower. Factory operational test shall duplicate actual performance anticipated for the complete station.

3. Amperage and voltage readings shall be taken for the pump motors to insure that the motors are operating within the nameplate limitations. The station and piping shall be tested in the factory for leaks in the weld seams and joints. All leaks shall be repaired before shipment. Certifications of the leak testing and paint thickness shall be submitted to the Engineer. Paint thickness shall be measured with a dry mil gauge.

4. The pump suction and discharge lines shall be tested at full capacity under simulated service conditions. The control panel shall undergo both a dry logic test and a full operational test with all systems operating. Each pump shall be tested as a complete unit after installation in the station.

5. Factory test instrumentation must include flow measuring with indicator, compound suction gauge, bourdon tube type discharge pressure gauge, electrical meters to measure amperes, volts, kilowatts and power factor speed indicator.

6. The Owner/Engineer shall inspect and witness factory tests of all materials or equipment to be supplied under these specifications before their shipment from the point of manufacture. The operational test shall be witnessed by the Engineer and representatives of the Owner at the manufacturer's facility.

7. The Owner/Engineer shall be notified in writing before initial shipment in ample time so that arrangements can be made for inspection testing or witnessing by the Owner/Engineer. The Contractor shall pay all expenses for the Owner/Engineer to witness any test at the manufacturing facility.

D. The manufacturers technical representative shall inspect the completed installation, correct or supervise the correction of any defect or malfunction, and instruct operating personnel in the proper operation and maintenance of the equipment as described in Part 3 of this section.

1.07 MANUFACTURER'S WARRANTY

A. The pump station manufacturer shall warrant all equipment to be of quality construction, free of defects in material and workmanship. A written warranty shall include specific details described below.

1. All other equipment, apparatus, and parts furnished shall be warranted for five (5) years, excepting only those items that are normally consumed in service, such as light bulbs, oils, grease, packing, gaskets, 0-rings, etc. The pump station manufacturer shall be solely responsible for warranty of the station and all components.

2. The pump shaft seal shall be warranted for a minimum of four (4) years from date of shipment. Should the seal fail within the first year, the manufacturer shall furnish a new seal, without charge to owner, f.o.b. factory. The warranty replacement cost for seals after the first year will be pro-rated as follows:

Failure Within	Percent New Price
2 years	25%
3 years	50%
4 years	75%

3. Components failing to perform as specified by the engineer, or as represented by the manufacturer, or as proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer without cost of parts or labor to the owner.

B. It is not intended that the station manufacturer assume liability for consequential damages or contingent liabilities arising from failure of any vendor supplied product or part which fails to properly operate, however caused. Consequential damages resulting from defects in design, or delays in delivery are also beyond the manufacturer's scope of liability.

C. The warranty shall become effective upon the acceptance by the purchaser or the purchaser's authorized agent, or sixty (60) days after installation, or ninety (90) days after shipment, whichever occurs first.

1.08 INSTALLATION AND OPERATING INSTRUCTIONS

A. Five (5) copies of a manual, containing installation instructions, operating and maintenance instructions, wiring diagrams, parts lists and, where applicable, test data and curves shall be provided by the station manufacturer.

B. Installation of the station shall be done in accordance with the written instructions provided in the manual as specified.

C. The station manufacturer shall provide the services of a factory-trained representative for a maximum period of one (1) full day to start-up the station and to instruct the Owner's operating personnel in the operation and maintenance of the equipment provided.

D. Start-up service technician shall be a regular employee of pump station manufacturer.

E. 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.

F. 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.

G. Start-up service to include two (2) bound O&M manuals.

H. Start-up service report attested to by start-up technician and representative of Owner or Engineer.

PART 2 - PRODUCTS

2.01 UNITARY RESPONSIBILITY

In order to unify responsibility for proper operation of the complete pumping station, it is the intent of these Specifications that all system components be furnished by a single supplier (unitary source). The pumping station must be of standard catalog design, totally warranted by the manufacturer. Under no circumstances will a system consisting of parts compiled and assembled by a manufacturer's representative or distributor be accepted.

2.02 MANUFACTURER

A. The specifications and project drawings depict equipment and materials manufactured by The Gorman-Rupp Company and prepared using a "basis of design". It is not intended, however, to eliminate other products of equal quality and performance. In the event that equipment is supplied which is different than the specified Base Bid Equipment, it shall be the responsibility of the CONTRACTOR to coordinate and make all necessary changes to related structures, controls, valves, piping, equipment, associated appurtenances, drawings and documentation. All changes must be reviewed and approved by the ENGINEER prior to any installation of equipment. In addition, all costs associated with such changes, including additional time required for review of the changes by the ENGINEER, shall be borne by the CONTRACTOR.

B. All bidders must recognize that, if any alternate booster pumping system is used and does not meet or exceed the physical and dimensional standards nor perform as specified in the judgement of the project Engineer or Owner, the Contractor shall be required to modify or replace the alternate equipment with the original booster pumping equipment at no additional cost to the Owner or Engineer.

C. In order for alternate equipment to the considered an "approved equal," prospective suppliers must make a pre-bid submittal as detailed in the following paragraphs and make it available to the design engineer ten (10) calendar days prior to the time of bidding. All differences shall be clearly marked between the specifications and proposed substitute equipment.

D. The pre-bid submittals for qualification to bid must contain an installation list of ten (10) similar in size and capacity pump stations completed and in operation within the past five (5) years. The installation list will be complete with the date of installation, the name and telephone number of the equipment operator and the name and telephone number of the design engineer.

2.03 UNIT BASE

The unit base shall be comprised of structural steel with a perimeter flange and reinforcements. Perimeter flange and reinforcements shall be designed to prevent flexing or warping under operating conditions. Perimeter flange shall be drilled for hardware used to secure unit base to concrete pad as shown on the contract drawings. Unit base shall contain provisions for lifting the complete pump unit during shipping and installation.

2.04 PUMP DESIGN

A. Pumps shall be horizontal, self-priming centrifugal type, designed specifically for handling raw, unscreened, domestic sanitary sewage. Pump solids handling capability and performance criteria shall be in accordance with requirements listed under PART 1 - GENERAL of this section.

B. Materials and Construction Features

1. Pump Casing: Casing shall be cast iron Class 30 with integral volute scroll. Casing shall incorporate following features:

   a. Mounting feet sized to prevent tipping or binding when pump is completely disassembled for maintenance.

   b. Fill port cover plate, 3 1/2" diameter minimum, shall be opened after loosening a hand nut/clamp bar assembly. In consideration for safety, hand nut threads must provide slow release of pressure, and the clamp bar shall be retained by detent lugs. A Teflon gasket shall prevent adhesion of the fill port cover to the casing.

   c. Casing drain plug shall be at least 1 1/4" NPT to insure complete and rapid draining.

   d. Liquid volume and recirculation port design shall be consistent with performance criteria listed under PART 1 - GENERAL of this section.

2. Cover Plate: Cover plate shall be cast iron Class 30. Design must incorporate following maintenance features:

   a. Retained by hand nuts for complete access to pump interior. Cover plate removal must provide ample clearance for removal of stoppages, and allow service the impeller, seal, wear plate or check valve without removing suction or discharge piping.

   b. A replaceable wear plate secured to the cover plate by weld studs and nuts shall be AISI 1015 HRS.

   c. In consideration for safety, a pressure relief valve shall be supplied in the cover plate. Relief valve shall open at 75-200 PSI.

   d. O-ring of Buna-N material shall seal cover plate to pump casing.

   e. Pusher bolt capability to assist in removal of coverplate. Pusher bolt threaded holes shall be sized to accept same retaining capscrews as used in rotating assembly.

   f. Easy-grip handle shall be mounted to face of coverplate.

3. Rotating Assembly: A rotating assembly, which includes impeller, shaft, mechanical shaft seal, lip seals, bearings, seal plate and bearing housing must be removable as a single unit without disturbing the pump casing or piping. Design shall incorporate following features:

   a. Seal plate and bearing housing shall be cast iron Class 30. Separate oil filled cavities, vented to atmosphere, shall be provided for shaft seal and bearings. Cavities must be cooled by the liquid pumped and lip seals will prevent leakage of oil. The bearing cavity to have an oil level sight gauge and fill plug check valve. The check valve shall vent the cavity but prevent introduction of moist air to the bearings.

      (1) The bearing cavity shall have an oil level sight gauge and fill plug check valve. The clear sight gauge shall provide easy monitoring of the bearing cavity oil level and condition of oil without removal of the fill plug check valve. The check valve shall vent the cavity but prevent introduction of moist air to the bearings.

      (2) The seal cavity shall have an oil level sight gauge and fill/vent plug. The clear sight gauge shall provide easy monitoring of the seal cavity oil level and condition of oil without removal of the fill/vent plug.

      (3) Double lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.

   b. Impeller shall be ductile iron, two-vaned, semi-open, non-clog, with integral pump out vanes on the back shroud. Impeller shall thread onto the pump shaft and be secured with a lockscrew and conical washer.

   c. Shaft shall be AISI 17-4 pH stainless steel unless otherwise specified by the engineer.

   d. Bearings shall be anti-friction ball or tapered roller type of proper size and design to withstand all radial and thrust loads expected during normal operation. Bearings shall be oil lubricated from a dedicated reservoir. Pump designs which use the same oil to lubricate the bearings and shaft seal shall not be acceptable.

   e. Shaft seal shall be oil lubricated mechanical type. The stationary and rotating seal faces shall be tungsten titanium carbide alloy. Each mating surface shall be lapped to three light bands flatness, as measured by an optical flat under monochromatic light. The stationary seal seat shall be double floating by virtue of a dual O-ring design; an external O-ring secures the stationary seat to the seal plate, and an internal O-ring holds the faces in alignment during periods of mechanical or hydraulic shock (loads which cause shaft deflection, vibration, and axial/radial movement). Elastomers shall be viton. Cage and spring to be AISI 316 stainless steel. Seal shall be oil lubricated from a dedicated reservoir. The same oil shall not lubricate both shaft seal and shaft bearings. Seal shall be warranted in accordance with requirements listed under PART 1 - GENERAL of this section.

f. Pusher bolt capability to assist in removal of rotating assembly. Pusher bolt threaded holes shall be sized to accept same capscrews as used for retaining rotating assembly.

4. Adjustment of the impeller face clearance (distance between impeller and wearplate) shall be accomplished by external means.

a. Clearances shall be maintained by external shimless coverplate adjustment, utilizing collar and adjusting screw design for incremental adjustment of clearances by hand. Requirement of realignment of belts, couplings, etc., shall not be acceptable. Coverplate shall be capable of being removed without disturbing clearance settings.

b. There shall be provisions for additional clearance adjustment in the event that adjustment tolerances have been depleted from the coverplate side of the pump. The removal of stainless steel shims from the rotating assembly side of the pump shall allow for further adjustment as described above.

c. Clearance adjustment which requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.

5. Suction check valve shall be molded Neoprene with integral steel and nylon reinforcement. A blow-out center shall protect pump casing from hydraulic shock or excessive pressure. Removal or installation of the check valve must be accomplished through the cover plate opening, without disturbing the suction piping. Sole function of check valve shall be to save energy by eliminating need to reprime after each pumping cycle. Pumps requiring a suction check valve to assist reprime will not be acceptable.

6. Spool flanges shall be one-piece cast iron, class 30 fitted to suction and/or discharge ports. Each spool shall have one 1-1/4" NPT and one 1/4" NPT tapped hole with pipe plugs for mounting gauges or other equipment.

C. Serviceability

1. The pump manufacturer shall demonstrate to the engineer's satisfaction that consideration has been given to reducing maintenance costs.

2. No special tools shall be required for replacement of any components within the pump.

2.05 VALVES AND PIPING

A. Each pump shall be equipped with a full flow type check valve, capable of passing a 3" spherical solid, with flanged ends and be fitted with an external lever and spring. 316 stainless steel body ring shall be threaded into the valve port. Valve clapper shall be cast iron, rubber face, and shall swing completely clear of waterway when valve is full open. The seating shall be by a resilient field replaceable ring on the valve disc contacting a bronze or stainless seat ring in the valve body. Hinge pin shall be of 18-8 stainless steel construction and shall be utilized with bronze bushings and packing type seal. Valves shall be equipped with removable cover plate to permit entry or for complete removal of internal components without removing the valve from the line. Valve shall be rated at 175 PSI water working pressure, 350 PSI hydrostatic test pressure. Valves other than full flow type or valves mounted in such a manner that prevents the passage of a 3" spherical solid shall not be acceptable.

B. The discharge header shall include a 3-way plug valve to permit either or both pumps to be isolated from the common discharge header. Valves shall have ports designed to pass spherical solids equal to the pumps capability. The plug valve shall be non-lubricated, tapered type. Valve body shall be semi-steel with flanged end connections drilled to 125 pound standard. Valve shall be furnished with a drip-tight shutoff plug mounted in stainless steel bearings, and shall have a resilient facing bonded to the sealing surface. Valve shall be operated with a single lever actuator providing lift, turn, and reseat action. The lever shall be equipped with a locking device to hold the plug in the desired position.

C. Air Release Valves:

1. Each pump shall be equipped with one automatic air release valve, designed to permit the escape of air to the atmosphere during initial priming or unattended repriming cycles. Upon completion of the priming or repriming cycle, the valve shall close to prevent recirculation. Valves shall provide visible indication of valve closure, and shall operate solely on discharge pressure. Valves which require connection to the suction line shall not be acceptable.

2. All valve parts exposed to sewage shall be constructed of cast iron, stainless steel, or similar corrosion resistant materials. Diaphragms, if used, shall be fabric-reinforced neoprene or similar inert material.

3. Serviceability

a. A clean out port, 3 inches or larger in diameter, shall be provided for ease of inspection, clean out, and service.

b. Valves shall be field adjustable for varying discharge heads.

D. Piping

1. Flanged header pipe shall be centrifugally cast, ductile iron, complying with ANSI/AWWA A21.51/C115 and class 53 thickness.

2. Flanges shall be cast iron class 125 and Comply with ANSI B16.1.

3. Pipe and flanges shall be threaded and suitable thread sealant applied before assembling flange to pipe.

4. Bolt holes shall be in angular alignment within $1/2^{o}$ between flanges. Flanges shall be faced with a gasket finish.

E. Contractor must insure all pipes connected to the pump station are supported to prevent piping loads from being transmitted to pumps or station piping. Pump station discharge force main piping shall be anchored with thrust blocks where shown on the contract drawings.

2.06 DRIVE UNIT - MOTORS

A. Pump motors shall be 3 phase, 60 hertz, 480 VAC, horizontal TEFC, NEMA design B with cast iron frame with copper windings, induction type, with class F insulation, inverter duty, and 1.15 SF for normal starting torque and low starting current characteristics, suitable for continuous service. The motors shall not overload at the design condition or at any head in the operating range as specified. The motors shall also be rated for use with VFD drive units.

B. Motors shall be tested in accordance with provisions of ANSI/IEEE Std 112.

C. Motor with engine shall be of a double shaft configuration.

2.07 ENGINE

A. Standby engine shall be a propane gas fueled air cooled type, and shall have continuous duty power rating suitable for the horsepower requirements of the pump, after derating to factors set forth under performance. Engine shall be cooled by an integral forced air cooling system capable of maintaining safe engine operating temperature under expected operating loads, and subject to the expected maximum ambient temperatures in the pump station enclosure.

B. Equipment

1. The engine shall be equipped with all controls and components required for manual and automatic operation when used with the engine controls and DC level control system described in these specifications. Such components shall include, but not be limited to, the following:

   a. 12 Volt dc electrical system including starter and alternator
   b. Storage battery, 84 ampere-hour capacity minimum
   c. Elapsed running time meter
   d. Sensors for engine temperature, oil pressure, and overspeed
   e. Muffler designed to limit engine noise to a level acceptable in a residential area
   f. Switch for manual operation of the cranking motor, mounted on or near the engine.
   g. Voltmeter
   h. Solenoid fuel lock-off valve suitable for use with natural gas or LPG service
   i. Lube oil pressure gauge
   j. Jacket water temperature gauge
   k. Tachometer

2. Engine electrical equipment shall be wired to a terminal board on the engine and pre wired to the base secured control panel. (NOTE: The control panel shall be shipped loose, connection to matching terminals in the control panel shall be by contractor).

3. Because the engine shall be required to operate during emergency situations, the following minimum performance standards shall be used for engine selection:

   a. Engine speed shall be controlled by an electronic, governor-controlled throttle which shall maintain the preset speed over the range of expected pumping loads. This speed shall not be less than 1800 rpm to insure adequate cooling, nor more than 3000 rpm so that internal engine wear is held to a minimum. This governed speed shall not be acceptable if it is greater than that speed at which the engine torque and horsepower curves intersect. Engine manufacturer's published performance curves shall be submitted for review to support engine selection.

   b. The engine shall develop approximately 95 percent of manufacturer’s published performance after a reasonable run-in period.

a. For selection of engine size, engine performance shall be derated according to manufacturer's specifications to allow for decreased performance if installed at elevations more than 1000 feet above sea level.

b. For selection of engine size, engine performance shall be derated according to manufacturer's specifications to allow for decreased performance in an ambient temperature of 100-degrees f, which can reasonably be expected in the pump station.

e. Engine rating shall be further reduced to conform to engine manufacturer's recommendations for continuous service applications.

C. Brake horsepower requirements of pump shall not exceed calculated engine horsepower after de-rating for power available after run-in, temperature compensation, and altitude compensation.

2.08 DRIVE TRANSMISSION

A. Power shall be transmitted from engine to pump by a v-belt drive assembly through a centrifugal clutch mounted on a jackshaft, which shall be coupled or otherwise interfaced with a shaft extension on the pump motor. Jackshaft shall be constructed of steel, not less than 1 1/2 inches in diameter, and shall be mounted in two pillow blocks furnished with anti-friction roller bearings.

B. Each drive assembly shall have a minimum of two v-belts. In no case will a single belt drive be acceptable. Each v-belt drive assembly shall be selected on the basis that adequate power will be transmitted from driver to pump based on the data developed in accordance with drive calculations.

C. Centrifugal clutch shall be designed to remain disengaged until engine has reached some speed greater than idle speed to reduce starting loads. Once engaged, clutch shall be rated to transmit power continuously until engine speed has been reduced below disengagement speed. Clutch shall disengage completely while engine is not operating.

D. Belt Guards

1. Pump drive transmissions shall be enclosed on all sides in a guard constructed of any one or combination of materials consisting of expanded, perforated, or solid sheet metal, except that maximum perforated or expanded openings shall not exceed ½ inch.

2. Guards shall be manufactured to permit complete removal from the pump unit without interference with any unit component, and shall be securely fastened to the unit base.

3. All metal shall be free of burrs and sharp edges. Structural joints shall be continuously welded. Panels may be riveted to frames with not more than five-inch spacing. Tack welds shall not exceed four-inch spacing.

4. The guard shall be finished with one coat of gray W.R. non-lift primer and one coat of orange acrylic alkyd W.R. enamel in accordance with section 3, Color Definitions of ANSI 253.1; Safety Color Code for Marking Physical Hazards.

2.09 FINISH

Pumps, piping, and exposed steel framework shall be cleaned prior to painting. Exposed surfaces to be coated with one coat gray W.R. non-lift primer and one coat white acrylic alkyd W.R. enamel. Paint shall be low VOC, alkyd based, high solids, semi-gloss white enamel for optimum illumination enhancement, incorporating rust inhibitive additives. The finish coat shall be 1.0 to 1.2 MIL dry film thickness (minimum), resistant to oil mist exposure, solvent contact, and salt spray. The factory finish shall allow for over-coating and touch up after final installation.

2.10 ELECTRICAL CONTROL COMPONENTS

A. The pump station control panel will be tested as an integral unit by the pump station manufacturer. The control panel shall also be tested with the pump station as a complete working system at the pump station manufacturer's facility.

B. The pump control system shall be supplied by the pump manufacturer to assure a complete unit and total system responsibility. The pumps, motors, and control system shall be set-up and tested as an integral unit at the pump manufacturers facility. The control panel shall also be tested with the pump station as a complete working system at the pump station manufacturer's facility.

C. UL Listing: The drive assemblies and liquid level control shall be manufactured by a UL panel builder and each assembly shall bear a serialized UL label for enclosed industrial control panels. Listing for open style industrial control panels or an assembly of listed or recognized components shall not be acceptable.

D Wiring Class: All motor control center wiring to be NEMA class IIB including interwiring and interlocking between units and the liquid level control. Units shipped separately because of shipping requirements shall be equipped with wiring harnesses with match-marked and keyed connectors for field assembly.

E. Complete control system engineering shall be supplied by the pump manufacturer and shall include system drawings showing all control units as they are interwired. Diagrams of individual units will not be acceptable.

F. An Allen Bradley SLC Model 1336 Plus II Variable Frequency Drive shall be furnished with an Allen Bradley PLC to accomplish the operations as specified herein and described in the following paragraphs. The Variable Frequency Drive shall also be used to convert the electrical service from single phase to three phase power supply, as needed.

G. Main Connections

a. Each control assembly shall be furnished with main terminals and ground lug for field connection of the electrical supply. The connections shall be designed to accept copper conductors of sufficient size to serve the loads. The main terminals shall be mounted to allow incoming wire bending space in accordance with article 373 of the National Electric Code (NEC). A separate terminal strip shall be provided for 115 volt, single phase control power and shall be segregated from the main terminals. Ten percent of the control terminals shall be furnished as spares.

i. Panel Enclosure

1. Enclosures shall be constructed in conformance with applicable section of National Electrical Manufactures' Association (NEMA) standards for type 1 motor control centers. Enclosure shall be fabricated of steel having a minimum thickness of not less than 0.075 inch (14 gauge). Interior and exterior surfaces shall be enamel over phosphatized surfaces.

2. All control devices and instruments shall be mounted using threaded fasteners, and shall be clearly labeled to indicate function.

H. Branch Circuit Components

a. Motor branch components to be of highest industrial quality, secured to the subplate with machine screws and lockwashers. Mounting holes shall be drilled and tapped; Self-tapping screws shall not be used to mount any component.

b. Circuit Breakers and Operating Mechanisms

i. A properly sized heavy duty motor circuit protector, with RMS interrupting rating of 22,000 amperes at 480 volts, shall be furnished for each pump motor. The circuit protectors must be sealed by the manufacturer after calibration to prevent tampering.

ii. An operating mechanism installed on each motor circuit breaker shall penetrate the control panel door. A padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in "OFF" position.

c. The inverter shall be suitable for operation of NEMA Design B, 4 pole motors. The inverter shall have a diode bridge rectifier on the input to minimize the generation of electrical noise back into the line and provide near unity power factor. Output devices shall be transistors.

I. Environment Conditions

The inverter shall be capable of operation under any combination of the following conditions without mechanical or electrical damage.

Ambient Temperature:	0 to + 40 degrees C
Relative Humidity:	Less than 90% non-condensing
Altitude:	Less than 1,000M (3300 ft) above sea level
Vibration:	.006 inches displacement, 1G peak
Shock:	15G peak for 11mS (+/- 1.0mS)

J. Control Specification

Control System:	Sinusoidal pulse width modulated voltage waveform
Frequency Accuracy:	+/- 1% of max. frequency
Volts/Hertz Ratio:	1 to 14.3 V/HZ user programmable
Operation Frequency:	0 to 250 hz
Overload Capacity:	115% for 60 seconds

K. Digital Readout and Monitor - A digital panel meter will display standby status (power on, not running), output frequency (drive run), set-up parameters and fault. With pushbutton, user hall be able to monitor current, voltage, frequency, acceleration and deceleration time, minimum frequency and maximum frequency. Readout also provides inverter status and protective circuits status.

L. Protection:

a. The variable speed drive system shall include a diode bridge rectifier, capacitor filter, and transistorized inverter section. Base driver signals to control firing of the power transistors will be designed with optically coupled isolators for maximum protection of the control circuits from high voltage and noise. The output will be a sinusoidal, pulse width modulated, voltage waveform for reduced harmonic heating in the motor.

The system protection will provide the following:

Intermittent overload - 50 to 150%
Current limit - 50 to 115%
Overcurrent - 180% of rated output current
Inverse time overload - 50 to 100%
Short circuit - Phase to phase or phase to ground
Overvoltage - 10% above input line or DC bus voltage
Undervoltage - 10% below line voltage
Component burnout - DC bus fuse protection and/or phase input fusing
Power loss ride-through - 500mS

b. When the inverter trips out on a fault, the fault relay shall activate and the display shall indicate the reason for the trip as follows:

Overcurrent
Short circuit
Overload
Overvoltage
Undervoltage
Overheat
Ground fault
Motor stalled
Power supply fault

c. Auto restart shall occur when the inverter faults. Auto restart shall be adjustable up to 9 attempts over a 4 minute period. Auto restart will not be attempted for ground fault, output shorted or transistor shorted but will trip out immediately, activate the fault relay and make the appropriate indication on the display.

d. In the event of a fault trip, the microprocessor shall save the status of the inverter at the time of the fault and make that information available on the digital display until the inverter is reset or the control power is removed.

M.. Operational Functions:

a. Acceleration and deceleration time independently adjustable from 1 to 600 seconds (selectable ranges).
b. Volts/Hertz patterns user selectable.
c. Maximum and minimum frequency limit adjustments.

2.11 THREE PHASE VOLTAGE MONITOR

A. Control Circuit Components

a. A normal duty thermal-magnetic circuit breaker shall protect all control circuits by interrupting control power.

b. Pump mode selector switches shall permit manual start or stop of each pump individually, or permit automatic operation under control of the liquid level control system. Manual operation shall override all shutdown systems, except the drive fault. Selector switches to be heavy duty, oil-tight design with contacts rated NEMA A300 minimum.

c. Six digit elapsed time meter (non-reset type) shall be connected to each motor starter to indicate total running time of each pump in "hours" and "tenths of hours".

d. The PLC shall be an Allen-Bradley SLC 500 system. The PLC shall be equipped with a Model 503 CPU with 8k memory, a Data Highway 485 port and a configurable RS-232 port. The RS-232 port is reserved for future customer use.

e. The PLC shall operate on 120vac power and be equipped with the communication devices, digital and analog I/O necessary to accomplish the specified operation. A minimum of 10% spare of the I/O used shall be supplied.

f. The program logic shall be stored in battery backed random access memory, as well as on a programmable, read only memory module. The memory module shall auto load and run when installed in the programmable control processor and is included to facilitate field repair or replacement of the programmable control hardware without the use of programming terminals or personal computers.

g. The power supply to the programmable control shall include an active tracking filter protection system to minimize the effects of electrical noise. Each motor starter or contactor shall be equipped with a surge suppressor.

h. The PLC shall communicate with the drive using remote I/O. The PLC shall issue drive start/stop and speed commands. Drive status shall also be communicated using remote I/O. The drive shall be configured to operate manually without the use of the PLC.

i. An Allen-Bradley Panelview 1200 electronic operator interface shall be provided for data entry and display. The operator interface shall be mounted on the front of the control panel with other operator controls and shall be compatible with the PLC communication protocol. The operator interface shall be a backlit, touch-screen terminal.

j. Electromechanical relays and timers, when used shall be equipped with 120vac coils and contacts rated NEMA-300 minimum. Timers shall be pneumatic or synchronous motor driven.

k. A duplex ground fault receptacle providing 115 VAC, 60 Hz, single phase current, shall be mounted on the control enclosure. Receptacle circuit shall be protected by a 15 ampere thermal-magnetic circuit breaker.

B. Control Logic

1. Control logic shall be accomplished using programmable controllers. Electromechanical relays may be used when necessary. However, the primary control logic shall be performed by the PLC.

2. The O&M manual shall be provided with complete ladder logic program documentation including English names, rung comments, and coil/contact cross-references.

3. The control shall be pre-programmed or wired to provide the following routines:
   - Pump alternation at lead stop

- Excessive pump run time alternation
- Jump to next pump on lead failure
- Start/stop pumps at normal level settings
- Pump start delays when called simultaneously
- General alarm pilot light activation: Quick flashing alarm/slow flashing acknowledge/ steady on reset/off when clear
- Station trouble alarm(115vac and normally open dry contact)
- High and low level alarms
- Pump start/stop level control
- Drive speed/level control
- Pump high temperature shutdown
- Drive fault alarm

The operator interface shall be equipped with the following displays and functions:

- Main Menu
- Wet Well Level
- Wet Well Level Simulation
- Low Water Alarm Status
- High Water Alarm Status
- Pump High Temperature Status #1, #2
- Drive Fault Status #1, #2
- Pump Sequence Selection
- Alarm Silence
- Alarm Reset
- General Alarm Lamp Test
- Lead Level Start/Stop Setpoints
- Lag Level Start/Stop Setpoints
- Low Water Alarm Setpoints
- High Water Alarm Setpoints
- Speed/Level Setpoints (1 pump running)
- Speed/Level Setpoints (2 pumps running)
- Power-up Delay Setpoint
- Alarm Delay Setpoint
- Pump Start Delay Setpoint
- Alternation Time Interval Setpoint
- Level Transmitter Calibration

2.12 LIQUID LEVEL CONTROL SYSTEM

A. Pump station shall operate on utility power while such power is available, except for exercise periods as specified herein. When operating on utility power, operation of pumps and motors shall be controlled by the ac level control system as specified herein. During a failure of utility power and during exercise periods, operation of the pump with the standby engine shall be controlled by the standby level control system and engine control system specified herein. Transfer from AC level control and to standby level control shall occur as follows.

1. Relays and other controls shall be provided to accomplish the following functions:

   a. Time delay after failure of utility power before transfer from AC level control to standby level control. Relay shall be manually adjustable from 0.2 To 60 seconds.

b. Time delay after restoration of utility power before transfer from standby level control to AC level control. Relay shall be manually adjustable from 0 to 30 minutes.

c. Automatic override of time delay after power restoration, upon occurrence of: engine or engine control failure as specified under engine control system.

d. Manual override of time delay on restoration of normal power. Momentary pushbutton or similar device shall be acceptable.

e. Time delay after transfer from standby level control to AC level control before application of AC power to motor of pump with standby engine. Such relay shall be preset at approximately 15 seconds to permit engine to stop completely before motor is started.

f. Indicate the presence of utility power. Such indicator shall be the press-to-test type to permit the operator to verify failure of utility power.

2. These functions and interlocks shall be applicable only to the motor of the pump furnished with the standby engine. No hindrance shall be included for the motor starter and motor branch circuit for the pump which does not have the standby engine. Immediately upon restoration of utility power after power interruption, and during exercise periods, the pump which does not have the standby engine shall be permitted to run if operation of that pump is required by the AC level control system.

B. Controls shall be provided to cause regular use of the standby level control system and standby engine. Such exercise of standby components shall occur to maintain these components in a ready condition, and to discover malfunctions before emergency conditions arise.

1. Exercise periods shall be established by a manually adjustable exercise timer. Timer shall provide a 7-day timing cycle, and shall permit the selection of one or more exercise periods of 15 minute duration, or multiples thereof, which shall repeat every 7 days.

2. During exercise periods, timer shall simulate a loss of utility power to transfer circuits described herein. After transfer from AC level control to standby level control, the standby level control system shall operate the pump with the standby engine through the engine control system as described in these specifications.

3. If the standby engine is operating at the end of the exercise period, it shall continue to operate until one of the following conditions occurs:

a. The standby level control system stops the engine through the engine control system, or

b. The delay on restoration of utility power relay times out.

4. Upon occurrence of either of these conditions, operation of the engine shall cease, and operation of the pump with the standby engine shall revert to control by the AC level control system.

5. During exercise periods, utility power shall remain available to the motor of the pump which does not have the standby engine.

C. Liquid Level Control

1. The AC level control system shall be provided with an electronic pressure switch to start and stop the pump motors in response to changes in the wet well level, as set forth herein.

2. The AC level control system shall utilize a submersible transducer which shall extend into the wet well. The transducer shall provide wet well level signals for the remainder of the level control system.

3. The AC level control system shall be designed to accomplish the following tasks:

   a. Continuously monitor the level of liquid in the wet well.

   b. Start and stop pumps as required by the level of liquid in the wet well.

   c. Select the operation of one pump or both pumps.

   d. Select the sequence of pump operation upon operator command for automatic alternation.

   e. Provide alarm indications upon occurrence of predetermined malfunctions.

   f. Upon restoration of utility power after a power outage, the system shall delay the application of power to the engine driven pump, by a length of time that has been preselected by the operator.

   g. Shut down a pump motor when the temperature of that pump reaches a level which could cause pump damage.

4. The level control system shall continuously monitor the wet well level, permitting the operator to read wet well level at any time. Upon operator selection of automatic operation, the electronic pressure switch shall start the motor for one pump when the liquid level in the wet well rises to the "lead pump start level". When the liquid is lowered to the "lead pump stop level", the electronic pressure switch shall stop this pump. These actions shall constitute one pumping cycle. Should the wet well level continue to rise, the electronic pressure switch shall start the second pump when the liquid reaches the "lag pump start level", so that both pumps are operating to pump down the well. Pumps shall stop at their respective "stop" levels. These levels shall be adjustable as described below.

5. The level control system shall utilize the alternator relay to select first one pump, then the second pump, to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle.

6. Electronic Pressure Switch

   a. The electronic pressure switch shall include integral components to perform all pressure sensing signal conditioning, EMI and RFI suppression, dc power supply and 120 volt outputs. Comparators shall be solid state, and shall be integrated with other components to perform as described below.

b. The electronic pressure switch shall be capable of operating on a supply voltage of 108 volts to 132 volts ac, 60 hertz, in an ambient temperature range of -18 degrees c (0 degrees f) through +55 degrees c (131 degrees f). Control range shall be 0 to 12.0 Feet of water with an overall repeat accuracy of plus or minus 0.1 Feet of water.

c. The electronic pressure switch shall consist of the following integral components: submersible type pressure sensor, display, electronic comparators, and output relays.

(1) Submersible type pressure sensor: The (level) pressure sensor shall be a diffused silicon piezoresistive semi-conductor submersible sensor which shall be designed to install into the wet well. The sensor shall convert the wet well level to a proportional electrical signal for distribution to the display and electronic comparators. The sensor output shall be filtered to prevent control response to level pulsations or surges. The sensor range shall be 0 to 10 PSI, temperature compensated from -0 degrees C (32 degrees F) through +50 degrees C (+122 degrees F), with a total accuracy of plus or minus 0.50% full scale about a fixed temperature. Sensor overpressure rating shall be 3 times full scale. Sensor housing and diaphragm shall be stainless steel of non-clogging design with silicone oil fill fluid. A laser trimmed hybrid circuit shall be used to standardize output and null offset and to provide precise temperature compensation. The transducer shall provide a proportional electrical signal for distribution to the display and electronic comparators. The transducer output shall be filtered to prevent control response to level pulsations or surges. The transducer range shall be 0 to 15 PSI, temperature compensated from -40 degrees c (-40 degrees f) through +85 degrees c (+185 degrees f), with a repeat accuracy of plus or minus 0.25% Full scale about a fixed temperature. Transducer overpressure rating shall be 3 times full scale.

(2) Display: The electronic pressure switch shall incorporate a digital panel meter which, upon operator selection, shall display liquid level in the wet well, and the preset start and stop levels for both the lead and lag pumps. The meter shall be a 3 1/2" digit display calibrated to read out directly in feet of water, accurate to within one-tenth foot (0.1 Foot), with a full scale indication of not less than 33 feet.

(3) Electronic Comparators: Level adjustments shall be electronic comparator setpoints to control the levels at which the lead and lag pumps start and stop. Each of the level settings shall be adjustable, and accessible to the operator without opening the control panel or any cover panel on the electronic pressure switch. Controls shall be provided to permit the operator to read the selected levels on the display. Such adjustments shall not require hard wiring, the use of electronic test equipment, artificial level simulation or introduction of pressure to the electronic pressure switch.

(4) Output Relays: Each output relay in the electronic pressure switch shall be solid state. Each relay input shall be optically isolated from its output and shall incorporate zero crossover switching to

provide high immunity to electrical noise. The "on" state of each relay shall be indicated by illumination of a light emitting diode. The output of each relay shall be individually fused providing fused overload and short circuit protection. Each output relay shall have an inductive load rating equivalent to one NEMA size 4 contactor. A pilot relay shall be incorporated for loads greater than a size 4 contactor.

(5) Intrinsically Safe Barrier: An intrinsically safe repeater shall be supplied in the control enclosure. Repeater must be recognized and listed as intrinsically safe by a nationally recognized testing laboratory. Station manufacturer shall make all connections from repeater to feeder lines and motor controls. Installing contractor shall make connections from repeater to transducer.

d. The electronic pressure switch shall be equipped with replaceable plug-in integrated circuits and output fuses. The main circuit board assembly shall be provided with keyed plug-in connections to "off board" components permitting main board removal without de-soldering. All printed circuits shall have a conformal coating applied to both sides to protect against moisture or fungus.

e. Circuit design in which the application of power to the lag pump motor starter is contingent upon completion of the lead pump circuit shall not be acceptable.

D. Standby Level Control System:

1. The standby level control system shall be furnished with an electronic pressure switch to start and stop the pump supplied with the standby engine through the engine control system in response to changes in the wet well level, as set forth herein.

2. The standby level control system shall utilize a submersible transducer which shall extend into the wet well. The transducer shall provide wet well level signals for the remainder of the level control system.

3. The standby level control system shall continuously monitor the wet well level, permitting the operator to read wet well level at any time. Upon operator selection of automatic operation the DC electronic pressure switch shall start the engine for the pump when the liquid level in the wet well rises to the "engine start level". When the liquid is lowered to the "engine stop level", the electronic pressure switch shall stop this pump. These actions shall constitute one pumping cycle.

4. Electronic Pressure Switch:

a. The electronic pressure switch shall include integral components to perform all pressure sensing signal conditioning, EMI and RFI suppression. Comparators shall be solid state, and shall be integrated with other components to perform as described herein.

b. The electronic pressure switch shall be capable of operating on the storage battery supply voltage of 12 volts DC, in an ambient temperature range of -18 degrees C (0 degrees F) through +55 degrees C (131 degrees F). Control range

shall be 0 to 12.0 feet of water with an overall repeat accuracy of plus or minus 0.1 feet of water.

c. The electronic pressure switch shall consist of the following integral components: submersible type pressure sensor, display, electronic comparators, and output relays.

(1) Submersible Type Pressure Sensor: The (level) pressure sensor shall be a diffused silicon piezoresistive semi-conductor submersible sensor which shall be designed to install into the wet well. The sensor shall convert the wet well level to a proportional electrical signal for distribution to the display and electronic comparators. The sensor output shall be filtered to prevent control response to level pulsations or surges. The sensor range shall be 0 to 10 PSI, temperature compensated from -0 degrees C (32 degrees F) through +50 degrees C (+122 degrees F), with a total accuracy of plus or minus 0.50% full scale about a fixed temperature. Sensor overpressure rating shall be 3 times full scale. Sensor housing and diaphragm shall be stainless steel of non-clogging design with silicone oil fill fluid. A laser trimmed hybrid circuit shall be used to standardize output and null offset and to provide precise temperature compensation.

(2) Display: The electronic pressure switch shall incorporate a digital panel meter which, upon operator selection, shall display liquid level in the wet well, and the preset start and stop levels for both the lead and lag pumps. the meter shall be a 3 1/2" digit display calibrated to read out directly in feet of water, accurate to within one-tenth foot (0.1 foot), with a full scale indication of not less than 33 feet.

(3) Electronic comparators: Level adjustments shall be electronic comparator set points to control the levels at which the engine starts and stops. Each of the level settings shall be adjustable, and accessible to the operator without opening the control panel or any cover panel on the electronic pressure switch. Controls shall be provided to permit the operator to read the selected levels on the display. Such adjustments shall not require hard wiring, the use of electronic test equipment, artificial level simulation or introduction of pressure to the electronic pressure switch.

(4) Output relays: Each output relay in the electronic pressure switch shall be solid state. Each relay input shall be optically isolated from its output and shall incorporate zero crossover switching to provide high immunity to electrical noise. The "on" state of each relay shall be indicated by illumination of a light emitting diode. The output of each relay shall be individually fused providing fused overload and short circuit protection. Each output relay shall have an inductive load rating equivalent to one NEMA size 4 contactor. A pilot relay shall be incorporated for loads greater than a size 4 contactor.

d. The electronic pressure switch shall be equipped with replaceable plug-in integrated circuits and output fuses. The main circuit board assembly shall be provided with keyed plug-in connections to "offboard" components permitting main board removal without de-soldering. All printed circuits shall have a conformal coating applied to both sides to protect against moisture or fungus.

e. The electronic pressure switch shall be equipped with an additional electronic comparator and solid state output relay to alert maintenance personnel to a high liquid level in the wet well. In the event that the wet well liquid reaches a preset high water alarm level, the alarm output relay shall energize a signal relay. The signal relay shall complete a 12 volt DC circuit for an external alarm device. An indicator, visible on the front of the control panel, shall indicate that a high wet well level exists. The signal relay shall maintain the alarm signal until the wet well level has been lowered and the circuit has been manually reset.

f. An alarm silence switch and relay shall be provided to permit maintenance personnel to de-energize the external alarm device while corrective actions are underway. After silencing the alarm device, manual reset of the signal relay shall provide automatic reset of the alarm silence relay.

g. The electronic pressure switch shall be equipped with an electronic comparator and solid state output relay to alert maintenance personnel to a low liquid level in the wet well. In the event that the wet well liquid reaches a preset low water alarm level the alarm output relay shall energize a signal relay. The signal relay shall complete a 12 volt DC circuit for an external alarm device. An indicator, visible on the front of the control panel, shall indicate that a low wet well level exists. The alarm signal shall be maintained until the cause for the low wet well level has been corrected and the circuit has been manually reset. A low liquid level condition shall disable both pump motors. When the wet well rises above the low level point, both pump motors shall be automatically enabled. Low water alarm shall be furnished with a dry contact wired to terminal blocks.

h. An alarm silence pushbutton and relay shall be provided to permit maintenance personnel to de-energize the audible alarm device while corrective actions are under way. After silencing the alarm device, manual reset of the alarm condition shall clear the alarm silence relay automatically. The pushbutton shall be oil tight design with contacts rated NEMA A300 minimum.

i. Operating power for the standby level control system shall be provided by the storage battery furnished with the standby engine.

E. Engine Control System:

1. The engine control system shall be designed to accomplish the following tasks:

a. Permit the operator to select mode of engine operation, providing manual start and stop of the engine to override the standby level control system and cranking circuit if required.

b. Crank the engine upon start command from the level control system, and stop the engine upon a stop command.

c. Stop the cranking sequence if the engine fails to start after a reasonable number of attempts, and provide an alarm indication of failure to start.

d. While the engine is operating, continuously monitor engine speed, temperature and oil pressure.

e. Stop the engine for excessive speed, excessive cylinder head temperature, or insufficient oil pressure, and provide an alarm indication of shutdown and its

cause, and shall

f. Maintain the charge on the engine storage battery.

g. Provide an alarm indication for loss of 12 volt dc power for the standby level control system and engine control system.

h. Shutdown features shall be wired to the terminal strip to provide a general alarm indication.

2. Upon operator selection of automatic operation, when the standby level control system provides a start command, the engine control system shall start the engine cranking motor for a short period of time. If the engine does not start, the system shall stop the cranking motor for a short period of time, then resume cranking. Typically, 5 10-second cranking periods, each followed by a 10-second rest period, should be considered a reasonable effort to start the engine. When the engine starts, a sensor on the engine or elsewhere in the system shall stop the cranking cycle and reset the cranking circuit for the next start.

3. If the engine does not start within the preset number of attempts, the cranking circuit shall be deenergized, a failure to start indicator on the control panel shall be illuminated, and an external alarm device shall be energized. Control of the pump with the standby engine shall be returned to the AC level control system.

4. Once the engine has started normally, the engine control system shall monitor engine speed, cylinder head temperature , and oil pressure. Upon engine failure from any cause, system shall provide an alarm indication, illuminate an indicator, and energize and external alarm device as specified below.

5. During periods when the DC level control system is fully operative, a battery charger shall continuously charge the engine storage battery.

6. Mode of engine operation

a. Switches or other devices shall be provided and connected to perform as follows:

(1) When automatic operation is selected, engine shall start and stop under control of the engine control system.

(2) When manual operation is selected, engine cranking motor shall be controlled by a manual pushbutton or other device on the engine. Once started, engine shall run until off is selected, or engine failure circuit stops engine.

(3) Operator can stop engine if it is running, and prevent it from starting during maintenance or repair.

b. Engine failure circuits shall stop the engine, illuminate a labeled indicator on the control panel, and energize an external alarm device for each of the following conditions:

(1) Engine speed exceeds maximum overspeed setting.

(2) Engine temperature exceeds safe operating temperature as

specified by the engine manufacturer.

(3) Engine oil pressure falls below engine manufacturer's specified recommendations. System must override or bypass this function during cranking and several seconds after starting to permit engine to build up oil pressure.

7. Engine control system shall be furnished with one battery charger, designed and connected to operate on 115 volts, AC 60 hertz to maintain the charge on the 12 volt DC storage battery supplied with the engine. Battery charger shall incorporate the following design features:

a. Automatic charge sensing and charging rate adjustment circuit.

b. Integral current limit circuit to limit charging rate.

c. Charging rate ammeter.

d. Fuse for protection of charging circuit.

3. Operating power for the engine control system, except the battery charger, shall be provided by the storage battery furnished with the standby engine.

PART 3 - EXECUTION

3.01 EXAMINATION

Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Station manufacture shall provide written instruction for proper handling. Immediately after off-loading, contractor shall inspect complete pump station and appurtenances for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all station serial numbers and parts lists with shipping documentation. Notify the manufacturers representative of any unacceptable conditions noted with shipper.

3.02 INSTALLATION

A. Install, level, align, and lubricate pump station as indicated on project drawings. Installation must be in accordance with written instructions supplied by the manufacture at time of delivery.

B. Suction pipe connections are vacuum tight. Fasteners at all pipe connections must be tight. Install pipe with supports and thrust blocks to prevent strain and vibration on pump station piping. Install and secure all service lines (level control, air release valve or pump drain lines) as required in wet well.

C. Check motor and control data plates for compatibility to site voltage. Install and test the station ground prior to connecting line voltage to station control panel.

D. Prior to applying electrical power to any motors or control equipment, check all wiring for tight connection. Verify that protective devices (fuses and circuit breakers) conform to project design documents. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence and ground before actual start-up.

3.03 FIELD QUALITY CONTROL

A. Operational Test

1. Prior to acceptance by owner, an operational test of all pumps, drives, and control systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.

2. After construction debris and foreign material has been removed form the wet well, contractor shall supply clear water volume adequate to operate station through several pumping cycles. Observe and record operation of pumps, suction and discharge gage readings, ampere draw, pump controls, and liquid level controls. Check calibration of all instrumentation equipment, test manual control devices, and automatic control systems. Be alert to any undue noise, vibration or other operational problems.

B. Manufacturers Start-up Services: Coordinate station start-up with manufactures technical representative. The representative or factory service technician will inspect the completed installation. He will calibrate and adjust instrumentation, correct or supervise correction of defects or malfunctions, and instruct operating personnel in proper operation and maintenance procedures.

3.04 CLEANING

Prior to acceptance, inspect interior and exterior of pump station for dirt, splashed material or damaged paint. Clean or repair accordingly. Remove from the job site all tools, surplus materials, scrap and debris.

3.05 PROTECTION

The pump station should be placed into service immediately. If operation is delayed. Station is to be stored and maintained per manufacturers written instructions.

3.06 PUMP STATION ACCESSORY EQUIPMENT

A. Spare Parts Kit: There shall be furnished with the pump station the following minimum spare parts:

1. One (1) spare pump mechanical seal (complete), and with it all gaskets, seals, sleeves, "o"-rings, and packing required to be replaced during replacement of the seal.

2. One (1) set of impeller clearance adjustment shims.

3. One (1) cover plate "o"-ring.

4. One (1) rotating assembly "o"-ring.

5. Three (3) spare flap valves.

6. One (1) spare level control pressure sensor transducer.

B. Pump Drain Kit: The pump drain kit shall consist of a 10' length of plastic hose with a quick connect female Kamlock fitting on one end of hose and two sets of fittings for pump drains. Each set of fittings for pump drain includes a pipe nipple, bushing, bronze ball valve and quick connect male Kamlock fitting.

C. Gauge Kit

1. Each pump shall be equipped with a glycerin-filled compound gauge to monitor suction pressures, and a glycerin-filled pressure gauge to monitor discharge pressures. Gauges shall be a minimum of 4 inches in diameter, and shall be graduated in feet water column. Rated accuracy shall be 1 percent of full scale reading. Compound gauges shall be graduated -34 feet to +34 feet water column minimum. Pressure gauges shall be graduated 0 to 140 feet water column minimum.

2. Gauges shall be mounted on a resilient panel and frame assembly which shall be firmly secured to pumps or piping. Gauge installations shall be complete with all hoses and fittings, and shall include a shutoff valve installed in each gauge inlet at the point of connection to suction and discharge pipes.

D. UL Label Requirement: Pump station controls shall conform to third party safety certification. The panel shall bear a serialized U.L. label listed for "Enclosed Industrial Control Panels". The enclosure, and all components mounted on the sub-panel or control cover shall conform to U.L. descriptions and procedures.

E. Secondary Lightning Arrestor: The control panel shall be equipped with a secondary lightning arrestor to minimize damage to the pump motors and control from transient voltage surges. The arrestor shall utilize silicon-oxide varistors encapsulated in a non-conductive housing. The arrestor shall have a current rating of 60,000 Amps, and a Joule rating of 1500.

F. Pump Start Delay: The control circuit for pump #2 shall be equipped with a time delay to prevent simultaneous motor starts.

G. Three Phase Voltage Monitor: The control panel shall be equipped to monitor the incoming power and shut down the pump motors when required to protect the motor(s) from damage caused by phase reversal, phase loss, low voltage, and voltage unbalance. An integral time delay shall be provided to minimize nuisance trips. The motor(s) shall automatically restart when power conditions return to normal.

H. Auxiliary Power Transformer: The lift station shall be equipped with a 3 KVA step-down transformer to supply 115 volt, AC, single phase for the control and auxiliary equipment. The primary and secondary side of the transformer to be protected by a thermal magnetic circuit breaker, sized to meet the power requirements of the transformer. An operating mechanism shall penetrate the control panel door. and a padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in "OFF" position.

I. Alarm Light (External): Station manufacturer will supply one 12 VDC alarm light fixture with vapor-tight shatter resistant red globe, conduit box, and mounting base. The design must prevent rain water from collecting in the gasketed area of the fixture, between the base and globe. The alarm light will be shipped loose for installation by the contractor.

J. Small Piping: All piping and fittings to air release valves, drain kit, and gauge assemblies shall be stainless steel.

3.07 FIELD ACCEPTANCE TESTS

A. After installation of the pumping equipment, and after inspection, operation, testing and adjustment have been completed by the manufacturer's representative, each pump shall be given a running test in the presence of the Engineer during which it shall determine its ability to operate without vibration or overheating, and to deliver its rated capacity under the specified conditions.

B. During the tests, observations shall be made of head, capacity, and motor input. All defects or defective equipment revealed by or noted during the tests shall be corrected or replaced promptly at the expense of the Manufacturer, and if necessary, the tests shall be repeated until results acceptable to the Engineer are obtained. The Contractor shall furnish all labor, piping, equipment, and materials necessary for conducting the tests.

C. All adjustments necessary to place the equipment in satisfactory working order shall be made at the time of the above tests.

D. If sufficient sewage or sludge is NOT available for the test, the Contractor shall provide water for testing, if so directed.

E. Water for testing shall be furnished by the Contractor.

F. In the event that the Contractor is unable to demonstrate to the satisfaction of the Engineer, that the units will satisfactorily perform the service required and that they will operate free from vibration and heating, the pumping units will be rejected.

G. The field verification and/or draw down tests shall be conducted on each individual pump and shall include measuring or determining the items listed below. Additional, each pump station shall be tested operating in combination with the other pump station or stations connected to the same force main manifold. Data shall be recorded for each pump during the field test.

1. Flow rate
2. Total head on the pump
3. Power input
4. Static head on the pump

H. The pump stations shall be tested according to the following operational scenarios with a single pump running and with two parallel pumps running.

PUMP STATION TESTED	**Pump(s) Operating**	**ADDITIONAL PUMP STATIONS OPERATING**	**Pump(s) Operating**
Wrights Lane Pump Station	Pump No. 1	None	-
Wrights Lane Pump Station	Pump No. 2	None	-
Wrights Lane Pump Station	Pump No. 1 & No. 2	None	-
Wrights Lane Pump Station	Pump No. 1	Marks PS	Pump No. 1
Wrights Lane Pump Station	Pump No. 1	Marks PS	Pump No. 1 & No. 2
Wrights Lane Pump Station	Pump No. 1 & No. 2	Marks PS	Pump No. 1
Wrights Lane Pump Station	Pump No. 1 & No. 2	Marks PS	Pump No. 1 & No. 2

- END OF SECTION -

DIVISION 15

MECHANICAL

KENTUCKY ENGINEERING GROUP, PLLC

SECTION 15050

BASIC MECHANICAL

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 15 Sections.

1. Pipe joint materials.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Mechanical sleeve seals.
6. Escutcheons.
7. Grout.
8. Fabricated metal equipment supports.
9. Installation requirements common to mechanical specification Sections.
10. Piping joint construction.
11. Cutting and patching.

B. Pipe and pipe fitting materials are specified in piping system Sections.

1.2 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein.

1. Kentucky Building Code – 2007 (KY BC)
2. International Mechanical Code – 2006 (IMC)
3. Kentucky Plumbing Code – 2007 (KY PC)
4. International Energy Conservation Code – 2000 (IECC)
5. American Society of Mechanical Engineers (ASME)
6. American National Standards Institute (ANSI)
7. National Fire Protection Association (NFPA)

8. Underwriters Laboratories (UL)

9. American Society for Testing and Materials (ASTM)

10. American Welding Society (AWS)

11. Occupational Safety and Health Administration (OSHA)

1.3 DEFINITIONS

A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.

B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

D. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

E. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

F. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

G. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.

2. CPVC: Chlorinated polyvinyl chloride plastic.

3. PE: Polyethylene plastic.

4. PVC: Polyvinyl chloride plastic.

5. FRP: Fiberglass reinforced plastic.

H. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.

2. NBR: Acrylonitrile-butadiene rubber.

1.4 QUALITY ASSURANCE

A. Unless otherwise specified, equipment or material of the same type or classification, used for the same purpose, shall be products of the same manufacturer.

B. All material shall be new and of the current design of the manufacturer providing equipment or material.

C. Install equipment in a neat and workmanlike manner. Align, level, and adjust for satisfactory operation. Provide easy access for inspection, operation, maintenance, and repair.

D. Qualify welding processes and operators for structural steel according to AWS D1.1 "Structural Welding Code – Steel."

E. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions of ASME B31 Series "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

F. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.

1.5 INSPECTION

A. Contractor shall have mechanical work inspected by the appropriate agencies as required by codes and standards.

B. Contractor shall furnish to the Owner's Representative certificates of compliance stating that the completed installation complies with code and standard requirements.

1.6 CONTRACT DRAWINGS

A. The locations of equipment, fixtures, piping, ductwork, connections, and similar items shown on the Contract Drawings are approximate. The Contractor shall determine exact locations. Where a substitute manufacturer is proposed, Contractor shall make adjustments necessary to incorporate proposed equipment.

1.7 CONTINUITY OF SERVICES

A. Schedules for construction shall be coordinated with other contracts and with Owner's Representative.

1.8 INSTRUCTION OF OWNER'S REPRESENTATIVE

A. Prior to requesting final acceptance of work, furnish necessary skilled personnel to operate all systems. Instruct designated Owner's representatives in proper operation and care of systems and equipment. Repeat instructions as required.

1.9 SUBMITTALS

A. Product data for following items:

1. Mechanical sleeve seals.

2. Transition fittings.

3. Dielectric fittings.

4. Escutcheons.

B. Shop drawings detailing fabrication and installation for supports and anchorage for mechanical materials and equipment.

C. Coordination drawings for access panel and door locations.

D. Coordination drawings prepared to a 1/4 inch equals 1 foot (1:48) scale or larger. Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Show where sequence and coordination of installations are important to the efficient flow of the Work. Include the following:

1. Proposed locations of piping, ductwork, equipment, and materials. Include the following:

a. Planned piping layout, including valve and specialty locations and valve stem movement.
b. Planned duct systems layout, including elbow radii and duct accessories.
c. Clearances for installing and maintaining insulation.
d. Clearances for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
e. Equipment service connections and support details.
f. Exterior wall and foundation penetrations.
g. Fire-rated wall and floor penetrations.
h. Sizes and location of required concrete pads and bases.

2. Scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

4. Reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

E. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the “Quality Assurance” Article.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Protect stored plastic pipes from direct sunlight. Support to prevent sagging and bending.

1.11 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

E. Coordinate connection of electrical services.

F. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

G. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces.

H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.1 PIPE JOINING MATERIALS

A. Refer to individual piping system specification Sections in Division 15 for special joining materials not listed below.

B. Solder Filler Metal: ASTM B32.

1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent), having 0.10 percent lead content.

2. Alloy Sn50: Tin (50 percent) and lead (50 percent).

3. Alloy E: Tin (approximately 95 percent) and copper (approximately 5 percent), having 0.10 percent maximum lead content.

4. Alloy HA: Tin-antimony-silver-copper-zinc, having 0.10 percent maximum lead content.

5. Alloy HB: Tin-antimony-silver-copper-nickel, having 0.10 percent maximum lead content.

6. Alloy Sb5: Tin (95 percent) and antimony (5 percent), having 0.20 percent maximum lead content.

C. Brazing Filler Metals: AWS A5.8.

1. BcuP Series: Copper-phosphorus alloys.

2. Bag1: Silver alloy.

D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Solvent Cements: Manufacturer's standard solvents complying with the following:

1. Acrylonitrile-Butadiene-Styrene (ABS): ASTM D2235.

2. Chlorinated Poly (Vinyl Chloride) (CPVC): ASTM F493.

3. Poly (Vinyl Chloride) (PVC): ASTM D2564.

4. PVC to ABS Transition: Made to requirements of ASTM D3138, color other than orange.

2.2 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Eslon Thermoplastics.
b. equal.

B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Thompson Plastics, Inc.
b. equal.

C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:

a. NIBCO INC.
b. NIBCO, Inc.; Chemtrol Div.
c. equal.

D. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Fernco, Inc.
c. Mission Rubber Company.
d. Plastic Oddities, Inc.
e. equal.

2.3 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Eclipse, Inc.
d. Epco Sales, Inc.
e. Hart Industries, International, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Industries, Inc.; Wilkins Div.
h. equal.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Watts Industries, Inc.; Water Products Div.
e. equal.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.
e. equal.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.
c. equal.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

a. Perfection Corp.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Co., Inc.
d. Victaulic Co. of America.
e. equal.

2.4 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.5 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated and rough brass.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated and rough brass.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.7 GROUT

A. Description: ASTM C1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

2.8 FABRICATED METAL SUPPORTS

A. Structural Steel Shapes: ASTM A36.

PART 3 EXECUTION

3.1 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components.

2. Verify all dimensions by field measurements.

3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.

4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Owner's Representative.

9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

11. Install access panel or doors where units are concealed behind finished surfaces.

12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.2 PIPING INSTALLATION

A. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 15 specify piping installation requirements unique to the piping system.

B. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.

C. Install piping at indicated slope.

D. Install components having pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 3-inch clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's printed instructions.

M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings in finished areas.

N. Verify final equipment locations for roughing in. Refer to equipment specifications in other Sections for roughing-in requirements.

O. Angle (wye) type strainers shall be provided with shutoff valve and cap on blowdown connection.

P. Where mains are reduced, provide eccentric reducing fittings installed with flat side on the bottom.

Q. Horizontal piping shall not be installed less than 6 inches above finished floor (along walls), less than 7 ft-6 inches above finished floor (other areas), or in front of windows.

R. Piping shall be offset, relocated, or changed to clear ducts, beams, conduits and other obstacles.

S. Piping systems shall be free of noise and vibration under normal operating conditions.

T. Install piping to permit valve servicing.

U. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

2. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.

3. Insulated Piping: One-piece, stamped-steel type with spring clips.

4. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

5. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.

6. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

7. Bare Piping in Unfinished Service Spaces: No escutcheon.

8. Bare Piping in Equipment Rooms: No escutcheon.

9. Bare Piping at Floor Penetrations in Equipment Rooms: No escutcheon.

3.3 SLEEVES

A. Install sleeves for pipes passing through concrete and masonry walls, fire-rated partitions, concrete floor and roof slabs, and where indicated.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 4 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.

2. Build sleeves into new walls and slabs as work progresses.

3. Install large enough sleeves to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than 6 inches.

b. Steel Sheet-Metal Sleeves: For pipes 6 inches and larger that penetrate gypsum-board partitions.

c. Cast Iron Sleeve Fittings: For floors having membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.

4. Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

5. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants specified in Division 7 Section “Joint Sealants.”

6. Above Grade, Exterior Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.

a. Install steel pipe for sleeves smaller than 6 inches.
b. Install cast-iron wall pipes for sleeves 6 inches and larger.
c. Assemble and install mechanical seals according to manufacturer’s printed instructions.

7. Below Grade, Exterior Wall, Pipe Penetrations: Install cast-iron wall pipes for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.

8. Below Grade, Exterior Wall, Pipe Penetrations: Install ductile-iron wall penetration system sleeves according to manufacturer’s printed installation instructions.

9. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping

sealant material. Firestopping materials are specified in Division 7 Section "Through-Penetration Firestop Systems."

B. Sleeves are not required for core-drilled holes.

3.4 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.

2. ABS Piping: Join according to ASTM D2235 and ASTM D2661 Appendices.

3. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.

4. PVC Pressure Piping: Join schedule number ASTM D1785, PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.

5. PVC Nonpressure Piping: Join according to ASTM D2855.

6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.

1. Plain-End Pipe and Fittings: Use butt fusion.

2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.5 PIPING CONNECTIONS

A. Piping Connections: Except as otherwise indicated, make piping connections as specified below.

1. Install unions in piping 2 inches and smaller adjacent to each valve and at final connection to each piece of equipment having a threaded pipe connection.

2. Install flanges in piping 2-1/2 inches and larger adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.

3. Dry Piping Systems (Gas, Compressed Air, and Vacuum): Install dielectric unions and flanges to connect piping materials of dissimilar metals.

4. Wet Piping Systems (Water and Steam): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

a. Where copper tube is joined to steel pipe, a section of brass pipe or brass valve may be substituted for a dielectric fitting.

3.6 EQUIPMENT INSTALLATION – COMMON REQUIREMENTS

A. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.

B. Install equipment according to submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Owner's Representative.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

E. Install equipment giving right-of-way to piping systems installed at a required slope.

3.7 PAINTING AND FINISHING

A. Refer to Section entitled "Painting" for field painting requirements.

B. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 FABRICATION AND ERECTION OF METAL EQUIPMENT SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical equipment.

B. Field Welding: Comply with AWS D1.1 "Structural Welding Code – Steel."

3.9 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.10 GROUTING

A. Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms for placement of grout, as required.

1. Avoid air entrapment when placing grout.

2. Place grout to completely fill equipment bases.

D. Place grout on concrete bases to provide a smooth bearing surface for equipment.

E. Place grout around anchors.

F. Cure placed grout according to manufacturer's printed instructions.

- END OF SECTION -

SECTION 15060

HANGERS, SUPPORTS AND RESTRAINTS

PART 1 GENERAL

1.1 SUMMARY

A. This section includes hangers, supports, and restraints for mechanical systems including piping, ductwork, and equipment.

1.2 REFERENCES

A. American Society of Mechanical Engineers (ASME):

1. ASME B31.9 - Building Services Piping

2. ASME Boiler and Pressure Vessel Code

B. Manufacturers Standardization Society (MSS):

1. MSS SP-58 Materials and Design of Pipe Supports

2. MSS SP-69 Selection and Application of Pipe Supports

3. MSS SP-89 Fabrication and Installation of Pipe Supports

C. American Society for Testing and Materials (ASTM):

1. ASTM A36 – Specification for Carbon Structural Steel

2. ASTM A167 – Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

3. ASTM A480 – Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

4. ASTM A653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.

5. ASTM A924 – Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot Dip Process.

6. ASTM B209 – Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

7. ASTM C1107 – Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

D. Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA):

1. SMACNA "HVAC Duct Construction Standards."

1.3 SUBMITTALS

A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.

C. Welding Certificates: Copies of certificates for welding procedures and operators.

1.4 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, and seismic restraint by a qualified professional engineer.

1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

PART 2 PRODUCTS

2.1 MANUFACTURERS

1. Grinnell

2. Fee & Mason

3. Crane

4. Products of the Grinnell Company are included in the specifications as a guideline.

2.2 CROSS MEMBERS

A. Structural steel shapes, ASTM A36.

2.3 UPPER HANGER ATTACHMENTS

A. Standard-Duty Beam Clamps (for piping): Malleable iron jaw, steel tie-rod, nuts, and washer. Underwriters Laboratories (UL) listed, Factory Mutual approved. Grinnell figures 218, 225, 226. [1365 lbs max]

B. Heavy-Duty Beam Clamps (for large pipe and equipment): Forged steel, Grinnell figures 292 and 228. [11,500 lbs max]

C. Welded Structural Attachments: Carbon steel, Grinnell figures 55, and 66.

D. Brace Fitting: Malleable iron bracket and pipe end, hex-head cap screw and nut. Grinnell figure 112.

E. Wall Brackets: Factory-fabricated carbon steel bracket with knee brace. Grinnell figures 194, 195, and 199.

F. Concrete Inserts [for new upper deck construction only]:

1. Malleable iron inserts, threaded for rod. Grinnell figure 152.

2. Carbon steel inserts with lateral adjustment capability. Grinnell figures 281, 282, and 285.

G. Concrete Attachments [for existing concrete upper decks]: carbon steel plate with factory-drilled and anchor holes and factory-welded rod attachments. Grinnell figures 47, 49, and 52.

2.4 RODS

A. Rods: Carbon steel, ASTM A36, continuous thread or end thread.

2.5 PIPE SUPPORTS AND RESTRAINTS

A. Adjustable Swivel Ring: 3/4-inch through 8-inch pipe, malleable iron construction, black finish, Underwriters Laboratories (UL) listed, Factory Mutual (FM) approved, MSS SP-69. Grinnell figure 104.

B. Clevis Hanger: Adjustable clevis, wrought carbon steel, Underwriters Laboratories (UL) listed, Factory Mutual (FM) approved, Grinnell figure 260.

C. Roll Hangers: Adjustable steel pipe roll hangers, Grinnell figure 181.

D. Roll Supports: Grinnell figures 171, 175, 177, 271, 274, and 277.

E. Pipe Guides: Unless otherwise indicated, guides shall be carbon steel spider clamp, sized for insulation. Grinnell fig 256 or equal.

F. Insulation Protection Saddle: Carbon steel protection saddle shall prevent crushing of insulation by transmitting hanger contact load to pipe while minimizing heat transfer. Saddle shall be a minimum of 12 inches long and shall cover a 60 degree arc. Grinnell figures 160 through 164.

G. Insulation Protection Shield: Sheetmetal protection shield shall prevent crushing of insulation by spreading hanger contact load while minimizing heat transfer. Shield shall be a minimum of 12 inches long and cover a 180 degree arc. Grinnell figure 167.

H. Riser clamps: carbon steel; black for steel, iron and plastic pipes; copper-plated for copper pipe; Grinnell figures 261 and CT-121.

2.6 DUCTWORK HANGERS

A. Sheetmetal Straps: Straps shall be same material as ductwork.

1. Galvanized steel: ASTM A 527, lock-forming quality; and ASTM A525, coating designation G-90.

2. Aluminum: ASTM B209, alloy MLA with H-14 temper.

3. Stainless steel: ASTM A167, Type 302, 304, or 316; and ASTM A480, finish no. 1 or no. 4.

B. Fasteners:

1. Sheetmetal screws: same material as duct.

2. Bolts and nuts: steel or galvanized steel, hex-head.

C. Fabricate ductwork hangers in accordance with SMACNA “HVAC Duct Construction Standards.”

2.7 FASTENERS

A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

2.8 STRUCTURAL STEEL

A. Structural Steel: ASTM A36, steel plates, shapes, and bars, black and galvanized.

PART 3 EXECUTION

3.1 GENERAL

A. Hang, support, and restrain mechanical work from structural work. Do not hang, support, or restrain mechanical work from electrical work or from other mechanical work. Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Vertical Piping:

1. Support vertical risers of piping systems by means of heavy duty hangers installed close to base of pipe risers, and by riser clamps with extension arms at intermediate floors, with the distance between clamps not to exceed 25 feet (12 feet for hubless cast iron pipe), unless otherwise specified. Support pipe risers in vertical shafts equivalent to the aforementioned. Install riser clamps above floor slabs, with the extension arms resting on floor slabs or pipe sleeves. Provide adequate clearances for risers that are subject to appreciable expansion and contraction caused by operating temperature ranges.

2. Support for extension arms of riser clamps, which are secured to risers to be insulated for cold service, shall be 4 inches above floor slabs, to allow room for insulation and vapor sealing around riser clamps.

C. Use clevis hangers for horizontal runs less than 20 feet long. Use roll hanger and supports for horizontal runs over 20 feet long.

D. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, “Building Services Piping,” is not exceeded.

E. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

c. Do not exceed pipe stress limits according to ASME B31.9.

2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.

3.2 HANGER SCHEDULE

A. Potable Cold Water Piping

1. 1/2 inch to 2 inch - Adjustable ring, wrought carbon steel, black for steel or pipe, copper plated for copper pipe, Grinnell figures 97 and CT-99, or approved equal.

2. 2-1/2 inch to 8 inch - Adjustable clevis, wrought carbon steel, sized for insulation, Grinnell figure 260 or approved equal; with insulation protection shield, galvanized carbon steel, Grinnell figure 167 or approved equal.

B. Potable Hot Water Piping

1. 1/2 inch to 2 inch - Adjustable ring, wrought carbon steel, black for steel or pipe, copper plated for copper pipe, Grinnell figures 97 and CT-99, or approved equal.

C. Sanitary Drainage Piping

1. 3 inch to 12 inch - Adjustable clevis, wrought carbon steel, black, Grinnell figure 260, or approved equal.

D. Storm Drainage

1. 3 inch to 12 inch - Adjustable clevis, wrought carbon steel, black, Grinnell figure 260, or approved equal.

E. Compressed Air Piping

1. 3/4 inch to 2 inch - Adjustable ring, wrought carbon steel, black for steel pipe, copper plated for copper pipe, Grinnell figures 97 and CT-99, or approved equal.

2. 2 inch to 6 inch - Adjustable clevis, wrought carbon steel, black for steel pipe, copper-plated for copper pipe, Grinnell figures 260 and CT-65, or approved equal. Where installed on pipe rack, provide roller chain, Grinnell figure 175 or approved equal.

F. Sludge and other wastewater process streams.

1. 3/4 inch to 2 inch – Adjustable ring, wrought carbon steel, black, Grinnell figure 97 or approved equal.

2. 2 inch to 6 inch – Adjustable clevis, wrought carbon steel, black, Grinnell figure 260 or approved equal.

G. Process Liquids

1. 3/4 inch to 2 inch – Adjustable ring, wrought carbon steel, black, Grinnell figures 97 or approved equal.

2. 2 inch to 6 inch – Adjustable clevis, wrought carbon steel, black, Grinnell figures 260, or approved equal.

H. Hydraulic Piping

1. 3/4 inch to 2 inch – Adjustable ring, wrought carbon steel, black, Grinnell figures 97 or approved equal.

2. 2 inch to 6 inch – Adjustable clevis, wrought carbon steel, black, Grinnell figures 260, or approved equal.

I. Process Drains

1. 3/4 inch to 2 inch – Adjustable ring, wrought carbon steel, black, Grinnell figures 97 or approved equal.

2. 2 inch to 6 inch – Adjustable clevis, wrought carbon steel, black, Grinnell figures 260, or approved equal.

3.3 PIPE HANGER SPACING

A. Space hangers or supports for horizontal piping on maximum center distances as listed in the following hanger schedules, except as otherwise specified, or noted on the Drawings.

B. Spacings do not apply where concentrated loads are placed between supports. Concentrated loads include flanges, valves, and specialties.

C. For steel pipe carrying water or liquid with specific gravity less than or equal to 1.0, at pressures from 0 to 125 psig and temperatures from 0 to 250 deg F:

Pipe Size	Spacing
1/2 inch	7 feet
3/4 inch	7 feet
1 inch	7 feet
1-1/2 inch	9 feet
2 inch	10 feet
2-1/2 inch	11 feet
3 inch	12 feet
4 inch	14 feet
6 inch	17 feet
8 inch	19 feet
10 inch	20 feet
12 inch	23 feet
16 inch	27 feet
20 inch	30 feet
24 inch	32 feet

D. For steel pipe carrying air, gas (except fuel gas), or steam at pressures up to 125 psig:

Pipe Size	Spacing
1/2 inch	9 feet
3/4 inch	9 feet
1 inch	9 feet
1-1/2 inch	12 feet
2 inch	13 feet
2-1/2 inch	14 feet
3 inch	15 feet
4 inch	17 feet
6 inch	21 feet

8 inch	24 feet
10 inch	26 feet
12 inch	30 feet
16 inch	35 feet
20 inch	39 feet
24 inch	42 feet

E. For copper pipe and copper tubing carrying liquid with specific gravity of 1.0 or less:

Pipe Size	Spacing
1/2 inch	5 feet
3/4 inch	5 feet
1 inch	6 feet
1-1/2 inch	8 feet
2 inch	8 feet
2-1/2 inch	9 feet
3 inch	10 feet
4 inch	12 feet

F. For PVC pipe operating at 70 deg F maximum:

Pipe Size	Spacing
less than 3 inch	continuous
3 inch	5 feet
4 inch	6 feet
6 inch and up	7 feet

G. PVC pipe operating above 70 deg F shall have continuous support.

H. For Cast Iron Soil Pipe: Space hangers or support pipe at each joint or on maximum centers of 5 feet. Support pipe in continuous 10 foot lengths or longer, on maximum centers of 10 feet. Place hangers or supports as close as possible to joints and when hangers or supports do not come within 1 foot of a branch line fitting, install an additional hanger or support at the fitting.

I. For Hubless Cast Iron Pipe: Space hangers or supports at every other joint, except when the horizontal distance between hangers exceeds 4 feet, hangers or supports shall be provided at each joint. Place hanger or supports as close as possible to joints and when hangers or supports do not come within 1 foot of a branch line fitting, install an additional hanger or support at the fitting. Where piping is suspended on centers in excess of 18 inches by means of non-rigid hangers, provide sway bracing to prevent horizontal pipe movement. Submit details of sway braces.

J. For Directional Changes: Install a hanger or support close to the point of change of direction of all pipe runs in either a horizontal or vertical plane.

K. For Concentrated Loads: Install additional hangers or sup-ports, spaced as required and directed, at locations where concentrated loads such as in-line pumps, valves, fittings or accessories occur, to support the concentrated loads.

L. For Branch Piping Runs and Runouts over 5 feet in Length: Install a minimum of one hanger, and additional hangers if required by the hanger spacing schedules.

M. Parallel Piping Runs: Where several pipe lines run parallel in the same place and in close proximity to each other, trapeze hangers may be submitted for approval. Base hanger spacing for trapeze type hangers on the smallest size of pipe being supported. Design the entire hanger assembly based on a safety factor of five, for the ultimate strength of the material being used.

N. Support floor drain traps from the overhead construction, with hangers of type and design as required. Over-head supports are not required for floor drain traps in-stalled directly below earth supported concrete floors.

3.4 ANCHORS, RESTRAINTS, RIGID SUPPORTS, STAYS AND SWAY BRACES

A. Install pipe anchors, restraints and sway braces, at locations noted on the Drawings. Design anchors so as to permit piping to expand and contract freely in opposite directions, away from anchor points. Install anchors independent of all hangers and supports, and in a manner, which will not affect the structural integrity of the building.

B. In grooved-end piping systems, install restraints, anchors, and rigid supports as recommended by the manufacturer of the grooved end fittings to ensure proper support and alignment of the piping under operating and testing pressures (maximum hanger or support spacing shall be as previously specified).

1. Horizontal piping shall maintain a constant pitch without sags, humps, or lateral deflections.

2. Branch piping shall remain perpendicular to main piping and/or risers.

3. Vertical piping shall remain plumb without deflections.

4. Vertical piping shall be rigidly supported, or anchored at both top and bottom and wherever necessary to prevent movement and/or shearing forces at branch connections.

C. In hubless cast iron piping systems, where piping is suspended on centers in excess of 18 inches by means of non-rigid hangers, provide sway braces, in number and location as required to prevent horizontal pipe movement.

3.5 EQUIPMENT HANGERS

A. Provide vibration isolating hangers for equipment with motors.

B. Support air terminal units independent of ductwork.

C. Support slot diffusers independent of suspended ceiling grid.

3.6 RODS

A. Pipe and duct hanger rods shall be full size to match hangers.

B. Trapeze and equipment hanger rods shall be sized for maximum load with a safety factor of five.

C. Provide two nuts at each end of rods for positioning rod and hanger and locking each in place.

3.7 UPPER HANGER ATTACHMENTS

A. General

1. Upper hanger attachments shall be made to structural steel wherever possible.

2. Powder-driven drive pins shall not be used.

3. Expansion nails shall not be used.

4. Powder-driven fasteners shall not be used in precast concrete.

5. Loads in excess of 250 pounds shall not be supported from a single welded or powder-driven stud.

B. Steel Frame Construction

1. Provide intermediate structural steel members where required by ductwork support spacing. Select members based on a minimum safety factor of five.

2. Secure upper hanger attachments to steel bar joists within 6 inches of panel points, or provide intermediate strut to transfer load to top chord of joist.

3. Holes shall not be drilled in structural steel members.

4. Friction clamps shall not be used.

-- END OF SECTION --

SECTION 15120

FLEXIBLE PIPE COUPLINGS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes requirements for providing flexible pipe couplings as indicated in accordance with the Contract Documents.

1.2 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:

1. American National Standards Institute (ANSI)

   a. B16.1 – Cast Iron Pipe Fittings and Flanged Fittings, Class 25, 125, 250 and 800
   b. B16.5 – Pipe Flanges and Flanged Fittings

2. American Society for Testing and Materials (ASTM)

   a. D395 – Test Methods for Rubber Properties – Compression Set

1.2 SUBMITTALS

A. Provide submittals in accordance with the General Provisions, including the following items:

1. Drawings and manufacturer's data showing details of materials and construction.

1.3 DELIVERY, STORAGE AND HANDLING

A. Materials and equipment shall be boxed, crated or otherwise completely enclosed and protected during shipment, handling, and storage. Such boxes, crates or protection shall be clearly labeled with manufacturer's name, brand or model designation, type or grade and color.

B. Protect materials and equipment from exposure to the elements and keep dry at all times. Handle and store to prevent damage in accordance with manufacturer's recommendations.

C. Material and equipment damaged by handling and storage shall be repaired or replaced by the Contractor as directed by the Engineer.

PART 2 PRODUCTS

2.1 GENERAL

A. Flexible couplings or expansion joints shall be provided for piping systems and at connections to equipment where shown.

B. The Contractor may install additional pipe anchors and flexible couplings to facilitate piping installation, provided that he submits complete details describing location, pipe supports, and hydraulic thrust protection.

C. Flexible pipe couplings shall be designed to withstand the test pressure specified for the pipeline in which they are to be installed.

D. Coupling joints shall be as required to conform to the type of pipe joints at the point of installation, unless otherwise indicated.

2.2 FLANGED ADAPTERS

A. Flanged adapters shall be assembled units of the wedge-gasketed, flared-sleeve type. Each adapter shall consist of a flanged body with a follower, wedge gasket, flange gasket and sufficient number of steel bolts to compress the wedge gasket.

B. The flange body shall be cast iron with one end properly formed to receive wedge gasket. The flange end of the adapter shall be in accordance with ANSI B16.1, Class 125 lb. cast iron flanges and/or B16.5, Class 150 lb. steel flanges, and shall be equipped with a modified "O" ring gasket.

C. The follower shall be fabricated of cast iron.

D. Wedge gaskets shall be made to the following specifications:

Durometer	75 $\pm$ 5
Compression Set	4% Maximum 30 minutes 3% Maximum 3 Hours

Compression set shall be determined upon 3/4" diameter x 1/2" thick discs cut from 3" diameter plaques and subjected to 600 psi for 48 hours at room temperature. In other respects, the procedure shall conform to the requirements of ASTM D395 Method A, using the external loading device. Gaskets shall be of a type of rubber.

E. The bolts shall be elliptical-neck, track-head design with rolled threads. The elliptical-neck shall correspond to the elliptical hole in the flange body to prevent bolt from turning.

F. Flanged adapters shall be as manufactured by Dresser Industries, Smith-Blair, Inc., or equal.

2.3 SOLID SLEEVE TYPE COUPLINGS

A. Solids sleeve type couplings shall be designed to fit the outside diameter of the pipes they connect.

B. Sleeves for use in the ground shall be cast construction or epoxy coated steel.

C. Sleeves for use exposed or submerged shall be steel or epoxy coated steel.

D. Gaskets shall be natural or synthetic rubber of a grade suitable for the intended service.

E. Unless otherwise specified or shown the middle ring shall be furnished without a pipe stop and shall have the following minimum dimensions:

Pipe Diameter	Thickness	Length
Less than 6 inch	--	5 inches
6 inch	1/4 inch	5 inches
8 inch - 14 inch	5/16 inch	7 inches
16 inch - 24 inch	3/8 inch	7 inches
30 inch and larger	1/2 inch	10 inches

G. Bolts and nuts shall be galvanized or cadmium plated for non-submerged service and shall be stainless steel for submerged service.

H. Solid sleeve type couplings shall be as manufactured by Dresser Industries, Smith-Blair, Inc., or equal.

2.4 RUBBER EXPANSION COUPLINGS

A. General

1. Rubber expansion couplings shall be standard spool type.

2. The tube shall be of a single piece construction and extend to the outside edges of the flanges.

3. The flexible pipe coupling shall have ANSI 125-pound flanges.

4. The exterior surface shall be oil resistant.

5. The split retainer rings shall be galvanized steel.

B. Low Pressure Process Air Piping Service

1. Rubber expansion couplings for all low pressure process air piping shall be of the double bellow type, unless otherwise noted.

2. Axial compression capacity shall be minimum 1.75 inches, and axial extension capacity shall be minimum 1.80 inches.

3. All low pressure process air piping rubber expansion couplings shall be capable of withstanding a pressure of 15 psig at a temperature of 250°F.

C. Sewage Piping Service

1. Rubber expansion couplings for all sewage piping shall be of the single bellow type with control rods, unless otherwise noted.

2. Axial compression capacity shall be minimum 0.80 inches, and axial extension capacity shall be minimum 0.40 inches.

E. Rubber expansion couplings shall be as manufactured by General Rubber Corp., Mercer Rubber Co., or equal.

2.5 FLEXIBLE METAL HOSE COUPLINGS

A. Flexible metal hose couplings in pressure piping to compressors, engines and similar applications shall be seamless corrugated tubing covered with high tensile wire braid.

B. Couplings shall be bronze unless otherwise indicated.

C. Flexible metal hose couplings for engine exhaust and other non-pressure piping shall be strip wound galvanized steel unless otherwise indicated.

2.6 EXPANSION COUPLINGS

A. Expansion couplings shall be the internally guided sleeve type.

B. Packing shall be suitable for the intended service.

2.7 HARNESS RODS

A. Thrust harness rods shall be provided for flexible couplings on all pressurized piping.

B. Tie rods and harness ears shall be as shown on the Contract Drawings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Prior to installation of couplings, thoroughly clean oil, scale, rust, and dirt from the pipe to provide a clean seat for the gasket. Care shall be taken that the gaskets are wiped clean before they are installed. If necessary, flexible couplings and gaskets may be lubricated with soapy water or manufacturer's standard lubricant before installation of the pipe ends.

B. Install in accordance with the manufacturer's recommendations.

C. Bolts and harness rods shall be tightened gradually and equally in stages to prevent uneven alignment and to allow uniform distribution of stress under pressure. Tightening shall be performed by workmen using torque-limiting wrenches.

D. Couplings shall not be used to support the weight of adjoining pipe or fittings.

E. When installed for underground or underwater service the coupling and associated harness rods shall be painted, after being installed, with two coats of tar pitch preservative coating unless otherwise shown.

-- END OF SECTION --

SECTION 15130

PRESSURE GAUGES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes direct reading, Bourdon tube pressure gauges for liquid (including wastewater), compressed air or gas service, as shown on the Contract Documents or as specified, complete with accessories.

1.02 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:

1. American Society of Mechanical Engineers (ASME)

a. ASME B40.1, Gauges – Pressure Indicating Dial Type Elastic Element

1.03 SUBMITTALS

A. Provide submittals in accordance with the General Provisions, including the following items:

1. Shop drawings, including manufacturer's details and materials of construction in compliance with this Specification.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The following manufacturers are named to establish a standard of quality necessary for the Project:

2. Ashcroft

3. Ametek/US Gauge

4. Or equal

2.02 GENERAL

A. Gauges shall conform to ASME B40.1.

B. Gauge range shall be approximately twice operating pressure, unless otherwise scheduled or specified.

C. Gauges shall be furnished with shutoff cocks, diaphragm seals and pulsation dampeners, unless otherwise specified.

D. Gauges of like type shall be the product of one manufacturer.

E. Gauges shall be 4 ½-inches unless otherwise shown. Minimum gauge size shall be 2 ½-inch diameter.

F. Provide 4 ½-inch pressure gauges with graduations as scheduled below (expressed in pounds per square inch gauge pressure).

Vacuum Pressure Gauges (ft. H_2O)

Maximum Indications	Figure Intervals	Intermediate Graduations	Minor Graduations
34	5	1	0.5

Pressure Gauges (psi)

Maximum Indications	Figure Intervals	Intermediate Graduations	Minor Graduations
15	1	0.5	0.1
30	5	1	0.2
60	5	1	0.5
100	10	5	1
160	20	5	1
200	20	10	2
300	30	10	2

G. High Temperature Applications

Gauge service shall be considered a high temperature application where the upper limit of the process fluid temperature range may be between 150 to 250°F in an ambient temperature of 110°F. Gauges for high temperature applications shall be fabricated and fitted with materials suited for intended application. Contractor shall coordinate suitability of gauge materials for high temperature application with manufacturer. Shop drawings shall include clear indication of suitability of gauge materials for high temperature application.

2.03 MATERIALS

A. Bourdon-Tube Gauges

1. Cases

   a. Cases shall be solid-front, blowout-back safety type, fabricated of aluminum, stainless steel or phenalic. Finish shall be black except for stainless steel.
   b. Dial covers shall be heavy plastic, acrylic or polycarbonate, unless otherwise specified.
   c. Gauges to be wall or flush mounted shall be provided with flanged case suitable for mounting configuration.
   d. Provide glycerin or silicone filled case where gauge suitable for severe vibration service is required.

2. Bourdon Tubes

   a. Bronze unless otherwise specified.

3. Accuracy

   a. Pressure gauges shall be rated for a minimum accuracy of ±0.5 percent of full span (ASME B40.1 Grade 2A), unless otherwise specified.

b. Vacuum and combination gauges shall be rated for a minimum accuracy of ±2/1/2 percent of span (ASME B40.1 Grade A), unless otherwise specified.
c. Gauges for high temperature applications shall be rated for a minimum accuracy of ±3/2/3 percent of span (ASME B40.1 Grade B).

4. Movements

a. Movements shall be brass or stainless steel.
b. Movements shall be adjustable for recalibration.

B. Shutoff Cocks

1. Shutoff cocks shall be provided for each gauge whether shown or not on the Contract Drawings.

2. Shutoff cocks shall be constructed of brass or Type 316 stainless steel.

C. Pulsation Dampeners

1. Brass or stainless steel construction.

2. Adjustable by pin size or pin location.

D. Diaphragm Seals

1. Stainless steel housing.

2. Type 316 stainless steel diaphragm.

3. Liquid filled gauges shall be factory assembled.

PART 3 EXECUTION

3.01 GENERAL

A. Gauges 4 ½-inch or larger, where not panel or wall mounted, shall be supported by suitable brackets.

B. Provide dielectric insulation where connection is made between corrosion causing dissimilar metals.

C. Gauges shall be protected until acceptance.

3.02 FIELD TESTING

A. Test each gauge for proper function prior to or during testing of system served.

B. Malfunctioning gauges shall be replaced prior to conclusion of system testing, at no additional cost to the Owner.

-- END OF SECTION --

DIVISION 16

ELECTRICAL

KENTUCKY ENGINEERING GROUP, PLLC

SECTION 16010

ELECTRICAL – GENERAL

PART 1 - GENERAL

1.1 SUMMARY

A. Provide complete, tested and fully functional electrical systems as shown on the Drawings and as specified herein.

B. Electrical equipment and installed systems shall be suitable for the intended application, shall be safe for the intended use, shall be rated for the available fault current, and shall conform to local building codes and statutory requirements.

1.2 RELATED DOCUMENTS

A. Electrical requirements specified in this Section apply to all electrical equipment and materials described in other Sections of Division 16.

1.3 SCOPE OF WORK

A. The work includes, but is not limited to, the following:

1. Secondary electrical service
2. Grounding and bonding
3. Electrical identification
4. Wire and cable
5. Raceways, boxes, and fittings
6. Transient voltage surge suppressors
7. Enclosed switches and circuit breakers
8. Panelboards
9. Dry type transformers (600V and less)
10. Interior lighting
11. Exterior lighting
12. Field wiring for equipment provided under other Sections of the Specification
13. Thorough cleaning of all equipment prior to energization
14. Protection of all equipment under this Division until the final acceptance of the job

B. Coordinate Division 16 requirements with work in other Divisions.

C. Submit preconstruction submittals, shop drawings, product data, samples, design data, test reports, certificates, manufacturer's instructions, manufacturer's field reports, operation and maintenance data, closeout submittals and other specified documents to the Engineer for review and approval as described in the Special Provisions, in this Section, and in other Sections of Division 16.

D. Perform Electrical Acceptance Testing as described in other Division 16 Sections.

1.4 PROJECT CONDITIONS

A. Ambient temperature, humidity, and elevation ranges: Equipment other than transformers shall be rated for continuous operation at full rated load without derating, under the following conditions:

1. Ambient Temperature: 0 to 40 deg C.
2. Humidity: Less than 90 percent (non-condensing).
3. Altitude: Not exceeding 3300 feet (1000 m).

B. Transformer output ratings shall be as specified in Division 16 Section "Dry Type Transformers (600V and Less)".

C. Product Selection for Restricted Space: Drawings show allowable space to scale for anticipated equipment sizes. Comply with NEC requirements for working clearances and with manufacturer's recommendations for access for maintenance. Notify the Engineer if insufficient space is available for available products.

1.5 DEFINITIONS

A. The following definitions apply to work specified in Division 16:

1. AHJ: The statutory Authority Having Jurisdiction as defined in NEC Article 100 for enforcement of legally required compliance to local codes, standards, and ordinances.
2. ANSI: American National Standards Institute
3. AEIC: Association of Edison Illuminating Companies
4. ASQ: American Society for Quality
5. AWG: American Wire Gauge
6. CFR: Code of Federal Regulations
7. Cable: an assembly of insulated conductors
8. Control panel: an electrical enclosure housing control logic devices and an operator control interface
9. Commissioning: the process of testing system performance after the sequential steps of installation, testing, energization, startup (including initial adjustment and debugging) and functional testing of individual pieces of equipment have all been completed
10. Contract: as used in the Electrical Specification, includes all Contract documents including Specifications and Appendices, Drawings, Addenda, and Change Orders
11. ICEA: Insulated Cable Engineers Association
12. Equipment: a general term including materials, fittings, devices, appliances, fixtures, apparatus, and the like, used as part of, or in connection with, an electrical installation (OSHA Section 29 CFR 1910.399(46) definition)
13. FM: Factory Mutual, Inc.
14. Field wiring: on-site installation of raceways & conductors to connect equipment in accordance with approved drawings
15. Field test: electrical test carried out on-site
16. Fail-safe: selection of control devices and contacts in a manner, which results in safe shutdown of the equipment whenever one of the following events occurs:
    a. Loss of remote control RUN command (normal configuration: contacts close to run equipment)
    b. Intentional and unintentional disconnection of device (normal configuration: contacts open to shut down equipment)

c. High contact resistance or high resistance connection
d. Loss of 4-20mADC signal
e. Definite-time sequence takes too long, e.g., reduced voltage motor starter fails to make transition from START mode to RUN mode after a reasonable time
f. Defined sequence does not occur, e.g., there is no flow from a motor driven pump within a reasonable time after the motor starter contactor is energized.

17. Furnish and install: same as "Provide" below.
18. Functional testing: verification of the satisfactory performance of control logic, with due attention to equipment protective devices, for example, overload relays, temperature switches, pressure switches, flow switches, and similar devices, under actual operating conditions
19. HV: high voltage, operating voltage over 600V (NEC definition)
20. IEEE: Institute of Electrical and Electronics Engineers, Inc.
21. ISO: International Standards Organization
22. Lineup: with respect to switchgear, switchboards, and motor control centers, a contiguous group of vertical sections with common main busbars, and including bus tie breaker sections and control sections
23. LV: low voltage, operating voltage under 600V (NEC definition)
24. Megger: insulation tester with megohm scale
25. NEC: NFPA 70, the National Electrical Code
26. NETA: InterNational Electrical Testing Association, Inc.
27. NICET: National Institute for Certification in Engineering Technologies
28. NFPA: National Fire Protection Association
29. NRTL: Nationally recognized testing laboratory as defined in 29 CFR 1910.7 as it applies to testing and inspecting for safety in the workplace (OSHA definition)
30. Nonconformity: The nonfulfillment of a specified requirement (ASQ definition)
31. "Or approved equal": proposed "equal" product shall be in conformance with all specified requirements, shall be equivalent in materials of construction to specified manufacturers' products, shall have equal or superior performance in the conditions anticipated for use of the product in this project, and shall be approved by the Engineer
32. OSHA: Occupational Safety and Health Act
33. Panel: with respect to circuit breaker and fuse power distribution centers, panel is equivalent to "panelboard", e.g., lighting panel; with respect to control panels, refers either to the entire control panel itself or to a steel plate used for mounting devices inside the control panel
34. Provide: Throughout the Specification, use of this term includes project administration, quality assurance, human resources, tools & equipment, logistics and scheduling, submittals of shop drawings & samples for approval, managing suppliers, purchasing, manufacturing, factory testing, release for shipment, packing, delivery, storage, submittal of coordinated & dimensioned installation drawings for approval, installation, surface preparation & finishes, site testing, startup & commissioning, onsite supervision by equipment manufacturers' representatives, spare parts & tools, Operations and Maintenance (O&M) Manuals, training, guarantees and warrantees, other work described in individual Sections of the Specification, and the Contractor's duties, responsibilities, risks, and liabilities under the Contract.
35. Punch list: document containing detailed descriptions of non-conformities
36. Quality: conformance to specified requirements.
37. RMS: root mean square
38. Raceways: cable ladder and tray, conduit, duct, wireway, and associated boxes and fittings, which enclose, support, and protect wires and cables
39. Shop drawings: a complete package of manufacturer's equipment drawings, bill of materials, catalog data sheets, performance curves, calculations, and other data pro-

vided to demonstrate conformance to the equipment specification

40. Substitution: an alternative, nonconforming product proposed by the Contractor in lieu of a specified, conforming product
41. Substantial Completion: an electrical system may be considered substantially complete when the equipment has passed the specified tests required prior to energization, has been energized, has passed the Electrical Acceptance Tests, and all related Specification requirements have been met except for well-defined minor items which, in the opinion of the Engineer, may be repaired or replaced prior to Final Acceptance without adversely affecting process performance.
42. Terminal box: an electrical enclosure containing labeled terminal blocks for connection of wiring
43. UL: Underwriters Laboratories, Inc.
44. VFC: variable frequency controller
45. VFD: variable frequency drive, the combination of VFC and inverter-duty motor that drive mechanical loads using the principle of variable frequency motor control
46. Wiring: conductors and connections to equipment terminals. 'Wiring' and 'cabling' shall be considered equivalent terms. Fiber optic cables shall be included in the scope of electrical wiring.

1.6 REFERENCE STANDARDS

A. Notwithstanding revision dates shown in this and other Sections of Division 16, the codes and standards applicable to this project shall be those in effect at the time of bid opening, except for NFPA 70 (NEC), which shall be the version acceptable to the AHJ.

1.7 QUALITY ASSURANCE

A. In consultation with the equipment and materials Suppliers, the Contractor shall prepare and submit a Compliance Statement as described in "SUBMITTALS" below with each submittal requiring approval.

B. The Engineer's approval of a submittal shall not relieve the Contractor of any Contractor responsibilities under the Contract. Approval of a submittal that is incomplete, or one that has nonconformities that are not described in the Compliance Statement that is specified to be included with each submittal, followed by the discovery of unapproved nonconformities, will result in replacement of the non-conforming items at no additional cost to the Owner. Substitutions require the approval of the Engineer.

C. Manufacturers of electrical equipment shall have quality certification to ISO 9000:2000 or an equivalent Quality Management System acceptable to the Engineer.

D. Equipment, materials, and installation shall conform to NEC requirements and shall be NRTL-listed and labeled under the relevant UL standard.

E. On-site testing prior to energization and electrical acceptance testing shall be performed as specified in other Sections.

F. Manufacturers, manufacturer's representatives, subcontractors, supervisors, installers, and testing agencies shall have qualifications and experience as described in other Sections of the Specification. Qualifications and experience submittals for firms and individuals shall be submitted, re-submitted, or updated whenever requested by the Owner's Representative.

1.8 SAFETY IN THE WORKPLACE

A. Electrical equipment and materials, and the Contractor's installation practices, shall conform to the following:

1. Current edition of OSHA sections of the Code of Federal Regulations (CFR): Part 29 CFR 1910 for General Industry and Part 19 CFR 1926 for Construction Activities
2. NFPA 70, the National Electrical Code
3. Current edition of NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces

B. These regulations and standards impose obligations on equipment manufacturers to obtain NRTL certification, listing, and labeling to comply with OSHA (Occupational Safety and Health Act) and Department of Labor regulations.

C. All electrical equipment for which NRTL test procedures have been established shall be certified, listed, and labeled, or otherwise determined to be safe for its intended use, by a NRTL. The absence of a specific reference to NRTL-listing in other Sections shall not relieve the Contractor of the requirement to provide NRTL-listed equipment, and to obtain certification as required by the AHJ in cases where NRTL listing and labeling is not a manufacturer's standard offering for a particular product.

D. Equipment shall not be modified in any manner adversely affecting safety for the intended use, nor shall any equipment be modified on-site without the approval of the manufacturer.

E. Equipment sound levels shall not exceed limits established by reference standards and local regulations. In the absence of reference standards and local regulatory requirements, sound pressure levels shall not exceed 85-dB (A) measured three feet from the equipment.

F. Equipment with moving parts shall be fully guarded in compliance with OSHA rules and regulations.

1.9 INSPECTIONS BY THE AHJ

A. The Contractor shall make arrangements for electrical inspection of the project by the AHJ. Upon completion of the work, final certificate of approval documents shall be submitted to the Engineer for forwarding to the Owner. This certificate shall be submitted prior to request for final payment. The Contractor shall pay all fees required for inspection.

1.10 WORKMANSHIP AND MATERIALS

A. Materials and equipment shall be new and undamaged, shall be marked by the manufacturer, and shall be delivered to the construction site in the original factory packaging.

B. Materials and equipment shall be installed in accordance with the Drawings, the Specification, and the manufacturer's installation, operation, and maintenance instructions. In the event of apparent conflicts or discrepancies, the Engineer shall be informed of the apparent conflict or discrepancy in writing, and will instruct the Contractor how to proceed.

1.11 CONTRACT DRAWINGS

A. The Electrical Drawings provide scaled layouts of representative equipment and key building dimensions, for example, structural gridlines, but do not include "approved for construction" dimensions for equipment.

1.12 COORDINATION OF WORK

A. Work under this Division shall be performed in conjunction with the work of other trades. Coordinate electrical installation work with the overall construction schedule. Examine the plans and specifications prior to commencement of work and become familiar with all phases of work involved prior to commencing installation work.

B. The Contractor shall be responsible for coordinating dimensions of equipment and working clearances in accordance with NEC, and in all cases bring to the attention of the Engineer any discrepancies on the plans and in the specifications prior to installation. Any work that installed without proper coordination shall be removed and reinstalled at the Contractor's expense. The layout for sleeves chases, openings, etc., must be arranged prior to construction in order to prevent unnecessary cutting. Examine Architectural drawings for doors swings, countertop heights, built-in furniture and casework, and other factors affecting electrical outlet locations prior to roughing-in raceways, boxes, fittings, and outlets.

C. Control and signal wiring requirements shall be coordinated with Division 17.

1.13 CODES AND STANDARDS

A. All equipment and materials shall be manufactured, tested, and installed in accordance with the National Electrical Code (NEC) and all applicable portions of local codes, in accordance with the requirements of the AHJ.

B. In addition, work shall be in accordance with the versions of the following referenced standards in effect at the time of bid opening:

1. American Association for Laboratory Accreditation (A2LA)
2. American Society for Testing and Materials (ASTM)
3. American National Standards Institute (ANSI)
4. Americans with Disabilities Act (ADA)
5. Code of Federal Regulations (29 CFR 1903, 1910, and 1926)
6. Factory Mutual Engineering & Research (FME&R)
7. Illuminating Engineering Society of North America (IESNA)
8. Insulated Cable Engineers Association (ICEA)
9. International Organization for Standardization (ISO)
10. National Electrical Manufacturers Associates (NEMA)
11. Institute of Electrical and Electronic Engineers (IEEE)
12. National Fire Protection Association (NFPA)
13. Occupational Safety and Health Act (OSHA)
14. Underwriters Laboratory, Inc. (UL) and other NRTL standards and test procedures

1.14 HAZARDOUS AREAS

A. Electrical equipment for use in hazardous areas shall be NRTL listed and labeled for the ap-

plication. Equipment and installation shall be in accordance with NEC requirements for the hazardous area classification indicated on the Drawings.

1.15 SUBMITTALS

A. Submittals shall conform to the General Provisions and Special Provisions.

B. Compliance Statement: with each submittal, include a Compliance Statement listing each Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-paragraph, compliance with the Specification, each minor nonconformity that is within the intent of the Specification, and proposed nonconformities. Provide short description of minor nonconformities, and detailed explanation of other nonconformities.

C. Record Drawings: Maintain a full size paper set of “black-line” working drawings throughout the project, and shall carefully record in red ink the actual locations including dimensions to locate each piece of electrical equipment, raceways, boxes, & fittings, and electrical outlets. Upon Substantial Completion of the work, deliver the marked-up set of prints to the Engineer. The Engineer reserves the right to withhold final payment until "As-Built" drawings are received.

D. Operation and Maintenance Manuals: Prior to acceptance of the finished project, provide copies of electrical Operation and Maintenance Manuals in conformance with the Special Provisions. O&M Manuals shall be organized according to Division 16 Section numbers. Each copy shall be bound in a durable, 3-ring hardback binder, with data sheets individually punched and reinforced to prevent tearout. Data sheets shall be grouped, and binder dividers shall be provided to match the Table of Contents. Each Manual shall have an identifying label on the spine and front cover and shall include the following:

E. Spare Parts and Special Tools List: 90 days prior to the scheduled Substantial Completion date, submit a complete list of Spare Parts and Special Tools included in other Sections of Division 16 to the Owner, and request a time and location for delivery of the Spare Parts and Special Tools to the Owner.

1.16 OUTAGES

A. Electrical outages: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service if required by the Specification.

1. Notify the Owner a minimum of 30 days in advance of proposed interruption of electrical service.

2. Submit step-by-step sequence and schedule for proposed interruption, and if required, proposed method of providing temporary electrical service, to the Owner for approval.

3. Confirm approved interruption of electrical service one week in advance of Owner-approved date.

4. Do not proceed with interruption of electrical service without written permission from the Owner.

1.17 TEMPORARY LIGHTING AND POWER

A. Conform to the General Provisions.

B. Provide all temporary electric service for power and lighting including panels, feeders, lighting, outlets, branch circuits, etc.

C. The Owner's electrical power shall not be used without permission.

D. All temporary work shall be in accordance with the NEC, OSHA, and NFPA safety requirements and shall be completely removed upon completion of the project.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Provide equipment and materials in compliance with other Sections of Division 16. The requirements in this Section apply to all Sections in Division 16.

2.2 ELECTRICAL IDENTIFICATION

A. Electrical equipment, raceways, boxes, wires and cables shall be marked in the field in accordance with Division 16 Section "Electrical Identification"

2.3 ELECTRICAL ENCLOSURES

A. In the absence of other specified NEMA enclosure ratings in other Sections of the Specification, and where cross-referenced in other Sections of the Specification, electrical enclosures shall have degree of protection ratings suitable for the intended application (e.g., watertight, dust-tight, explosion-proof) and environmental conditions. Electrical equipment enclosures shall have the following NEMA 250 ratings and materials of construction:

1. NEMA 1 or 1A: Enclosures located in clean, dry, indoor Control Rooms and Electrical Rooms shall be NEMA 1 painted steel, except that motor control centers in dedicated electrical rooms shall have foam gaskets on covers and doors (NEMA 1A) to reduce dust intrusion.

2. NEMA 4X:

    a. Outdoor enclosures containing electrical equipment: NEMA 4X stainless steel.
    b. Outdoor pull and terminal boxes: NEMA 4X stainless steel.
    c. Indoor enclosures in process areas that are not in Hazardous (Classified) locations.

3. NEMA 4X: Outdoor enclosures containing heat producing electrical equipment such as VFC's shall be provided with individual side mounted air conditioner units and shielded to maintain the NEMA 4X rating.

4. Enclosures located in hazardous areas shall be epoxy powder-coated cast aluminum NEMA 7 and/or 9 with NRTL listing for the hazardous area classification. Outdoor explosion-proof enclosures shall also be rated NEMA 4.

5. Where different enclosure ratings and enclosure materials are specified in other Sections of the Specification, the Contractor shall submit a written request for clarification of the intent of the Specification to the Engineer.

6. For outlet box and junction box requirements, refer to Division 16 Section "Raceways, Boxes, and Fittings".

2.4 ELECTROMAGNETIC INTERFERENCE

A. Power conversion equipment, including variable frequency controllers, battery-powered inverters, computer power supplies, frequency converters, and Uninterruptible Power Supplies, shall be fitted with EMI (electromagnetic interference), RFI (radio frequency interference) and telephone interference filters to limit interference effects on other equipment in the area in accordance with IEEE standards and recommendations applicable to the equipment.

2.5 DISSIMILAR METALS

A. Dissimilar metals shall not be connected, spliced, or joined except where specifically approved in writing by the Engineer. Copper busbars, aluminum busbars, and copper-to-aluminum busbar connections shall be tin-plated at joints and at cable lugs. Bolted electrical conductor connections shall be made with silicone-bronze bolts, nuts, and washers. Belleville washers & tin-plated flat washers shall be used at aluminum-to-copper and aluminum-to-aluminum busbar joints.

2.6 WARRANTIES

A. Warranties for equipment and materials shall conform to the General Provisions.

B. Provide an on-site parts and labor warranty for a minimum period of one year after Substantial Completion for all equipment and materials. In cases where the manufacturer offers a longer warranty period, the longer warranty period shall apply as described by the manufacturer.

C. All components of electrical systems that are not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage of fully operational equipment unless otherwise approved by the Owner's Representative.

PART 3 - EXECUTION

3.1 DELIVERY AND HANDLING

A. Equipment delivered to site shall be handled in accordance with manufacturer's recommendations by experienced riggers, crane operators, and fork lift truck operators.

3.2 STORAGE AND PROTECTION OF EQUIPMENT

A. All electrical equipment to be used in construction shall be properly stored and protected against the elements. General construction materials shall be stored in covered trailers. Switchgear, unit substations, motor controllers, panelboards, emergency lighting, solid state equipment, engine generator shall be stored in a clean, dry, indoor location, under cover, un-

til the building is weathertight and the area where the equipment is to be installed has been completed to the satisfaction of the Engineer, including completion of overhead work by other trades.

3.3 INSPECTIONS PRIOR TO COVERING-UP

A. Raceways embedded in concrete or otherwise concealed shall be inspected in the presence of the Engineer's Representative prior to placement of concrete. Sufficient time shall be allowed to make corrections if required.

3.4 ON-SITE INSPECTIONS AND NONCONFORMITIES

A. Equipment shall be inspected on delivery to site for physical damage and for compliance with the Specification and approved equipment shop drawings.

B. Installed equipment, raceways, and wiring shall be inspected on completion of installation for compliance with the Specification and approved installation drawings.

C. A Punch List will be prepared by the Owner's Representative during inspections and testing, and issued to the Contractor for corrective action.

D. Repairs, replacement, and other corrective action that requires de-energizing any part of the Electrical Power Distribution and Control System shall be completed prior to the scheduled date for substantial completion of the project.

3.5 PENETRATIONS AND SEALING

A. Sleeves and rectangular openings shall be provided for raceways provided under this Contract, and for raceways for future equipment where future equipment is shown on the Drawings. Sleeves and rectangular openings for the passage of raceways and conductors shall be sealed after the raceways and conductors have been installed. Spare sleeves and rectangular openings shall also be sealed.

B. Penetration of Waterproof Construction: Coordinate the work to minimize penetration of waterproof construction, including roofs and exterior walls. Where penetrations are necessary, provide sleeves and sealing fittings to make each penetration watertight. Conduit sleeves and openings shall be sealed watertight with mechanical seals. Watertightness shall not rely on caulking.

3.6 ALTERATIONS AND REMOVAL OF EXISTING WORK

A. Where the work specified under this Division connects to the existing electrical systems, the Contractor shall perform alterations to the existing work as described in the Contract Documents.

B. All work performed on the existing electrical systems shall be in accordance with the applicable provisions of the Specification. Visit the project site prior to submitting bids and examine the conditions in which work will be performed. Carefully document all existing conditions pertaining to removal and demolition work.

C. While performing connections and alterations to existing electrical work, the Contractor shall

take special care to protect all existing equipment from dirt, debris and damage. Damaged equipment shall be replaced at no additional cost to the Owner.

D. All removal work shall be performed in a neat and workmanlike manner and shall be executed with the least possible disturbance to the building and tenants. The scheduling of all removal work shall be coordinated with other trades and with the Owner's schedule and operation of the building.

3.7 ELECTRICAL SAFETY AND TEST EQUIPMENT

A. Provide electrical safety equipment, including personal protective equipment, gloves, electrical blankets, test instruments, lighting, ventilation, and instructions in the use of safety equipment, and perform the work under this Contract in accordance with applicable safety rules and regulations. The Contractor’s attention is directed to safety issues related to confine spaces as defined in OSHA regulations.

3.8 CLEANING AND PAINTING

A. After installation and wiring work is completed, all dust and debris shall be removed from the interior and exterior of each electrical equipment enclosure and motor by vacuum-cleaning with circuits de-energized. Do not use compressed air for cleaning. Vacuum cleaner wands and brushes shall be non-conducting. Anti-static protection shall be provided for static-sensitive devices.

B. Clean and remove all rust, scale, oil, grease, and dirt from panelboard enclosures, conduits, pull, junction and terminal boxes, fittings and hangers, leaving surfaces in condition for final surface preparation and painting under Division 9.

C. All ferrous materials that are concealed, or exposed in unfinished areas, including fittings, hangers, junction, pull and terminal boxes, that are not plated or painted with a factory-applied finish, shall be painted under this Section with one coat of zinc-chromate primer and one finish coat of enamel paint approved by the Engineer. Nonferrous materials shall be cleaned only and left unpainted.

D. Equipment furnished with a factory finish coat shall have finish carefully touched-up where it is scratched or otherwise damaged. Touch-up work shall be match the color and type of the original finish.

3.9 INSPECTION AND TESTING ON-SITE

A. Perform Electrical Acceptance Tests in accordance with NETA Acceptance Testing Standards as described in individual Division 16 Sections, Part 3.

B. Submit manufacturer-endorsed field test data sheets & procedures for approval, test equipment and materials on-site prior to site visit by manufacturer’s factory-trained representative, test equipment on-site under the supervision of the Engineer and the equipment manufacturer’s factory-trained representative(s), and submit manufacturer’s statement of acceptance of installation prior to energization of equipment. Invite the Engineer’s and Owner’s representatives to witness field testing.

C. A complete certified electrical test report shall be compiled by the electrical testing firm, checked for completeness, and submitted for the record.

D. The Contractor shall notify all parties whose presence is necessary for the test; and in all cases, the Engineer shall be notified at least one week prior to the actual test.

3.10 LOAD BALANCING

A. Single phase circuits in single and three-phase fuse and circuit breaker distribution boards and lighting panels shall be balanced initially based on the load calculations. Load currents shall be measured under actual operating conditions, and under conditions described by the Engineer. Circuiting shall be re-arranged as necessary to obtain current balancing within 10% on each busbar.

3.11 DEMONSTRATION AND TRAINING

A. Conform to the General and Special Provisions.

B. Upon completion of all work furnished and installed under Division 16, instruct and train the Owner's representatives in the operation and maintenance of all the various apparatus and equipment to the complete satisfaction of the Engineer.

C. Additional requirements for training are described in other Sections of the Specification.

-- END OF SECTION --

SECTION 16060

GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide a complete system of grounding electrodes, grounding electrode conductors, main bonding jumpers, equipment grounding conductors, and bonding in accordance with NEC requirements, in conformance with this Section and Division 16 Section “Electrical - General”, and as shown on the Drawings.

B. This Section includes requirements for grounding electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.2 RELATED DOCUMENTS

A. Related Sections include the following:

1. Division 2 Section "Trenching, Backfilling, and Compacting".

2. Division 16 Section “Wire and Cable” for wire connector and equipment grounding conductor requirements.

3. Division 16 Section “Raceways, Boxes, and Fittings” for grounding bushing requirements.

4. Division 16 Section "Lightning Protection" for lightning protection system grounding and bonding materials.

1.3 DEFINITIONS

A. Refer to NEC for definitions of grounding terms used in this Section.

1.4 QUALIFICATIONS

A. Manufacturer’s Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer. The manufacturing company shall be listed in a published NRTL directory of companies offering NRTL-listed and labeled products.

B. Testing Firm Qualifications: An independent firm, with experience and capability to conduct specified tests, and is a member company of NETA or is an NRTL as defined by OSHA in 19 CFR 1910.7, acceptable to the AHJ.

C. Testing Firm’s Field Supervisor Qualifications: person currently certified by NETA or NICET to supervise on-site testing specified in Part 3.

1.5 REFERENCE STANDARDS

A. Comply with the following standards:

1. IEEE 81-1983 Guide for Measuring Earth Resistively, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
2. IEEE 118-1978 (R1992) Standard Test Code for Resistance Measurements
3. IEEE 142-1991 Recommended Practice for Grounding of Industrial and Commercial Power Systems (IEEE Green Book)
4. IEEE 665-1995 (R2001) Guide for Generating Station Grounding
5. IEEE 837-1989(R1996) Standard for Qualifying Permanent Connections Used in Substation Grounding
6. IEEE 1100-1999 IEEE Recommended Practice for Powering and Grounding Electronic Equipment. (IEEE Emerald Book)
7. NFPA 70 The National Electrical Code

1.6 SUBMITTALS

A. Product Catalog Data Sheets: For each type of product indicated.

B. Product Data: For the following:

1. Ground rods
2. Grounding electrode conductors
3. Exothermic weld grounding connection products

C. Qualification Data: For firms and persons specified in "Qualifications" in Part 1 of this Section.

D. Acceptance Test Reports: Submit written test reports to include the following:

1. Test procedures used.

2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with the requirements described in this Section, provide products by one of the listed manufacturers in the Sub-Sections below.

1. Ground Rods:

a. Copperweld Corp.
b. Eritech / Erico International Corporation
c. Galvan Industries, Inc.
d. Harger Lightning and Grounding, Inc.
e. Robbins Lightning, Inc.

2. Grounding electrode connectors:

a. Exothermic type:

1) Cadweld / Erico International Corporation
2) Furseweld
3) Harger Lightning and Grounding, Inc. (Ultraweld)
4) ThermOweld, a division of Continental Industries

2.2 GROUNDING ELECTRODES

A. Ground Rods: 3/4 in. x 10-ft. Copper-clad steel, sectional type, with silicone bronze threaded connectors.

2.3 GROUNDING ELECTRODE CONDUCTORS

A. Grounding Electrode Conductors: Solid for #6 AWG and smaller, Class A stranded for #4 AWG and larger, bare copper conductor, size(s) as indicated on the Drawings. Class B stranding is not acceptable for conductors in contact with earth.

B. Comply with the following:

1. Solid Conductors: ASTM B 3.
2. Assembly of Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

2.4 BONDING JUMPERS

A. Main Bonding Jumpers: copper or tin-plated copper, furnished with the service equipment by the equipment manufacturer. Panelboards, main circuit breakers, or pump control panels up to 225 amps may use a bonding screw.

B. Equipment Bonding Jumpers: insulated copper building wire, sized to match the largest equipment-grounding conductor in the associated conduits.

C. Bonding Jumper: insulated copper wire, protected by conduit where exposed to physical damage

2.5 EQUIPMENT GROUNDING CONDUCTORS

A. Equipment Grounding Conductors: Insulated building wire in accordance with Division 16 Section “Wire and Cable”. #6 AWG and smaller shall have green insulation, #4 AWG and larger shall have green insulation or shall be marked with green tape at each end.

2.6 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467.Products shall be NRTL-listed and shall be suitable for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure type silicone bronze connectors for test joints at ground rods with test (access) wells, and two-hole long barrel tin-plated copper compression type at equipment busbars and bonding connections to structural steel.

C. Grounding clamps for metal water pipe connections: all cast bronze parts with silicone bronze bolts.

D. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

E. Wirenuts: for use only for branch circuit wiring in switch and receptacle outlet and junction boxes containing #10 AWG and smaller wires.

PART 3 - EXECUTION

3.1 INSTALLATION – GENERAL

A. Install grounding electrodes, grounding electrode conductors, main bonding jumpers, equipment grounding conductors, equipment bonding jumpers, and bonding, in accordance with NEC requirements and as shown on the Drawings.

B. Provide only copper and bronze grounding materials in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

C. Make connections so galvanic action or electrolysis possibility 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 ensure high conductivity and to make contact points closer to order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

D. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or those show convex surfaces indicating improper cleaning are not acceptable.

3.2 INSTALLATION: GROUNDING ELECTRODES

A. Ground Rods: Install ground rods as shown on the Drawings.

1. Drive ground rods until tops are 12 inches minimum below finished floor or final grade, unless otherwise indicated.

2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.

3.3 INSTALLATION: GROUNDING ELECTRODE CONDUCTORS

A. Grounding Electrode Conductors: Route along shortest and straightest paths possible, unless otherwise indicated on the Drawings. Avoid obstructing access or placing conductors where subject to strain, impact, or damage.

B. Connect grounding electrode conductor(s) to the service equipment as shown on the Drawings.

C. For connections to structural steel and for underground connections, provide exothermic-welded connections except at test (access) wells, where bolted mechanical connections are required.

D. Bond grounding electrode conductors in conduit to each end of each conduit run using a bronze conduit-to-wire grounding fitting.

3.4 INSTALLATION: EQUIPMENT GROUNDING CONDUCTORS

A. Provide separate insulated equipment grounding conductors in raceways, boxes, and fittings, as shown on the Drawings and specified herein.

B. Equipment Grounding Conductor Terminations:

1. At dry-type transformers, provide two-hole long-barrel tin-plated compression connector bolted to ground busbars with tin-plated or silicone bronze bolts.

3.5 INSTALLATION: EQUIPMENT BONDING JUMPERS

A. At sheet metal junction, pull and outlet boxes, and electrical enclosures, use conduit hubs bolted to enclosure or double locknuts to bond enclosure to conduit, and connect grounding bushings to equipment grounding conductors. Install equipment-bonding jumpers between conduit bushings entering and leaving boxes, using the lugs provided with the grounding bushings.

B. At cast enclosures, connect equipment-grounding conductors together with a mechanical connector. Use mechanical connectors in conformance with Division 16 Section “Wire and Cable”. Equipment Grounding Conductor 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.

3.6 INSTALLATION: MAIN BONDING JUMPERS

A. Install main bonding jumpers at service equipment in accordance with service equipment manufacturer’s written instructions.

3.7 INSTALLATION: BONDING JUMPERS

A. Bonding Straps and Jumpers: Install so equipment vibration is not transmitted to rigidly mounted equipment support structure. Use long-barrel tin-plated compression connectors

and galvanized steel or silicone bronze hex head cap screws in drilled and tapped holes to bond miscellaneous equipment to equipment grounding conductors.

3.8 CONNECTIONS

A. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

B. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

C. From grade level up to and through communication service and transformer spaces.

3.9 ACCEPTANCE TESTING

A. Testing: Engage a qualified testing agency to perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test ground resistance.

2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the 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. Perform tests using the fall-of-potential method according to IEEE 81.

3. Provide sketch of test setup with dimensions, locating each ground rod and ground rod assembly and other grounding electrodes. Identify each electrode by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results.

4. Grounding resistance shall be 5 ohms or less. If resistance to ground measured at the service equipment with all grounding electrodes connected together is more than 5 ohms, proceed as described in the paragraph below.

5. Excessive Ground Resistance: If resistance to ground exceeds specified value(s), drive rods deeper with a connecting rod. If driving the rods to twice the original depth does not yield specified values, notify the Engineer and include recommendations to reduce ground resistance.

-- END OF SECTION --

SECTION 16095

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Provide electrical equipment nameplates, junction, pull and outlet box labels, raceway identification, wiremarkers, receptacle circuit identification, and warning signs for electrical equipment and field wiring included in this Contract, as specified herein.

B. This Section includes products and installation requirements for identification of electrical equipment, raceways, and conductors, wiring devices, warning signs.

1.2 CODES AND STANDARDS

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:

1. National Electrical Code - NEC
2. NFPA 70E Standard for Electrical Safety in the Workplace
3. Underwriter's Laboratories, Inc. UL

1.3 QUALITY ASSURANCE

A. Manufacturers: Manufacturers shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer, and shall offer NRTL-listed and labeled products.

B. Comply with NFPA 70.

1.4 SUBMITTALS

A. Make submittals in accordance with the General Provisions.

B. Submittals shall include the following:

1. Complete list of all engraved nameplates.
2. Sample of each size of engraved nameplate, punched tape labels, wiremarkers, and laminated instrument tags.

PART 2 - PRODUCTS

2.1 EQUIPMENT NAMEPLATES

A. Provide custom nameplates for all equipment listed in Part 3 of this Section.

B. Nameplates shall have white letters engraved on black field, and shall be fabricated from 3-

layer (black-white-black) thermoset plastic.

C. Drill holes in nameplates to be fastened with tie-wraps as described in Part 3 of this Section.

D. Nameplate lettering to be uppercase Roman block letters, minimum height as follows:

1. Switchboards, Generators, MCCs, VFCs, panelboards, and transformers: 3/4 inch.
2. Process Control Panels (unless factory-labeled): 1/2 inch.
3. Valve actuators: 3/8 inch.
4. Other equipment: 1/4-inch minimum.

2.2 WIREMARKERS

A. Wiremarkers shall be computer-printed on white wrap-around paper with clear plastic protective "tail" and pressure-sensitive adhesive.

B. Manufacturer: Brady, T&B, Panduit, or approved equal.

2.3 WIRE COLOR CODING

A. Comply with NEC requirements for applying color-coding.

B. Color Coding for service, feeder, and branch circuit wiring shall be as follows:

1.	240 / 120 VOLTS	A-B-C-N-G	Black	Red	Blue	White	Green
2.	480 / 277 VOLTS	A-B-C-N-G	Brown	Orange	Yellow	Gray	Green

C. Color coding for 120 VAC control wiring shall be as follows:

1. Line - Black
2. Neutral - White
3. Ground - Green
4. Switched - any color except black, white, and green.

D. Color coding for 4-20 mA DC signal wiring shall be the manufacturer's standard insulation color.

E. Color coding for DC power and control circuits:

1. Negative polarity - Black
2. Positive polarity - Red
3. Switched - any color except black, red, white, and green.

2.4 WARNING SIGNS

A. Provide warning signs on electrical equipment, electrical room doors, and automatically started mechanical equipment in accordance with NEC, NFPA 70E, and OSHA requirements.

B. Apply arc flash hazard warning labels to electrical power distribution equipment.

PART 3 - INSTALLATION

3.1 NAMEPLATES

A. Fabricate equipment nameplates using the description shown on the Drawings.

B. Provide equipment nameplates for switches, pump control panels, enclosed circuit breakers, transformers, disconnect switches.

C. Fasten nameplates to flat sheet metal with pressure-sensitive two-sided adhesive tape.

D. Fasten nameplates to valve actuators with nylon tie-wraps.

3.2 WIRE COLOR CODING AND MARKING

A. Color code phase, neutral, and ground wires for service conductors, feeders, and branch circuits, at points of origin and termination of wires.

B. Provide wiremarkers on all control and signal wires, as shown on the approved Loop Diagrams, Motor Control Wiring diagrams, and Control Panel field wiring diagrams.

3.3 CONDUIT IDENTIFICATION

A. Clean conduit surfaces with mineral spirits. Write conduit number shown on the Conduit & Wire Schedules on each conduit at each exposed conduit termination point.

-- END OF SECTION --

SECTION 16110

RACEWAYS, BOXES, AND FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide a complete system of raceways, including conduit, fittings, terminal boxes, hangers, supports, and accessories, as shown on the Drawings and in conformance with the requirements in this Section.

1.2 RELATED DOCUMENTS

A. Rigid metal conduits for duct bank installation are specified in this Section.

1.3 REFERENCE STANDARDS

A. Comply with the following standards:

1. NEMA Standards applicable to raceways, boxes, and fittings.
2. UL Standards applicable to raceways, boxes, and fittings. Each raceway, box, and fitting shall be NRTL-listed and labeled.

3. ANSI and ASTM standards mentioned in this Section and included in the UL and NEMA Standards applicable to raceways, boxes, and fittings.

1.4 ENVIRONMENTAL CONDITIONS

A. Provide raceways, boxes, and fittings fabricated from materials resistant to corrosion and suitable for the application in the locations where installed, including NEC requirements for installation in “Damp”, “Wet”, and Hazardous (Classified) Areas.

1.5 SUBMITTALS

A. Submittals shall conform to the General Provisions and Special Provisions.

B. Submit Manufacturer's Catalog Data for all raceways, boxes, and fittings proposed to be installed for this project. Include technical specifications sheets. Mark out inapplicable data.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70 and NEMA standards.

C. PVC-coated conduit, boxes, and fittings that are connected together shall be from the same manufacturer.

PART 2 - PRODUCTS

2.1 CONDUIT, BOX, AND FITTING MANUFACTURERS

A. Provide products by the following manufacturers:

1. Adalet / A Scott Fetzer Company
2. AFC Cable Systems, Inc.
3. Alflex Inc.
4. Allied Tube & Conduit Corporation
5. Allied Tube and Conduit Div. / A TYCO International Ltd. Company
6. Anamet Electrical, Inc.; Anaconda Metal Hose.
7. Appleton
8. Bell
9. Cooper / B-Line
10. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
11. Electri-Flex Co.
12. Emerson/General Signal; Appleton Electric Company.
13. Erickson Electrical Equipment Co.
14. Hoffman.
15. Hubbell, Inc. / RACO
16. Hubbell, Inc./ Killark Electric Manufacturing Co.
17. Lew Electric Fittings Co.
18. LTV Steel Tubular Products Company
19. Myers
20. O-Z Gedney
21. Perma-Cote
22. Pittsburgh Standard Conduit Co.,
23. RACO; Division of Hubbell, Inc.
24. Robroy Industries
25. Robroy Industries, Inc.; Enclosure Division.
26. Scott Fetzer Co.; Adalet-PLM Division.
27. Spring City Electrical Manufacturing Co.
28. Thomas & Betts Corporation.
29. Triangle PWC Co.
30. Wheatland Tube Co.
31. Or approved equal.

2.2 RIGID METAL CONDUIT (RMC)

A. Rigid Galvanized Steel Conduit (RGS): hot dip galvanized exterior and interior to ANSI C80.1, threads hot dip galvanized after fabrication, for use in accordance with NEC Article “Rigid Metal Conduit: Type RMC”, NRTL-listed and labeled under UL 6. Threads shall be hot dip galvanized after fabrication.

B. PVC-Coated Rigid Galvanized Steel Conduit: RGS with .040 inch PVC exterior coating, and .002 urethane or epoxy interior coating. Threads shall be protected with urethane coating over galvanizing.

C. Provide RMC locknuts, bushings, fittings, conduit bodies, junction boxes, pull boxes, and outlet boxes as follows:

1. NEMA ratings: in accordance with Part 3 of this Section

2. Locknuts: galvanized steel. Locknuts on outside of NEMA 12 sheet metal enclosures shall be sealing O-ring type.

3. Bushings: galvanized steel or malleable iron, insulated throat grounding type, with thermoset plastic insulation insert, complete with mechanical ground lug for connection to ground wire.

4. Fittings: ANSI 80.4, hot-dip galvanized cast steel or malleable iron. Conduit hubs or similar approved fittings shall be provided for conduit entry to water and dust-resistant enclosures.

5. Conduit bodies: galvanized cast steel or malleable iron Form 8 with oil-resistant gasket and galvanized cast steel or malleable iron cover

6. Junction boxes: galvanized cast steel or malleable iron with oil-resistant gasket and galvanized cast steel or malleable iron cover in non-hazardous areas, cast or malleable iron external screw cover type in hazardous (classified) areas

7. Pull boxes: painted or stainless steel fabricated sheet metal type with hinged screw cover in non-hazardous areas, cast aluminum with hinged bolted cover in hazardous (classified) areas.

8. Outlet boxes: Type FS or FD for exposed locations in non-hazardous areas, cast or malleable iron external screw cover type in hazardous (classified) areas

9. PVC-coated fittings, conduit bodies, junction boxes, pull boxes, and outlet boxes: Same as RGS described above, with exterior and interior coatings similar and equal to PVC-coated RGS conduits, and shall have PVC sleeves extending approximately one conduit diameter beyond threaded hub for conduit overlap. Provide stainless steel cover screws.

10. Explosion-proof flexible couplings: UL listed and labeled for the hazardous (classified) area location, with stainless steel outer braid. Non-stainless steel parts shall be PVC-coated when used with PVC-coated RGS conduit.

11. Explosion-proof sealoffs: : UL listed and labeled for hazardous (classified) area location, cast metal, combination horizontal and vertical type, with 40% wire fill capacity to match allowable wire fill in conduit, with breather and drain. Non-stainless steel parts shall be PVC-coated when used with PVC-coated RGS con-duit.

2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Liquidtight flexible metal conduit (LFMC): Flexible steel type UA conduit with PVC jacket, for use in accordance with NEC Article “Liquidtight Flexible Metal Conduit: Type LFMC”, NRTL-listed and labeled under UL 360. Non-UL listed LFMC is not ac-ceptable.

B. Fittings: Insulated-throat screw-in connectors, NEMA FB 1, UL 514B, galvanized malle-able iron or steel. Connectors shall be suitable for use as grounding fittings. Provide fit-tings with bonding jumper connections for exterior bonding jumpers at motors. Non-stainless steel parts shall be PVC-coated when used with PVC-coated RGS conduit.

2.4 CONDUIT SLEEVES AND SEALING FITTINGS

A. Manufacturers:

1. Appleton
2. Crouse-Hinds
3. Spring City Electric
4. Thomas & Betts
5. O.Z. Gedney
6. Or approved equal

B. Wall and Floor Sleeves:

1. Hot-dip galvanized steel or stainless steel pre-fabricated conduit sleeves with welded water-stop ring.

2. Galvanized steel, PVC, and polyethylene sleeves that are part of a manufac-turer's standard wall seal assembly are also acceptable, subject to compliance with the fire resistant rating of the related walls and floors.

C. Conduit-to-Sleeve Sealing Fittings:

1. Synthetic elastomeric gland with galvanized steel or stainless steel compression plates sized for the conduit OD and sleeve ID, or a manufactured assembly of hot-dip galvanized or stainless steel pressure plates, neoprene sealing grommets, and cast or malleable iron sealing bodies with zinc-rich epoxy coating, with fac-tory-assembled galvanized steel, PVC, or polyethylene pipe sleeve. Segmented seals are also acceptable for conduit 4-inch trade size and larger.

2. Sealing fittings for wall penetrations with water or soil on one side shall have seals installed at both ends of the conduit sleeve or core-drilled hole.

3. Where single conductors pass through a single sleeve, select materials to miti-gate the effects of inductive heating.

4. Provide ground wire attachment bolts for manufactured sleeve assemblies.

5. Seals shall have fire ratings equal to the fire-resistant rating of the wall.

2.5 FACTORY FINISHES

A. Finish: For painted steel enclosures, provide manufacturer's standard commercial and industrial coating in ANSI 61 light grey color, or different color when required by the NEC.

B. Field painting will be required for uncoated cast iron, steel, galvanized, zinc-coated, and factory primed surfaces. Products shall be degreased and made suitable for field painting prior to packaging for shipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATIONS

A. Outdoor raceways, boxes, and fittings:

1. Exposed conduits: Rigid galvanized steel conduit.

2. Underground concealed in concrete: Schedule 40 PVC conduit.

3. Underground, Individual Conduit Runs: PVC-coated rigid galvanized steel conduit.

4. Hazardous Classified Locations: Rigid galvanized steel conduit with fittings and boxes UL listed and labeled for the hazardous area classification shown on the Drawings.

5. Connections to transformers, motor-driven equipment, vibrating equipment, and equipment requiring position adjustment, e.g., rail-mounted motors: liquidtight flexible metal conduit in non-hazardous areas, explosion-proof flexible cou-plings in hazardous areas.

6. Boxes and fittings: as described in each raceway sub-section, and recommended as suitable for the particular application by the manufacturer.

B. Indoor raceways, boxes, and fittings:

1. Below floor slab in slab-on-grade construction: PVC-coated rigid galvanized steel conduit.

2. Exposed: rigid galvanized steel conduit.

3. Conduits containing shielded cables: rigid galvanized steel.

4. Connections to transformers, motor-driven equipment, vibrating equipment, and equipment requiring position adjustment, e.g., rail-mounted motors: liquid-tight flexible metal conduit in non-hazardous areas, explosion-proof flexible couplings in hazardous areas

5. NEC Damp and Wet Locations: PVC-coated rigid galvanized steel conduit.

6. Hazardous Classified Locations: PVC-coated rigid galvanized steel conduit with fittings and boxes UL listed as suitable for the hazardous area classification shown on the Drawings.

7. Boxes and fittings: as described in each raceway sub-section, and recommended as suitable for the particular application by the manufacturer.

C. Minimum Raceway Size: 3/4-inch trade size.

3.2 INSTALLATION – GENERAL

A. Deliver raceways, boxes, and fittings to jobsite in factory packaging. Store in clean, dry, weatherproof locations. Handle in accordance with manufacturer's recommendations.

B. Install raceways, boxes, and fittings in accordance with manufacturer's installation instructions and NEC requirements as a minimum, and comply with the additional requirements described in this Section.

C. Conduits shall be electrically and mechanically continuous, and suitable for use as an equip-

ment-grounding conductor. Make up threaded joints wrench tight.

D. Fasten boxes in wet and damp areas using external mounting feet. Do not drill through boxes.

E. Comply with NEC Article 314 requirements for sizing outlet, pull, and junction boxes to accommodate wires, splices, and devices.

F. Bends and offsets between pull points shall not exceed a cumulative total of 270 degrees unless otherwise approved by the Engineer. Maximum distance between pull points in conduit systems inside buildings shall be 100 feet unless otherwise approved by the En-gineer.

G. Raceways shall be routed in accordance with the following guidelines:

1. Run conduits exposed, concealed, and underground as indicated on the Draw-ings.

2. Maintain eight feet minimum clearance above finished floor wherever it is physically possible to do so. Comply with OSHA requirements for minimum headroom.

3. Comply with raceway, boxes, and fitting details shown on the Drawings.

4. Provide seals and flashings at roof penetrations in accordance with the recommendations of the roofing system supplier, or as shown on the Drawings.

5. Where conduits enter the top of electrical equipment enclosures and control pan-els, install conduit interior sealing fittings to prevent entry of water and conden-sation from conduit.

H. Cut conduits square with roller-wheel pipe cutter. Hacksaw cuts are acceptable only if the entire conduit is swabbed clean after cutting and threading is completed. Conduits cut in the field shall be threaded with sharp, standard NPT dies to achieve a fully cut tapered thread with a minimum of five full tapered threads at the end of the conduit. Running threads are not acceptable. Over- and under-threading are not acceptable. After thread-ing, ream conduit ends, remove cuttings and debris from inside and outside of conduit, degrease, and apply cold spray-on zinc-rich paint.

I. Conduit bends shall be made with conduit bending tools manufactured for the purpose. Comply with conduit and bending tool manufacturers' instructions. Use specially sized shoes in bending tools for PVC-coated rigid galvanized steel conduits.

J. Join raceways with fittings designed and approved for that purpose and make joints wrench tight. Comply with NEC requirements for minimum thread engagement in Haz-ardous Classified areas.

K. Provide expansion, deflection, or expansion & deflection couplings at building expan-sion joints. Expansion and deflection fittings shall comply with UL 467 and UL 514B, and shall be suitable for the anticipated amount of movement and direction(s) of move-ment.

L. Three-piece (Erickson) couplings shall be used where it is not possible to turn conduits to make up threaded joints. Threadless fittings are not generally acceptable. Application for permission to use threadless fittings at particular locations shall be made in writing to the Engineer, and threadless fittings shall not be used unless approved.

M. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

N. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box. Install bushings wrench-tight.

2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nip-ples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

3. Install temporary closures to prevent foreign matter from entering raceways.

O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

P. Install explosion-proof and moisture seal-off fittings at NEC-required accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. At hazardous classified locations and where otherwise required by the NEC.

Q. Flexible Connections:

1. Recessed and semi-recessed lighting fictures: maximum of 72 inches of flexible metal conduit with UL-listed grounding fittings

2. Motors and equipment subject to vibration or movement: maximum 36 inches of LFMC up to 2 inch trade size, up to 72 inches in larger sizes, and explosion-proof couplings of adequate length for the installed conditions in hazardous (classified) locations.

3. Install separate equipment bonding jumper across flexible connections where required by the NEC.

R. PVC Coated Rigid Galvanized Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

3.3 INSTALLATION – EXPOSED RACEWAYS, BOXES AND FITTINGS

A. Install raceways, boxes, and fittings exposed as indicated on the Drawings.

B. Make concentric bends in parallel exposed conduit runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

C. Install electrical enclosures and cabinets plumb. Support at each corner.

3.4 PROTECTION DURING CONSTRUCTION

A. Provide final protection and maintain conditions that ensure coatings and finishes with-out damage or deterioration at time of Substantial Completion.

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

3.5 CLEANING & PAINTING

A. Swab conduits clean after installation and plug ends until conductors are installed.

B. Remove dust, construction debris, plaster and paint spatters from raceways, boxes, and fittings after all trades have completed their work, and prior to painting.

C. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes, touch up damage, and prepare for finish painting in accordance with Division 9 Section “Painting and Finishing”.

3.6 IDENTIFICATION

A. Identify raceways, boxes, and fittings as described in Division 16 Section “Electrical Identification”.

-- END OF SECTION --

SECTION 16120

WIRE AND CABLE

PART 1 - GENERAL

1.1 SUMMARY

A. Provide a complete system of wiring and cabling, including wire and cable pulling, splicing, and termination accessories, as shown on the Drawings and in conformance with the requirements in this Section.

B. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.2 RELATED DOCUMENTS

A. Related requirements are also specified in the following Sections:

1. Division 16 Section "Electrical Identification" for identification requirements.

2. Division 16 Section "Wiring Devices" for wiring devices installed in boxes.

3. Division 16 Section “Grounding” for grounding and bonding.

1.3 DEFINITIONS

A. In addition to the definitions in Division 16 Section “Electrical - General” the following definitions apply to this Section:

1. NMC: non-metallic jacketed cable
2. RTD: resistance temperature detector
3. SE: service entrance cable
4. THHN: NEC and UL designation for flame-retardant and heat resistant thermoplastic insulation, gas and oil resistant nylon jacketed, suitable for dry locations only, 90 deg. C. max in dry locations
5. THW: NEC and UL designation for flame-retardant, moisture resistant thermoplastic insulation suitable for dry and wet locations, 75 deg. C. max
6. THWN: NEC and UL designation for for flame retardant and moisture-resistant thermoplastic insulation, gas and oil resistant nylon jacketed, suitable for dry and wet locations, 75 deg. C. max in wet locations
7. XHHW: NEC and UL designation for (thermoset) cross-linked synthetic poly-mer-insulation suitable for dry and wet locations, 90 deg. C. max in dry loca-tions, 75 deg. C max in wet locations
8. XHHW-2: NEC designation for (thermoset) cross-linked synthetic polymer-insulation suitable for dry and wet locations, 90 deg. C. max in wet and dry locations

1.4 REFERENCE STANDARDS

A. Comply with the following standards in effect at the time of bid submittal:

1. Underground Extruded Power Cable Pulling Guide
2. ICEA P-51-432-1970 Copper Conductors, Bare & Weather Resistant
3. ICEA P-56-520-1984 Cable Tray Fire Test Report (Round Robin Project)
4. ICEA S-58-679-1996 Standard for Control Cable Conductor Identification
5. ICEA S-95-658 / NEMA WC70 Non-Shielded Power Cables Rated 2000 V or Less
6. IEEE 576-2000 Recommended Practice for Installation, Termination, and Test-ing of Insulated Power Cable as Used in Industrial and Commercial Applications
7. UL 44 Thermoset–insulated Wires and Cables
8. UL 62 Flexible Cord and Fixture Wire
9. UL 83 Thermoplastic-insulated Wires and Cables
10. UL 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors
11. UL 486C Splicing Wire Connectors
12. UL 486D Insulated Wire Connector Systems for Underground Use in Damp or Wet Locations
13. UL 493 Thermoplastic-insulated Underground Feeder and Branch-Circuit Cables

1.5 SUBMITTALS

A. Submittals shall conform to the General and Special Provisions.

B. Compliance Statement: With each submittal, include a Compliance Statement listing each Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-paragraph, compliance with the Specification, each minor nonconformity that is within the intent of the Specification, and proposed non-conformities. Provide short description of minor non-conformities, and detailed explanation of other non-conformities.

C. Submit Manufacturer's Catalog Data for each type of product specified herein, including technical catalog data sheets, technical specifications, evidence of UL listing, and evi-dence of manufacturer’s certification to ISO 9000:2000 or an equivalent quality man-agement system certification acceptable to the Engineer.

D. Qualifications and experience proposal for the electrical testing firm.

E. Samples: 16-inch (400-mm) lengths of each size and type of approved wire and cable, mounted on a sample board of 1/2 inch AC exterior plywood painted white.

F. Electrical Acceptance Test reports.

G. Operation and maintenance data is not required, however, approved shop drawing sub-mittals are required to be included for the record in the Operation and Maintenance Manuals, as described in Division 16 Section “Electrical - General”.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain all wire and cable of a particular type through one source from a single qualified manufacturer.

B. To be a qualified manufacturer, wire, cable, splice and termination components manu-facturers shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer, and shall offer NRTL-listed and labeled products.

C. Testing firm shall be qualified as defined by OSHA in 29 CFR 1910.7, shall be a mem-ber of

the InterNational Electrical Testing Association, shall be acceptable to the AHJ, and shall have supervision as follows:

1. Testing Firm's Field Supervisor: Qualifications and experience for the person currently certified by the InterNational Electrical Testing Association or the Na-tional Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

D. Wire and cable and accessories: Listed and labeled as defined in NEC Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 APPLICATIONS

A. Refer to Part 3 for wire and cable applications.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.3 BUILDING WIRE AND MULTI-CONDUCTOR POWER CABLES

A. Manufacturers:

1. Alcan Cable, Div. of Alcan Aluminum Corp.
2. American Insulated Wire Corp.
3. Belden Wire and Cable Co.
4. Cerro Wire and Cable Co., Inc.
5. General Cable Industries Inc.
6. Okonite Co.
7. Pirelli Cable Corp.
8. Rome Cable Corp.
9. Southwire Co.

B. Conductor Material: Copper, solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.

C. Building Wire and Multi-conductor Cable Insulation Types: Type THHN -THWN and XHHW.

D. Portable appliance cords: 600V type SO and 300V SJO.

2.4 CONTROL AND INSTRUMENTATION WIRE AND CABLE

A. Manufacturers:

1. Belden Wire and Cable Co.
2. Clifford of Vermont / TVC
3. General Cable Co., Inc.
4. Okonite Co.

5. Rome Cable Corp.
6. Southwire Co.

B. Control wire: 600V type THWN insulated stranded copper conductors in conduit, mini-mum size #14 AWG, UL listed and suitable for installation in conduit.

C. Instrumentation cable for 4-20 mA DC circuits: Polyethylene insulated #16 AWG stranded tinned copper twisted pair, with #18 AWG or larger stranded tinned copper drain wire, overall aluminum-on-mylar shield, with chrome PVC outer jacket. UL listed and suitable for installation in conduit and cable tray.

D. Instrumentation cable for RTDs: UL listed polyethylene insulated #16 AWG stranded tinned copper twisted triple, with #18 AWG or larger stranded tinned copper drain wire, overall aluminum-on-mylar shield, with chrome PVC outer jacket. UL listed and suitable for installation in conduit and cable tray.

2.5 WIRE AND CABLE CONNECTORS AND SPLICES

A. Manufacturers:

1. 3M Company, Electrical Products Division
2. AMP Incorporated / Tyco International
3. Burndy
4. Square D
5. Thomas and Betts

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

C. Wirenuts: Spring type rated for copper wire, sized for the actual number of wires con-nected.

D. Splices: Tin-plated copper compression type. Pre-insulated crimp-on connectors may be used for #14 AWG control wires. Long barrel splices shall be used for #1/0 AWG and larger.

E. Connections at molded case circuit beakers, disconnect switches, and other equipment provided with wire termination lugs: NRTL-listed, suitable for use with the copper wire size to be connected.

F. Connection lugs: Tin-plated copper compression type with NEMA drilling. Long-barrel lugs shall be used for #1/0 AWG and larger wire.

PART 3 - EXECUTION

3.1 INSPECTION

A. Ensure that conduits, duct banks, manholes, handholes, and pullboxes are clean and clear of construction debris prior to installation of wire and cable.

3.2 DELIVERY, STORAGE, AND HANDLING

A. Deliver wire and cables to construction site and unload in accordance with manufacturer's

recommendations.

B. Store and transport reels in compliance with manufacturer's printed instructions.

C. Wire and cable ends shall be taped watertight until terminations and splices are com-pleted.

3.3 WIRE AND CABLE APPLICATIONS

A. Service Entrance: Type XHHW, single conductors in raceway Type THHN-THWN, sin-gle conductors in raceway Type SE or USE multiconductor cable.

B. Feeders: Type XHHW, single conductors in raceway

C. Branch Circuits: Indoor branch circuit wiring shall be type THHN-THWN, single conductors in raceway. Branch circuit wiring outdoors, including duct banks and outdoor concrete slabs, shall be type XHHW.

D. Cord Drops and Portable Appliance Connections: Type SO, 600V hard service cord, for applications over 150V to ground, and type SJO, 300V hard service cord, for applications less than 150 V to ground.

E. NEC Class 1 Control Circuits: Type THHN-THWN, in raceway.

F. NEC Class 2 and 3 Control Circuits: Type THHN-THWN, in raceway

3.4 CABLE LAYING AND PULLING

A. Install cables in accordance with manufacturer's installation instructions, IEEE 576 and AEIC CG5-90.

B. Run wires and cables in raceways as shown on the Drawings and as specified in Division 16 Section "Raceways, Boxes, and Fittings".

C. Use cable manufacturer approved wire pulling lubricant for pulling in wire and cables in conduit. Lubricant shall be UL-listed and shall be suitable for the conductor insulation. Use water-based products.

D. Pull wire and cables in accordance with the manufacturer's installation recommendations and requirements, with emphasis on the following:

1. Do not exceed manufacturer's recommended maximum pulling tensions and side-wall pressure values
2. Lubricate cables with water-base pulling compound or lubricant that is approved by the cable manufacturer and will not deteriorate conductor or insulation mate-rials of construction.
3. Follow cable manufacturer's recommendations for attaching pulling means to cables, including fish tape, cable, rope, and basket-weave cable grips. Do not attach to cable jacket alone for pulling.
4. Rig pulleys and use pull ropes for pulling cables into raceways.
5. Use tension indicators and electric-motor driven capstan rollers for pulling ca-bles that are too large for pulling by hand.

6. Observe manufacturer's recommendations for the minimum wire and cable-bending radius for each type and size of wire and cable provided for this project.

E. In handholes, pull boxes, and junction boxes, train cables around perimeter from entry to exit, and support cables at intervals adequate to prevent sagging.

F. Seal around cables penetrating fire-rated elements according to Division 7 Section "Through-Penetration Firestop Systems."

G. Identify and color-code conductors and cables according to Division 16 Section

3.5 WIRE AND CABLE CONNECTIONS AND TERMINATIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. For compression lugs and splices, use the lug manufacturer's compression tools and comply with the manufacturer's written instructions.

C. Control wires shall be run from terminal to terminal without splices, and no more than two wires under a terminal screw.

D. Splices and terminations shall be insulated with boots, heat shrink tubing, or tape to 600 volts in accordance with the insulation product manufacturer's written instructions.

E. Feeder taps shall be made with cast bronze 2-bolt or 4-bolt connectors with built-in conductor spacer, suitable for the run and tap conductor sizes. Split bolt connectors shall not be used unless approved by the Engineer.

F. Wiring at Device Outlets: Install conductor at each outlet, leaving 8 inches (200 mm) of wire coiled in the box for connection to wiring devices. Wiring devices that are suitable for solid wire only shall be pigtailed to stranded wire with solid wire 6 inches long using wirenuts.

G. Install a green insulated NEC-sized grounding jumper from a green ground screw in the outlet box to the receptacle or switch green ground screw.

H. Wiring to terminals at transformers and busbars shall be connected with tin-plated cop-per compression connectors and insulated for 600 volts with tape, boots, or heat-shrink tubing rated for the temperature specified by the equipment manufacturer. Two hole lugs shall be used for power cable terminations # 1/0 AWG and larger.

I. Building wire connections to flexible motor leads shall be made with compression connectors bolted back-to-back with silicone-bronze bolts and insulated for 600 volts. For motors with busbar connections, connections shall be made with tin-plated copper lugs and silicone bronze bolts.

J. Multi-conductor cables shall be installed and terminated in accordance with the cable manufacturer's installation instructions. Armored and metal clad cables shall be terminated with fittings suitable for grounding.

K. Shielded cable conductors shall be terminated with insulated crimp-on connectors suit-able for the terminals provided with the equipment, or tinned for connection to terminals, which are not suitable for crimp-on connectors. A minimum two inch length of heat shrink tubing shall be applied over each insulated conductor and the insulated portion of the crimp-on connector, and a separate piece of larger diameter heat shrink tubing shall cover the end of the cable jacket and cut shield, and overlap the individual conductor heat shrink tubing. Connect drain wire to the ground bus.

3.6 ELECTRICAL ACCEPTANCE TESTING

A. Testing: Engage a qualified testing agency to perform the following field quality-control testing:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

SECTION 16141

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide switches, receptacles, and accessories required for a complete wiring device installation, as shown on the Drawings and specified herein.

1.2 REFERENCES

A. Material and installation shall be in accordance with latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:

1. American National Standard Institute (ANSI)
2. National Electrical Code (NEC)
3. National Electrical Manufacturers Association (NEMA)
4. Underwriters Laboratories, Inc. (UL)

1.3 QUALITY ASSURANCE

A. Qualifications of Manufacturer

1. All equipment furnished under this Section shall be furnished by manufacturers who meet the quality, workman-ship, and experience requirements as specified in the General Provisions section of this Contract.

1.4 SUBMITTALS

A. Submittals shall be in accordance with the General and special Provisions.

B. Compliance Statement: With each submittal, include a Compliance Statement listing each Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-paragraph, compliance with the Specification, each minor nonconformity that is within the intent of the Specification, and proposed non-conformities. Provide short description of minor non-conformities, and detailed explanation of other non-conformities.

C. Manufacturer’s Catalog Data

1. Submit manufacturers catalog data describing each item and demonstrating conformance to the Specification.

D. Other Submittals

1. Samples are not required for specified manufacturers and part numbers. If "equal" products are proposed, samples of both the "equal" and the specified product shall be submitted for comparison purposes.

E. Equal products will not be considered unless samples are submitted.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide industrial grade heavy-duty wiring devices, in types, characteristics, grades, colors, and electrical ratings for applications indicated which are UL listed and which comply with NEMA WD 1 and other applicable UL, and NEMA standards.

B. Provide ivory color devices unless otherwise indicated.

C. Model or series numbers, where indicated, refer only to the specified manufacturer. Identical numbers by other manufacturers are not considered equal.

2.2 RECEPTACLES

A. Receptacles

1. Duplex convenience and appliance receptacles shall be NEMA 5-20R rated 20 amperes at 120 VAC.

2. Duplex receptacles shall be:

a. Hubbell 5362 Series heavy-duty industrial grade.
b. Leviton 5362 Series heavy-duty industrial grade
c. Arrow Hart 5362 Series heavy-duty industrial grade.
d. Daniel Woodhead 5362 Series heavy-duty industrial grade.
e. Equal (samples of any proposed equal products shall be submitted as noted above).

3. Simplex receptacles shall be NEMA standard straight-blade type, industrial grade with plastic body and plated contacts, suitable for the voltage and current application shown on the Drawings.

B. GFI Receptacles

1. Receptacles shown as GFI shall be of the ground fault interrupter type. They shall be UL rated Class A, Group 1.
   a. Hubbell Series GF5262
   b. Or approved equal.
2. Single GFI Receptacles providing "downstream" protections are not acceptable. Each GFI receptacle shall be GFI type with test and reset buttons.
3. GFI breakers used with conventional receptacles shall not be acceptable where GFI receptacles are shown.

C. Other Receptacles

1. Other receptacles shall be industrial grade heavy-duty, of the type shown on the Drawings.

F. Device Boxes for receptacles shall be of the type appropriate for each location as specified

under Division 16 Section “Raceways, Boxes, and Fittings”.

2.3 SWITCHES

A. Switches

1. Light switches shall be rated 20 amperes at 120-277 VAC, toggle operated, thermo-set plastic enclosed, single pole, three-way or four-way as shown on the Drawings.

   a. Hubbell 1221 Series heavy-duty industrial grade
   b. Leviton 1221 Series heavy-duty industrial grade
   c. Arrow Hart 1221 Series heavy-duty industrial grade
   d. Equal (samples of any proposed equal products shall be submitted as noted above)

2. Switches shall have silver alloy contacts and pro-visions for side and back wiring.

3. Device boxes for switches shall be of the type appropriate for each location as specified under Division 16 Section “Raceways, Boxes and Fittings”.

2.4 DEVICE PLATES

A. Flush-mounted device plates located indoors shall be brushed stainless steel type 304.

B. Surface-mounted device plates shall be galvanized steel for stamped steel boxes, and painted malleable iron for type FS and FD boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wall receptacles shall be mounted at 18 inches to the centerline of the device box above finished floor, unless otherwise noted or required by the National Electric Code or the Americans with Disabilities Act (ADA).

B. Switches shall be mounted 44 inches to the centerline of device box above finished floor on knob side of doors unless otherwise noted or required by the National Electric Code or the Americans with Disabilities Act (ADA). Coordinate switch locations with cabinets, temperature controls, etc. to avoid conflicts.

C. Install wiring devices and accessories as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.

D. Coordinate with other Work, including painting, electrical boxes and wiring installations, as necessary to interface installation of wiring devices with other Work.

E. Install wiring devices only in electrical boxes, which are clean and free from building materials, dirt, and debris.

F. Install wiring devices after wiring work is completed.

G. Install wall plates after painting work is completed.

-- END OF SECTION --

SECTION 16269

VARIABLE FREQUENCY CONTROLLERS

PART 1 – GENERAL

1.1 SUMMARY

A. Provide Variable Frequency Controllers (VFCs) in compliance with this Section for motors that drive mechanical equipment specified in other Divisions of the specifications.

1.2 RELATED DOCUMENTS

A. Drawings and General and Special Provisions apply to this Section.

1.3 QUALIFICATIONS

A. The variable frequency drive controller shall be designed, assembled, factory-tested, setup and commissioned by the AC converter – DC link – variable frequency AC inverter manufacturer.

1.4 DEFINITIONS

A. In addition to the definitions in Division 16 Section "Electrical - General," the following definitions apply to this Section:

1. AC: Alternating Current
2. BMS: Building Management Systems
3. Converter: Converts AC to DC
4. DC: Direct Current
5. HP: Horsepower
6. I/O: Input / Output
7. IGBT: Insulated gate bipolar transistor.
8. Inverter: Converts DC to AC
9. MCC: Motor Control Center
10. PWM: Pulse-Width Modulated.
11. Point of Analysis: with reference to IEEE 519, the point of common coupling selected by the Engineer
12. TDD: Total Demand Distortion as defined in IEEE 519
13. THD: Total Harmonic Distortion as defined in IEEE 519

1.5 REFERENCE STANDARDS

A. Comply with the following standards in effect at the time of bid submittal unless otherwise noted in Division 1:

1. IEEE 519 IEEE Recommended Practices & Requirements for Harmonic Controls in Electrical Power Systems

2. NEMA FU 1 Low Voltage Cartridge Fuses

3. NEMA ICS 6 Industrial Control and Systems Enclosures

4. NEMA KS 1 Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)

5. NEMA MG 1 Motors and Generators

6. NEMA MG 10 Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors.

7. NFPA 70 National Electrical Code

8. UL 198C High-Interrupting-Capacity Fuses, Current-Limiting Types

9. UL 50 Safety Enclosures for Electrical Equipment

10. UL 508 Industrial Control Equipment

1.6 SUBMITTALS

A. Submittals shall be in conformance with the General and Special Provisions.

B. Compliance Statement: With each submittal, include a Compliance Statement listing each Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-paragraph, compliance with the Specification, each minor nonconformity that is within the intent of the Specification, and proposed non-conformities. Provide short description of minor non-conformities, and detailed explanation of other non-conformities.

C. Shop Drawings

1. Specially prepared shop drawings including the following:

a. Equipment nameplate data and electrical ratings
b. Weights and overall dimensions
c. General arrangement, plan view, section view, elevation, and sub-assembly drawings cross-indexed to a complete bill of materials listing all components and part numbers. Include layout of door-mounted components. Show conduit entry areas and field wiring termination points.
d. Three-line AC power schematic diagrams.
e. Control schematic showing all control devices.
f. Field wiring diagrams showing each external device connected.
g. Installation instruction including details, required clearances for access, operation and maintenance, and special instructions for unloading and hoisting, short term and long term storage, and unpacking.

C. Product Data Sheets

1. Technical data sheets for manufactured equipment and sub-assemblies, marked to show equipment selected for this project. Include product data sheets in Shop Drawing submittal.

D. Test Reports

1. Factory test reports

2. Acceptance test reports

E. Manufacturer's Field Reports

1. Inspection of equipment installation (prior to energization and startup) report

2. Complete tabulation of equipment settings and adjustments, and functional testing report

F. Operation and Maintenance Data

1. Operation and Maintenance Instructions: For equipment and accessories, including pre-energization tests and checks, initial startup procedure, manufacturer's written instructions for testing and adjusting overcurrent protective devices, exploded views of major assemblies and sub-assemblies indexed to parts lists, maintenance instructions and recommended maintenance intervals, troubleshooting procedures, and contact details for spare parts purchase and technical support.

G. Closeout Submittals

1. Follow up service reports
2. Warranty

1.7 QUALITY ASSURANCE

A. All VFCs for this project shall be supplied by the same manufacturer.

B. VFC sizing shall be based on the nameplate data for the motor selected by the mechanical equipment supplier to operate at variable frequency over the specified speed range.

C. Quality Certification: The variable frequency drive motor controllers manufacturer shall have quality certification to ISO 9000:2000. Evidence of certification shall be submitted with equipment shop drawings.

D. Compliance with the Specification: Clearly list Specification non-conformances on the shop drawing transmittal letter. Furnish controllers as approved on shop drawing submittals.

E. Technical Support: The manufacturer shall maintain a service center capable of providing training, parts, and emergency maintenance and repairs within 200 miles of Project site.

F. Safety in the Workplace: Provide NRTL-listed and labeled electrical components as defined in NEC Article 100, by an NRTL acceptable to the AHJ.

1.8 PROJECT CONDITIONS

A. Ambient temperature, humidity, and elevation: Equipment shall be rated for continuous operation, capable of driving full load without de-rating, within the ambient temperature, humidity, and elevation ranges specified in Division 16 Section "Electrical - General".

B. Equipment shall be suitable for operation under the service conditions listed in Division 16 Section "Electrical - General" and long-term exposure to low levels of hydrogen sulfide typical of wastewater facilities.

1.9 COORDINATION

A. The Contractor is required to coordinate selection of variable frequency controller and motor to match equipment provided under other Sections in order to meet the Specification requirements for a complete and fully functional system.

B. For freestanding enclosures, coordinate size and location of concrete equipment pads with the work of other trades in the area. Use afterset epoxy anchors to anchor equipment to concrete pads unless otherwise instructed by the equipment manufacturer. Concrete, reinforcement, and formwork requirements are specified in Division 3 "Concrete".

C. Coordinate output current and motor full load current ratings with equipment provided under other Sections of the Specification.

D. Provide VFC-to-motor wire size and length data to the VFC manufacturer prior to shop drawing submittal so that the VFC manufacturer can include accessory devices, such as output line reactors and motor termination DV/DT reduction devices that may be necessary to limit the impulse voltage at the motor to values within the inverter-duty motor insulation impulse voltage rating specified in Division 11 for the Sewage Pumps.

E. Coordinate controller interfaces with pilot devices and control and signal circuits furnished under Division 17. Follow the VFC manufacturer's recommendations for power, control, and signal cable separation and related installation details.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND COMPONENTS

A. Materials, equipment, and devices shall be NRTL-listed, and shall comply with NFPA 70 National Electrical Code requirements.

B. Indoor enclosures shall be NEMA 1 painted steel. Outdoor enclosures shall be NEMA 4 stainless steel painted white with sun shields and with air conditioning for heat dissipation.

2.2 MANUFACTURERS

A. Available 6-pulse variable frequency motor controller manufacturers: Subject to compliance with harmonic distortion limits, manufacturers include the following:

1. Rockwell Automation Inc. / Allen Bradley
2. Eaton Corporation / Cutler Hammer
3. Square D Company

2.3 GENERAL DESCRIPTION:

A. Solid-state constant-torque VFC and accessories with full-wave diode bridge AC-to-DC converter, and PWM-type IGBT output, with accessories as specified herein, listed and labeled as a complete unit and arranged to provide variable speed control of a NEMA Design B, 3-phase squirrel-cage induction motor by adjusting output voltage and frequency while maintaining a constant volts/hertz ratio.

B. For AC Drives rated up to 50 Hp, the AC Drive manufacturer shall use a 6-pulse bridge rectifier design with line reactors, isolation transformers, or harmonic suppressors for effective harmonic mitigation. The diode rectifiers shall convert fixed voltage and frequency, AC line power to fixed DC voltage. The power section shall be insensitive to phase rotation of the AC line.

C. For AC Drives rated over 50 Hp, the AC Drive manufacturer shall supply an 18-pulse design using a multiple bridge rectifier with integral reactor and phase shifting transformer. The 18-pulse configuration shall result in a multiple pulse current waveform that approximates near sinusoidal input current waveform. The power section shall be insensitive to phase rotation of the AC line.

2.4 DRIVE PERFORMANCE REQUIREMENTS

A. The VFC shall control the motor speed over the range of 25 percent to 100 percent of base speed without motor forced-cooling accessories.

B. Provide VFC output line voltage conditioning devices such as output reactors, output filters, and motor termination filters, to reduce impulse voltage at the motor terminals to values acceptable for operation of inverter-duty motors having 1500 volt 1 microsecond impulse voltage as defined by NEMA MG 1.

2.5 CONTROLLER PERFORMANCE REQUIREMENTS:

A. Controllers shall be designed for operation with the following performance:

1. Minimum Efficiency: 95 percent at 60 Hz, full load.

2. Minimum Displacement Power Factor: 95 percent.

3. Overload Capability: 110% of continuous current output for 60 seconds; 150% of continuous current output for 3 seconds.

4. Starting Torque: Provide starting boost up to 150%

5. Speed Regulation: Plus or minus 1 percent without tachometer feedback.

B. Controllers shall be equipped with the following internal adjustable functions:

1. Minimum Speed: 5 to 25 percent of maximum rpm.

2. Maximum Speed: 80 to 100 percent of maximum rpm.

3. Acceleration Ramp: 2 to 22 seconds.

4. Deceleration Ramp: 2 to 22 seconds.

5. Current Limit: 50 to a minimum of 110 percent of maximum rating.

6. Slip Compensation: adjustable

7. Skip frequency bands: minimum of three to avoid mechanical equipment critical frequencies

8. Carrier frequency: adjustable

C. Controllers shall have the following self-protection and reliability features:

1. Input transient voltage protection by means of NRTL-listed transient voltage surge suppressors designed to limit transient over-voltages to acceptable limits for

controller reliability. Provide metal enclosure for TVSS and minimize length of wire lead connections to incoming line terminals.

2. Under- and over-voltage trips; inverter over-temperature, overload, and over-current trips.

3. Motor Overload Relay: Adjustable and capable of NEMA 250, Class 10 performance for submersible pump motors and Class 20 performance for standard NEMA frame motors.

4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.

5. Instantaneous line-to-line and line-to-ground over-current trips.

6. Loss-of-phase protection.

7. Short-circuit protection.

8. Motor over-temperature fault (for motors specified with over-temperature protection).

9. Historical Logging Information and Displays:

a. Real-time clock with current time and date.
b. Running log of total power versus time.
c. Total run time.
d. Fault log, maintaining last four faults with time and date stamp for each.

2.6 CONTROLLER ACCESSORIES

A. The following accessories shall be provided:

1. Motor-rated fused disconnect switch with external flange-mounted operating handle, padlockable in the OFF position

2. Five percent incoming line reactor

3. VFC Output Filtering: Provide output line reactors and filtering devices (at motors) for limiting voltage at motor terminal at VFC carrier frequencies to less than the motor impulse voltage rating, if required for the drive application.

2.7 SPECIAL APPLICATIONS

A. Reduced Frequency Output: Reduce motor speed without shutting down VFC during voltage sags and brownouts when VFC input voltage is below normal operating range of VFC.

B. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction.

2.8 FRONT-OF-ENCLOSURE MOUNTED DEVICES:

A. Provide the following devices mounted on the door of the controller enclosure:

1. Status Lights: Door-mounted LED indicators shall indicate the following conditions:

a. Power on
b. Motor Running
c. Fault

2. Operator Control Station:

a. LOCAL-OFF-REMOTE selector switch for start-stop commands
b. LOCAL-REMOTE selector switch for speed reference signals
c. Red START and green STOP pushbuttons
d. Red RUNNING and green STOPPED indicator lights
e. Black RESET pushbutton with shroud for variable frequency fault reset.
f. Black RESET pushbutton for motor overload relay reset (if constant speed bypass is provided).
h. Local speed control potentiometer or keypad RAISE – LOWER speed control.

3. Indicating Devices: Flush-mounted panel meters or digital readout devices to indicate the following controller parameters:

a. Output frequency (Hz).
b. Motor speed (rpm).
c. Motor status (running, stop, and fault).
d. Motor current (amperes).
e. Motor torque (percent).
f. Fault or alarm status (code).
g. Speed feedback signal (percent).
h. DC-link voltage (VDC).
i. Set-point frequency (Hz).
j. Output voltage (V).

2.9 CONTROLS INTERFACE:

A. Remote START and STOP commands shall be Form C (SPDT) dry contacts that close to start the VFD and open to stop it.

B. Remote Signal Inputs: Accept any of the following speed input commands from remote control systems specified in other Divisions:

1. 0 to 10 V dc.
2. 4-20 milliamp DC.
3. Potentiometer
4. Raise-Lower speed digital inputs.
5. RS485.

D. Output Signal Interface:

1. A minimum of one isolated analog output signal (4-20 milliamp DC), which can be programmed to any of the following:

a. Output frequency (Hz).
b. Output current (load).
c. Motor torque (percent).
d. Motor speed (rpm).
e. Set-point frequency (Hz).

E. Remote Status and Alarm Indication Interface: A minimum of one Form C 10 amp 120 V AC dry circuit relay outputs for remote indication of each of the following:

1. RUNNING status (forward and reverse)

2. Controller READY (controller LOCAL-OFF-REMOTE selector switch is in REMOTE, and control power is on, and controller is available for normal operation)

3. SHUTDOWN on fault condition

4. FAULT

F. Digital Communications Interface: Provide an RS485 interface allowing VFC to be used with an external system within a multi-drop LAN configuration. Interface shall allow all parameter settings of VFC to be programmed via BMS control. Provide capability for VFC to retain these settings within the nonvolatile memory.

2.10 FACTORY TEST

A. Each controller shall be factory tested at rated full load current and an ambient temperature of 40 degrees C for a period of not less than 24 hours. If a component fails, it shall be replaced and the test shall be repeated for the full time period.

B. A certified copy of the factory Test Report shall be furnished to the Engineer prior to shipping the controller to the job site.

2.11 WARRANTY

A. Provide parts and labor warranty in accordance with Division 1. In the absence of more stringent warranty requirements, equipment furnished under this Section shall have a minimum 1 year on-site parts and labor warranty.

B. Include contact details (names, addresses, telephone and fax numbers, and email if available) for warranty callbacks with the manufacturer's installation, operation, and maintenance instruction submittal.

C. The manufacturer's standard warranty shall apply in cases where the standard warranty is more favorable to the Owner than the minimum warranty described in Division 1.

PART 3 – EXECUTION

3.1 EXAMINATION PRIOR TO INSTALLATION

A. Inspect areas prepared for VFC installation for compliance with manufacturer's installation instructions, installation tolerances, NEC working clearances, and other conditions affecting performance.

B. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. For freestanding enclosures, anchor each VFC assembly to a concrete equipment pad in accordance with the VFC manufacturer's installation instructions. Attach with stainless steel bolts.

3.3 CONCRETE BASES

A. Coordinate size and location of concrete equipment pad with manufacturer's installation instructions for approved equipment.

B. Concrete materials and installation requirements are specified in Division 3.

3.4 IDENTIFICATION

A. Identify VFCs, components, and control wiring according to Division 16 Section "Electrical Identification".

B. Operating Instructions: Mount engraved plastic sign with simplified normal and emergency operating instructions, including constant speed operation, on front of VFC enclosure five feet above finished floor. Sign shall have white letters on black field. Lettering shall be 1/4-inch minimum height.

3.5 ACCEPTANCE TESTING

A. Manufacturer's Field Service: Engage a factory-authorized service representative to assist in acceptance testing.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports.

1. Perform electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specifications, Section 7.17 Adjustable Speed Drive Systems. Certify compliance with test parameters.

2. Replace damaged and malfunctioning controls and equipment.

C. Remove malfunctioning units, replace with new units, and retest as specified above.

D. Test Reports: Prepare written reports to record the following:

1. Test procedures used.

2. Test results that comply with requirements.

3. Test results that do not comply with requirements and corrective actions taken to achieve compliance with requirements.

3.6 DEMONSTRATION AND TRAINING

A. Engage the services of a factory-authorized service representative to train Owner's maintenance personnel.

B. Upon completion of the work and at a time designated by the Owner, the equipment manufacturer's authorized representative shall instruct the Owner's personnel in the

programming, operation, and maintenance of each type of variable frequency motor controller.

C. A proposed training course schedule and a complete description of each day's training syllabus, hour-by-hour, shall be submitted to the Owner and the Engineer at least 30 days in advance of the proposed training date. All pages of the manufacturer's instructions and recommendations for maintenance, troubleshooting, and parts replacement shall be reviewed during the training course.

-- END OF SECTION --

SECTION 16410

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonfusible switches.
2. Molded-case circuit breakers (enclosed)
3. Molded-case circuit breakers (used in Pump Control Panels)
4. Enclosures.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.

1.3 SUBMITTALS

A. Product Data: For each type of enclosed switch and circuit breaker.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 NONFUSIBLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Suitable for number, size, and conductor material.

2.2 MOLDED-CASE CIRCUIT BREAKERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity as noted on the drawings.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I^2t response.

E. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA 4X, NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Outdoor Locations: NEMA 250, Type 4X.
2. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Comply with NECA 1.

3.2 IDENTIFICATION

A. Comply with requirements in Division 16 Section "Electrical Identification."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 16442

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide panelboards as shown on the Drawings and specified herein.

1.2 RELATED DOCUMENTS

A. Drawings and the General and Special Provisions of the Contract apply to this Section.

B. Transient voltage surge suppressors for panelboards are specified in Division 16 Section "Transient Voltage Surge Suppression".

1.3 GENERAL

A. This Section describes requirements for the following:

1. Distribution panelboards.

2. Lighting and appliances branch-circuit panelboards.

1.4 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. RFI: Radio-frequency interference.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

1.5 SUBMITTALS

A. Conform to the General and Special Provisions.

B. Compliance Statement: With each submittal, include a Compliance Statement listing each Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-paragraph, compliance with the Specification, each minor nonconformity that is within the intent of the Specification, and proposed non-conformities. Provide short description of minor non-conformities, and detailed explanation of other non-conformities.

C. Product Data: For each type of panelboard, overcurrent protective device, transient voltage surges suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

D. Shop Drawings: For each panelboard and related equipment.

1. Dimensions plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
   a. Enclosure types and details for types other than NEMA 250, Type 1.
   b. Bus configuration, current, and voltage ratings.
   c. Short-circuit current rating of panelboards and overcurrent protective devices.
   d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power and control wiring.

E. Panelboard Schedules: For installation in panelboards.

F. Operation and Maintenance Manuals: Conform to the Special Provisions. Include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.7 PROJECT CONDITIONS

A. Conform to the requirements in Division 16 section " Electrical - General".

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.

2. Key all panelboards alike.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.
3. Siemens Energy & Automation, Inc.
4. Square D.

2.2 MANUFACTURED UNITS

A. Enclosures: Flush- and surface-mounted cabinets, as shown on the drawings NEMA PB 1, enclosure type in conformance with Division 16 section " Electrical - General".

1. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, matchbox dimensions; for flush-mounted fronts, overlap box.

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Provide full height piano hinge.

3. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

4. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.

5. The manufacturer's nameplate shall be of corrosion resistant metal such as stainless steel and have the pertinent ratings embossed in raised letters and numerals. The pertinent ratings shall include at least the following; amperage, voltage, phase, wires, AIC, manufacturer and model number.

B. Phase and Ground Buses:

1. Material: Tin-plated hard-drawn copper, 98% conductivity.

2. All busing shall be constructed of the same material.

3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

4. Split Bus: Vertical buses divided into individual vertical sections.

C. Conductor Connectors: Suitable for use with conductor material.

1. Main and Neutral Lugs: Mechanical type.

2. Ground Lugs and Bus Configured Terminators: Mechanical type.

3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

D. Service Equipment Label: UL labeled for use as service equipment for panelboards with main disconnecting means.

E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 DISTRIBUTION PANELBOARDS

A. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

B. Main Device: Main lugs (MLO) or main circuit breaker (MCB), as indicated on the drawings.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Main and Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.7 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.

1. 150 amp frame and smaller: Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits.

2. 225 amp frame and larger: Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug with the following field-adjustable settings:
   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and I^2t response. Provide only where indicated on the drawings.

3. GFCI Circuit Breakers: Single- and two-pole configurations with 5 or 30 -mA trip sensitivity as shown on the Drawings.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

2.8 ACCESSORY COMPONENTS AND FEATURES

A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Fungus Proofing: Permanent fungicidal treatment for panelboard interior, including overcurrent protective devices and other components.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.

B. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

C. Install overcurrent protective devices and controllers.

1. Set field-adjustable circuit-breaker trip ranges.

D. Install filler plates in unused spaces.

E. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 CONNECTIONS

A. Ground equipment according to Division 16 Section "Grounding and Bonding."

B. Connect wiring according to Division 16 Section "Wire and Cable."

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

B. Infrared Scanning: After occupancy, but not more than 90 days after Final Acceptance, perform an infrared scanning of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.

2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

3. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action. Provide a color photo along side an infrared photo of each panelboard in the report.

3.5 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

-- END OF SECTION --

SECTION 16461

DRY TYPE TRANSFORMERS (600V AND LESS)

PART 1 - GENERAL

1.1 SUMMARY

A. Provide energy-efficient dry type transformers (600V and less) as shown on the Drawings and specified herein.

1.2 RELATED DOCUMENTS

A. Drawings and General and Special Provisions of the Contract apply to this Section.

B. Related requirements are specified in the following Sections:

1. Division 16 Section "Grounding and Bonding" for transformer grounding.

1.3 GENERAL

A. This Section describes requirements for dry type distribution and power transformers with primary and secondary windings under 600V.

1.4 DEFINITIONS

A. In addition to the definitions in Division 16 Section “Electrical General Provisions”, the following definitions apply to this Section:

1. AA: air-to-air (dry type, ventilated, self-cooled)
2. AC: alternating current
3. Energy efficient transformer: transformer kVA rating is at lower than maximum temperature rise for a particular insulation class
4. FA: forced-air (cooled)
5. FFA: future forced air (cooled)
6. FCAN: full capacity above normal
7. FCBN: full capacity below normal
8. MOV: metal oxide varistor
9. Standard transformer: transformer kVA rating is at maximum temperature rise for a particular insulation class

1.5 QUALIFICATIONS

A. The manufacturer of the core and coil shall procure all other transformer components, and shall assemble, factory test, and prepare the transformer for shipping.

B. The transformer manufacturer shall have quality certification to ISO 9000:2000 or equivalent.

REFERENCE STANDARDS

A. Comply with the following standards in effect at the time of bid submittal:

1. IEEE C2 National Electrical Safety Code.

2. IEEE 259-1999 IEEE Standard Test Procedure for Evaluation of Systems of Insulation for Dry-Type Specialty and General Purpose Transformers

3. IEEE C57 Family of Guides and Standards for Distribution, Power, and Regulating Transformers, with emphasis on the following:

   a. IEEE C57.12.01-1998 IEEE Standard General Requirements for Dry-Type Distribution and Power Transformers Including Those with Solid Cast and/or Resin Encapsulated Windings
   b. IEEE C57.12.70 IEEE Standard Terminal Markings and Connections for Distribution and Power Transformers
   c. IEEE C57.12.80 IEEE Standard Terminology for Power and Distribution Transformers
   d. IEEE C57.12.91 IEEE Standard Test Code for Dry-Type Distribution and Power Transformers
   e. IEEE C57.96-1999 IEEE Guide for Loading Dry-Type Distribution and Power Transformers
   f. IEEE C57.105-1978 (R1999) IEEE Guide for Application of Transformer Connections in Three-Phase Distribution Systems
   g. IEEE C57.110-1998 IEEE Recommended Practice for Establishing Transformer Capability When Supplying Nonsinusoidal Load Currents

4. NEMA Standard ST-20

5. NEMA Standard TP-1 for Energy-Efficient Transformers

6. NEMA Standard TP-2 for Test Requirements For Energy Efficient Transformers

7. NFPA 70 National Electrical Code 2005

8. UL Standard 1561

9. Other applicable NRTL Standards

1.7 ENVIRONMENTAL CONDITIONS

A. Environmental conditions:

1. Conform to temperature range, humidity range, and elevation specified in Division 16 Section “Electrical - General”.

1.8 SUBMITTALS

A. Submittals shall conform to the General and Special Provisions.

B. Compliance Statement: With each submittal, include a Compliance Statement listing each Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-paragraph, compliance with the Specification, each minor nonconformity that is within the intent of

the Specification, and proposed non-conformities. Provide short description of minor non-conformities, and detailed explanation of other non-conformities.

C. Shop Drawings

1. Compliance Statement

2. Specially prepared shop drawings including the following:
   a. Equipment nameplate data and electrical ratings
   b. Weights and overall dimensions
   c. General arrangement, section view, and sub-assembly drawings cross-indexed to a complete bill of materials listing all components and part numbers
   d. Connection diagrams and details.
   e. Location of field wiring & conduit connections

D. Plans, elevations, sections, and details showing installation dimensions, required clearances for access, operation and maintenance, installation details, and special instructions.

E. Product Data Sheets

1. Technical data sheets, marked to show equipment selected for this project.

1.9 QUALITY ASSURANCE

A. Quality Certification: The transformer manufacturer shall have quality certification to ISO 9000:2000 or an equivalent Quality Management System acceptable to the Engineer. Evidence of certification shall be submitted with equipment shop drawings.

B. Comply with NFPA 70 National Electrical Code requirements, and Reference Standards listed herein.

PART 2 - PRODUCTS

2.1 **MANUFACTURERS**

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton / Cutler-Hammer

2. General Electric

3. Square D / Groupe Schneider NA

2.2 DRY-TYPE DISTRIBUTION AND POWER TRANSFORMERS

A. Dry type distribution transformer[s] shall have the following ratings:

1. kVA ratings as shown on the Drawings, 30 deg. C average, 40 deg. C max. ambient air temperature in accordance with IEEE C57.96-1999

2. 220 deg. C standard insulation system for indoor transformers.

3. Insulation Temperature Rise**:** maximum 115 deg C, maximum rise above 40 deg C., energy-efficient type.

4. Voltage ratings as shown on the drawings.

5. NEMA 2 painted steel enclosure for indoor locations, NEMA 3R painted steel enclosure for outdoor loadcenter locations.

B. Dry-type two-winding transformers shall be in compliance with applicable portions of NEMA ST 20, IEEE C57.12.01, and UL 1562.

C. Dry-type two-winding transformer minimum efficiencies shall comply with NEMA TP1 Table 4-2 requirements. A portion of the Table 4-2 is shown below for reference:

Single Phase kVA	Efficiency	3 Phase kVA	Efficiency
15	97.7%	15	97.0%
25	98.0%	30	97.5%

D. Primary and Secondary Connections: Air terminal compartment with removable door. Tin-plated copper bar with predrilled NEMA spade terminals.

E. Insulation Materials: IEEE C57.12.01, NEMA ST20, non-hygroscopic, thermosetting varnish for indoor transformers, non-hygroscopic vacuum pressure impregnated epoxy for outdoor loadcenter transformers.

F. Core and Coil Assemblies: Transformer coils shall be copper wound on a core of electrical grade steel with high magnetic permeability and insulated laminations. Core and coil assembly shall be mounted on a structural steel base, which shall be isolated from the rest of the structure by vibration pads.

G. Grounding: Provide equipment grounding terminal welded to the core support structural steel. Provide tin-plated braided copper grounding jumpers between the core and coil assembly and the enclosure ground. Provide tin-plated secondary neutral terminal with provisions for connecting a grounding electrode conductor directly to the neutral terminal, and a copper bonding jumper to the transformer equipment (enclosure) ground.

H. The maximum temperature of the top of the enclosure shall not exceed 50 deg. C rise above 40 deg. C ambient.

I. Enclosure shall be fabricated from heavy gauge steel, cleaned, degreased, primed and painted with electrostatic process polyester powder coat, ANSI 61 light gray.

2.3 QUALITY ASSURANCE

A. Factory Tests: Perform design and routine tests according to standards specified for components. Conduct transformer tests according to NEMA ST-20 for standard transformers, and NEMA ST-20 and TP2 for energy-efficient transformers.

2.3 TOUCHUP PAINT

A. Furnish 0.5 pint (250 mL) of touchup paint.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of conduits and grounding systems to verify the following:

1. Wiring entries comply with layout requirements.

2. Entries are within conduit-entry tolerances specified by manufacturer and wiring will not have to cross section barriers to reach load or line lugs.

B. Examine walls, floors, roofs, and concrete equipment pads for suitable mounting conditions where transformers will be installed.

C. Verify that equipment grounding conductors are in place and that requirements in Division 16 Section "Grounding and Bonding" have been met. Maximum ground resistance shall be 5 ohms at transformer.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 DELIVERY, STORAGE, AND HANDLING

A. Store transformers in clean dry indoor rooms with a temporary dehumidifier and electric heating to maintain the storeroom between 5 and 40 deg. C with humidity less than 90%. Comply with manufacturer's additional written instructions for storing and periodic inspection and testing.

B. Transformers shall be megger-tested monthly during storage. Units that have absorbed excessive moisture due to poor humidity and temperature control shall be returned to the manufacturer for drying-out and re-establishing acceptable megger test values at no additional cost to the Owner.

3.3 INSTALLATION

A. Transformers 75 kVA and larger shall be floor-mounted on concrete equipment pads. 45 kVA and smaller transformers shall be floor-, wall-, or ceiling-mounted, as shown on the Drawings. Loadcenter transformers shall be mounted inside the loadcenters.

1. Construct concrete equipment pads of dimensions indicated, but not less than 2 inches larger in both directions than supported unit and 4 inches high.

2. Use 3000-psi , 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete.

3. Install dowel rods to connect concrete equipment pads to structural concrete floor. Unless otherwise indicated on the Drawings, install dowel rods on 12-inch centers around full perimeter of pad. Install epoxy anchor bolts for supported equipment.

4. Place and secure anchorage devices. Use equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

B. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and the NEC.

3.4 CONNECTIONS

A. Ground equipment in conformance with Division 16 Section "Grounding and Bonding".

B. Connect wiring in conformance with Division 16 Section "Wire and Cable".

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

-- END OF SECTION --

DIVISION 17

INSTRUMENTATION

KENTUCKY ENGINEERING GROUP, PLLC

SECTION 17000
SUPERVISORY CONTROL & DATA ACQUISITION SYSTEM

PART 1- GENERAL

1.01 WORK INCLUDED

The Instructions for Bidders, General Conditions, Division 1 of the Specifications and all Contract Documents shall apply and govern the work of all sections in this Division regardless of how the work may be apportioned to various trades or subcontractors.

1.02 SCOPE

A. The Contractor shall furnish all labor and materials and shall install complete and ready for use as shown on the Contract Drawings and specified herein.

B. The Contractor shall provide and install all necessary conduits and instrumentation wiring, whether shown or not, for the telemetry system from the various components (pumps, meters, etc.) at each pump station and make the necessary modifications to the existing system for a complete and functioning installation.

1.03 SUBMITTALS

A. Complete submittal shall be provided to the engineer for approval prior to equipment fabrication. The submittal data shall include the following:

1. Product Data - Provide product data sheets for each instrument and component supplied in the system. The data sheets shall show the component name as used on reference drawings, manufacturer's model number or other product designator, input and output characteristics, scale or ranges selected, electrical or mechanical requirements, and materials compatibility.

2. Shop Drawings - Provide drawings for each panel showing the wiring diagrams for control circuits and interconnections of all components. The drawings shall include wiring diagrams for all remote devices connected to the panel.

3. Panel Layout Drawings - A front panel and sub-panel layout shall be included as part of each control panel drawing. Components shall be clearly labeled on the drawing.

4. Installation Drawings - Typical installation drawings applicable to each site in the system shall be included.

5. Operator Interface Software - The submittal shall include a generic but detailed technical description of the Operator's Interface Software as proposed for this system including:
   - Sample text screens and menus
   - Sample graphics screens
   - Sample report logs and printed graphs

1.04 GUARANTEE

The Contractor shall refer to the article on Guarantees and Warranties in the General Conditions and Special Conditions to determine the extent of his guarantee periods.

1.05 CODES AND STANDARDS

All electrical equipment and details of installations shall comply with the requirements of the latest editions of the National Electrical Code (NFPA-70), the National Electrical Safety Code (ANSI C2) and all State and Local Codes.

1.06 APPROVAL AND MARKING OF EQUIPMENT

Electrical devices and materials shall be listed and/or labeled by the Underwriters' Laboratories, Inc.

1.07 PROTECTION OF ELECTRICAL EQUIPMENT

A. All instruments and equipment shall be designed to operate under the environmental conditions where they are to perform their service. The equipment shall be designed to handle lightning and transient voltages as normal environmental hazards. The environmental conditions are as follows:

1. Outdoor - The equipment will be exposed to direct sunlight, dust, rain, snow, ambient temperatures from -20 to +120 degrees F, relative humidity of 10 to 100 percent, and other natural outdoor conditions. The installations shall be hardened to with stand normal vandalism.

2. Indoor - The equipment will be capable of operating in ambient temperatures of +32 to +130 degrees F and relative humidity of 20 to 100 percent.

B. Electrical equipment shall be protected from the weather, especially from water dripping or splashing upon it, at all times during shipment, storage, and construction. Equipment shall not be stored outdoors even if its enclosure is rated as weatherproof, watertight, etc. Where equipment is installed or stored in moist areas, such as unheated buildings, etc., it shall be provided with an acceptable means of preventing moisture damage such as a uniformly distributed source of heat to prevent condensation.

C. All items shall be stored in a dry sheltered place, not exposed to the outside elements, until ready for installation. All items shall be handled with appropriate care to avoid damage during transport and installation.

1.08 DEFECTIVE OR DAMAGED EQUIPMENT

A. Should it be determined by the Contractor, Owner or Engineer that any equipment or material has been subjected to possible damage by water, it shall be thoroughly dried and put through a dielectric test as directed by the manufacturer, at the expense of the Contractor or shall be replaced by the Contractor without change in contract price. Any equipment found to be marginal or that fails to meet manufacturer's standards shall be replaced at no additional charge to the Owner or Engineer.

B. Any equipment damaged during shipment, while stored, or during construction shall be replaced at the Contractor's expense. Minor scratches on equipment cabinets, etc. may be repaired on site. Any current carrying parts, switch blades, operators, coils, contacts, etc. which are damaged, shall be replaced at no cost to the Owner or Engineer.

1.09 PERMITS AND APPROVALS

A. The Contractor shall obtain all permits necessary. The Contractor shall furnish inspection by an agency licensed or otherwise qualified to perform electrical inspections in the (Commonwealth of Kentucky) Scott County.

B. The Contractor shall notify the Electrical Inspector, in writing, immediately upon the start of the work and A COPY OF THE NOTICE SHALL BE SENT TO THE ENGINEER.

C. All costs incidental to the electrical inspection shall be borne by the Contractor.

D. The Contractor shall furnish certificates of final approval by the Electrical Inspector and FINAL PAYMENT WILL BE WITHHELD UNTIL HE HAS PRESENTED THE ENGINEER WITH THE AFOREMENTIONED CERTIFICATE OF APPROVAL.

1.10 SEQUENCING & SCHEDULING

A. Coordination
The Systems Integrator shall coordinate with other electrical and mechanical work including wires/cables, raceways, electrical boxes and fittings, controls supplied by others, and existing controls, to properly interface installation and commissioning of the control system.

B. Sequence
Sequence installation and start-up work with other trades to minimize downtime and to minimize the possibility of damage and soiling during the remainder of the construction period.

PART 2- - PRODUCTS

2.01 GENERAL

A. All materials and equipment installed shall be new and unused and shall be of the latest design of manufacturers regularly engaged in the manufacture of such products that conform with the requirements of the Contract Drawings and Specifications.

B. These Specifications, the associated Drawings, and other Contract Documents have been prepared with the intention of their yielding, through construction, electrical installations that are fully operable, safe, complete and in full compliance with the latest editions of the National Electrical Code, local codes and ordinances, and any other authority having jurisdiction over the work. The omission of miscellaneous electrical items or accessories not specifically called for in these Contract Documents, which would detract from this intention, shall not relieve the Contractor of the responsibility of furnishing and installing these items and accessories.

2.02 MONITORING RTU & ACCESSORIES / EQUIPMENT

A. The RTU unit has be provide with the required number of analog, digital, and pulse inputs to meet the intent of the specifications and capability of monitoring the parameters listed in the following paragraphs of the section.

B. The monitoring RTU shall be enclosed in a NEMA 4X enclosure.

C. The RTU shall transmit all data and alarms via the Nextel or Sprint wireless data network. Such network(s) shall have 128-bit AES encryption.

D. The RTU shall be powered by 12 volts AC and have a built in battery backup capable of keeping the RTU powered for 24 hours in case of primary AC failure.

E. All terminations inside the RTU enclosure shall be low voltage AC or DC (28 volts or less).

F. The RTU shall be supplied with a U.L. recognized 120 VAC to 12 VAC step down transformer.

G. The RTU shall have the require analog inputs, 10-bit resolution, 4- 20ma or 0-5 vdc inputs, with four (4) alarm thresholds per input. The analog input values shall be transmitted by the RTU to the central monitoring software at least every 2 minutes.

H. The RTU shall have built in AC failure and low battery detection.

I. The RTU shall have the required digital inputs of which up to three (3) shall be capable of recording pump runtimes in one (1) minute resolution. Any change of the RTU digital inputs shall be transmitted to the central monitoring software within 10 seconds of occurrence.

J. The RTU shall have at least three (3) remotely controllable relay outputs that may be controlled at will by the customer.

K. The RTU shall have up to the require pulse counting totalizers of which one can be programmed to report every two (2) minutes.

L. The RTU shall have a built in electronic key or card reader, which can be used to securely put the RTU in/out of alarm reporting mode and/or to accept in progress, alarms.

M. The RTU shall produce an audible noise to indict to the operator that the key or card has been successfully read. The RTU shall be a MISSION Model 800 or equivalent.

2.03 CUSTOMER WEB SITE or OPC COMPLIANT HMI SOFTWARE PACKAGE

A. The RTU shall be capable of reporting alarms and all supervisory information to a password protected customer web site, an OPC compliant customer HMI software package, or both. The web site or HMI software package shall be capable of displaying all RTU alarms and supervisory data. This to include alarms, individuals accepting alarms, RTU electronic key/card reads with user names and time of read, pump running status, pump run times with historical graphs, individual pump flow estimates, automatic daily analysis of pump runtimes for abnormalities with automatic customer notification of such abnormalities, pump starts, hourly analysis of excess pump starts with automatic notifications of excess pump starts, minute-by-minute radio health checks with automatic notification of non-reporting or poorly reporting RTU's, scaled and labeled pulse totalizations and if rainfall gauges are used, inter-day rainfall graphs.

B. The customer web site or HMI software package shall be capable of performing and displaying volumetric inflow calculations from RTU supplied data for each pump cycle as they occur. Such volumetric calculations will utilize real-time pump start/stop data with simultaneously gathered level transducer data to perform the inflow and pump GPM calculations.

C. The customer web site or HMI software package shall be capable of reporting alarms via phone dialup, numeric pager dialup, alphanumeric pager, fax or email or any combination of the above.

D. The customer web site or HMI software shall produce an audit report of every alarm or notification event with accurate results of all notification attempts. The customer web site or HMI software shall produce and deliver weekly reports, which summarize alarms and responses, pump runtimes and flow estimates and all electronic key or card uses at the RTU sites.

2.04 SEWAGE LIFT STATION REQUIREMENTS:

Installation Requirements:
Telemetry to be provided & installed by the Contractor. All equipment & installation shall be compatible with existing GMWSS SCADA System provided by Mission Communications.

The Contractor shall provide all necessary equipment, conduit, and wiring to monitor high water level in the mag meter vault and to provide an alarm via the SCADA system to the master controller for the following stations:

A. Wrights Lane Pump Station
B. Harbor Village Pump Station

The pump control panel shall be furnished with terminal connection leading to the telemetry panel for the following input parameters:

A. Low Water Alarm
B. High Water Alarm
C. High Temperature Pump #1
D. High Temperature Pump #2
E. Pump Failure Alarm
F. Phase Failure Alarm
G. Control Power Failure
H. Pump #1 Run Meter
I. Pump #2 Run Meter
J. Pump #1 Motor Overload
K. Pump #2 Motor Overload
L. Flow Meter **(Wrights Lane Pump Station Only - Future)**

The Contractor shall provide telemetry pump control panels for the following stations:

C. Wrights Lane Pump Station
D. Harbor Village Pump Station

2.05 CIRCUIT LOADS

The Contractor shall verify the total load to be placed on the circuits as well as voltage, phase, frequency and connections required to equipment before rough-in and if they differ from the Plans and Specifications, he shall contact the Engineer immediately for further instructions before the work commences.

2.06 TESTS AND INSPECTIONS

The Contractor shall provide all tests as specified herein and all additional tests necessary to establish the adequacy, quality, safety, completed status, and suitable operation of each system and components thereof. The final inspection will be made after the Engineer is satisfied that the work has been completely installed and that complete preliminary tests were made which indicate the adequacy, quality, completion, and satisfactory operation of the system.

2.07 CONDUIT

A. No conduit smaller than 3/4 - inch shall be used.

B. Rigid Conduit: Rigid conduit shall be standard weight, mild steel pipe. The conduit shall receive a protective zinc coating both inside and outside by means of hot-dip galvanizing. Threads shall not have any coating, which will reduce the conductivity of the joint. Couplings, bends, elbows, fittings, etc., shall be subject to the same requirements as for the straight lengths. All conduit and fittings shall be UL approved. Rigid conduit shall be delivered with plastic protectors on the threads.

C. Electrical Metallic Tubing (EMT): No EMT will be allowed on this project.

D. Liquid tight flexible metallic conduit shall be constructed of flexible or spirally wound galvanized steel enclosed in light gray colored PVC outer jacket. Liquid tight flexible metallic conduit shall be equal to American Brass "Sealtite" Type "UA." Connectors shall be equal to Midwest Type LT.

E. Plastic conduit shall be schedule 40, PVC, rated for use with 90 degree C conductors and for use in direct sunlight, with chemical weld joints. This Contractor shall provide all fittings, adapters, etc., required for a complete installation as shown on the Drawings.

2.08 WIRE AND CABLE

A. All conductors shall be insulated so that they are rated at 600 volts.

B. No conductors smaller than AWG No. 12 shall be used except for signal or control systems, or where otherwise indicated.

C. All conductors shall be soft drawn, 98% conductivity copper conforming to the latest ASTM Specifications and the requirements of the National Electrical Code.

D. Single conductors shall be insulated with THW insulation and all conduits shown on the Drawings are sized accordingly. At the Contractor's option, THWN insulation may be substituted.

2.09 GROUNDING

A. The resistance value of the main grounding conductor measured between the main switchgear and a good earth ground shall not exceed twenty-five (25) ohms.

B. Ground Rods: Ground Rods shall be the copper clad steel type and shall be a minimum of 8 feet in length, 5/8 inch in diameter. Ground rods shall be equal to those as manufactured by Copperweld Steel Co.

C. Grounding electrode conductors shall be bare copper. Equipment grounding conductor shall be copper, THW insulated, green (or green with yellow tracer) in color, and rated at 600 volts.

D. Ground clamps for use on metallic pipes shall be of copper, brass or silicon bronze with a rigid metal base providing good contact by proper seating on the pipe. Strap type clamps shall not be used.

2.10 POWER DISTRIBUTION

A. All circuit breakers in the control panels shall be equal to Square D, Type Q0, Q0B, Q1, or Q1B and of the size as shown on the Drawings. Two- and 3-pole breakers shall be factory assembled in one molded case. ATTACHMENTS WHICH TIE TWO OR THREE SINGLE POLE BREAKER HANDLES TOGETHER WILL NOT BE ACCEPTABLE.

B. Safety switches shall be heavy-duty, load break type with a quick-make, quick-break, switch mechanism, in a NEMA 3R enclosure. Padlocking capability shall be provided for locking the switch either in the closed (On) position or open (Off) position. Fuse clips shall be rejection type. Switches shall be provided with a cover-blade interlock so that the cover cannot be opened when the switch blades are closed, nor can the switch blades be closed with the cover open. Interlock bypassing devices shall be included for use by authorized personnel.

C. The Contractor shall provide fuses for actual load installed. Unless otherwise indicated on the Drawings, all fuses shall be non-renewable, current limiting, dual element, time-lag type. The fuses shall have an interrupting capacity of at least 100,000 amperes RMS symmetrical.

PART 3 - EXECUTION

3.01 INSTALLATIONS

A. Excavation, Backfilling and Grading:

1. The Contractor shall perform all earth and rock excavation, backfilling and grading required for this part of the work. Rock excavation shall be made to a depth of 4 inches below pipe and filled to subgrade with dense graded aggregate limestone. After the bid is submitted, there will be no additional funds forthcoming for excavation work on this project. All excavation shall be bid as unclassified.

2. Trenches shall be maintained free of water until backfilling is completed.

3. Backfilling material in earth excavation shall be clean earth to a line at least 12 inches above the top of the conduit. From this line upward, rock not more than 6 inches in diameter may be used provided it is spaced at least 12 inches apart. Filling between rock shall be of clean earth, thoroughly tamped in 6 inch layers to the finished grade. All surplus rock and earth shall be removed from the site as directed by the Engineer.

4. Depth of bury for all conduit shall be as shown on the Drawings but a minimum of 24 inches below finished grade.

B. Conduit:

1. Rigid steel conduit shall be used for the 600 volt and below circuits for emergence from underground. Schedule 40 PVC shall be used underground. Adapters shall be used and rigid steel extended above grade from PVC that is installed underground or below slab-on-grade. PVC shall not be used where exposed on the exterior nor where exposed to direct sunlight. Conduit shall be installed so as to insure against trouble from the collection of trapped condensation. This Contractor shall plan his work so that runs of conduit miss equipment by other trades. Conduit bushings shall have insulating material which has been permanently fastened to the fittings. Bushings for conduit 1-1/2 inches trade size and larger shall be complete with grounding lug and shall be bonded to the box by means of bare copper wire. All field bends shall be made with standard tools and bending equipment manufactured especially for this purpose. Bends in metallic conduit shall be made while cold and in no case shall the conduits be heated. Conduits shall not be bent through more than 90 degrees. Size of conduits shall not be less than that required by the National Electrical Code. The Contractor shall install larger size conduits than detailed where there is more than 100 feet of unbroken run or where the total of the angles through which the conduit has been bent during a single run exceeds 270 degrees.

2. All conduit shall be run continuous between outlets with a minimum number of bends. Back-to-back 90 degree bends (180 degree change of direction) will not be acceptable. During construction, all new conduits shall be kept dry and free of moisture and debris. Before the wire is pulled in, all conduits shall be swabbed to clear all moisture and debris which may have unavoidably accumulated. Rigid conduits, where they entered panelboards, cabinets, pull boxes or outlet boxes shall be secured in place by galvanized, double locknuts (one inside and one outside) motor terminal boxes or other vibrating equipment to outlet or device boxes or to conduit.

C. Wire and Cable:

1. Direct Burial Cable: No cable buried directly in the earth, not in raceway will be allowed on this project.

2. Wire shall not be installed until all work of any nature that may cause injury to the wire is completed. Mechanical means shall not be used in pulling in wires No. 8 or smaller. Approved wire pulling lubricant shall be used as required to prevent insulation damage and overstressing of the wire while pulling through conduit. In no case shall conductors be greased or coated with any substance injurious to the conductor insulation or sheath.

3. All wires connected to terminal boards, terminal blocks, or to other similar terminals shall terminate by means of pressure terminals. Where terminal boards, terminal blocks, etc. are designed and manufactured to accept bare wire and have a pressure plate on each side of the wire, no pressure terminals on the wire will be required. Where the wire would have to encircle the holding screw to make a proper connection, the wire terminals are required.

4. Where the wire is shown larger than that required for the load, it is done so for voltage drop or other purposes and must be installed as shown. Where the wire is stranded, the removal of strands in order to install the wire into a lug provided on any equipment will not be permitted. A larger lug shall be installed which will accept the wire size indicated.

5. All splices made in exterior pull or junction boxes including any concrete pull boxes or hand holes shall be made waterproof and shall be made with a splicing kit containing materials approved for making waterproof splices. Splice kits shall be as manufactured by 3M Company and properly sized for the wire being spliced. Kits shall employ the use of a pourable resin. The use of only a shrink type sleeve will not be acceptable.

6. Each wire shall be labeled at both termination points. Individual conductor or circuit identification shall be carried throughout, with circuit numbers or other identification clearly stamped on terminal boards and printed on directory cards in cabinets.

7. In all junction boxes, cabinets, control compartments and terminal boxes where no terminal board is provided, each wire, including all power wires, shall be properly identified by plastic coated, self-adhesive, wire marker. In cases similar to the above where the terminal boards are provided for the control, indicating, and metering wires, all wires including motor leads and other power wires shall be identified by wire markers as specified above. Equipment ground wire insulation shall be colored green or green with two or more yellow stripes. In general and unless otherwise shown on the drawings, no two wires of the same color shall be run in the same conduit except such as control wiring, switch legs, neutral, and ground. Where a conduit run is shown on the drawings to have two or more wires connected to the same phase and, therefore, are the same color, pressure sensitive, plastic marked wire marker identification tape shall be used wherever the wire is accessible (junction boxes, panels, device boxes, etc.).

8. Insulation on ungrounded conductors larger than AWG #10 and on grounded (neutral) and grounding (equipment ground) conductors larger than AWG #6 may be black with color coding accomplished with the use of colored plastic tape. Tape shall be installed on the conductors wherever they are visible and shall be wrapped at least three (3) turns around the conductor.

9. All wiring on this project, except control wiring, shall reflect the phase relationship as follows: black, red and blue for ungrounded conductors, white for neutral conductors.

D. Boxes, Cabinets and Enclosures: Boxes, cabinets shall be mounted using a steel channel equal to Unistrut or Kindorff support bracket.

E. Grounding:

1. Ground rods shall be driven vertically into the earth to at least one foot below finished grade. Where rock is encountered at a depth of less than four (4) feet, rods shall be buried in a trench at not less than two feet below finished grade.

2. Connections to ground rods and all other ground connections below grade shall have a MINIMUM mechanical contact surface area between the conductor and the ground rod of not less than three (3) square inches. All connections made below finished grade shall be exothermic. Installation of grounding conductors shall be such that they are not exposed to physical damage. All connections shall be firm and tight.

3. All metal electrical equipment cabinets (wireways, panels, device boxes, junction and pull boxes, etc.) shall be securely bonded to a grounding conductor running through any conduit terminating at the cabinet or enclosure by use of a grounding lug bushing and jumper wire to the enclosure wall. Control cabinets shall be provided with an equipment ground bus (including lugs or screw terminals) securely bonded to the enclosure. Junction boxes and other enclosures shall utilize an equipment ground bus or lug as required to securely bond the equipment grounding conductor to the enclosure. The grounding conductor shall be connected with pressure connectors at the main switchgear to the main grounding system. Where screw terminals or set screw lugs are used, sufficient lugs shall be provided such that not more than one conductor is installed into each lug or terminal.

4. No flexible conduit shall serve as a grounding conductor.

5. Where lightning arresters are furnished and installed either separately or with equipment and the grounding connections are not inherently provided, a suitable, separate, grounding conductor shall connect the lightning arrester with a separate ground rod. This rod shall be interconnected with any adjacent grounding system.

PART 4 - ELECTRICAL FIELD ACCEPTANCE TESTS

4.01 WORK INCLUDED

After the electrical installation is complete, tests shall be made to demonstrate that the entire system is in proper working order and in accordance with the Drawings and Specifications. The tests outlined herein shall be in addition to, and not substitution for, the tests of the individual items at the manufacturer's plant. Insulation and ground resistance tests shall be made before operating tests.

4.02 DEFECTIVE EQUIPMENT

All wiring and equipment found defective or failing to meet the specified requirements shall be replaced by the Contractor without charge, unless written permission for repair is given by the Engineer.

4.03 OPERATING TESTS

A. Switches, Circuit Breakers, and Control Devices: All switches, circuit breakers and control devices shall be operated to show correct and satisfactory operation.

B. Controls: Controls circuits shall be fully operated with the power circuits to the motors de-energized to assure proper sequence and operation before the system is energized.

C. Equipment shall be operated as nearly as possible under normal operating conditions for as long as reasonable and for a length of time sufficient to demonstrate correct alignment, temperature rise, speed, and satisfactory operation.

4.04 INSULATION RESISTANCE TESTS

Each complete feeder and branch circuit of 600 volts or less, with everything but power supply and power-consuming equipment, connected thereto, shall be tested and shall have an insulation resistance between conductors, between each conductor and ground, and between each conductor and any metallic conduit enclosing of not less than 1,000,000 ohms unless otherwise accepted by the Engineer.

4.05 GROUND RESISTANCE TESTS

The Contractor shall test each entire grounding system for continuity of connections and for resistance. The ground resistance of conduits, equipment cases, and supporting frames shall not vary appreciably from that of the system as a whole and shall not exceed 25 ohms.

4.06 WITNESS

The Engineer shall be notified at least seven (7) calendar days in advance of each of the tests covered in this section of the Specifications so that he may arrange to witness the tests.

4.07 TEST RECORDS

Report: A record of all tests shall be delivered to the Engineer before final acceptance will be forthcoming.

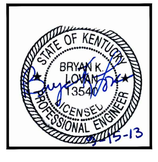
- END OF SECTION -

2013 WASTEWATER SYSTEM IMPROVEMENTS

US 25 - WRIGHTS LANE PUMP STATION and FORCE MAIN

FOR THE

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
GEORGETOWN, KENTUCKY
SEPTEMBER, 2013



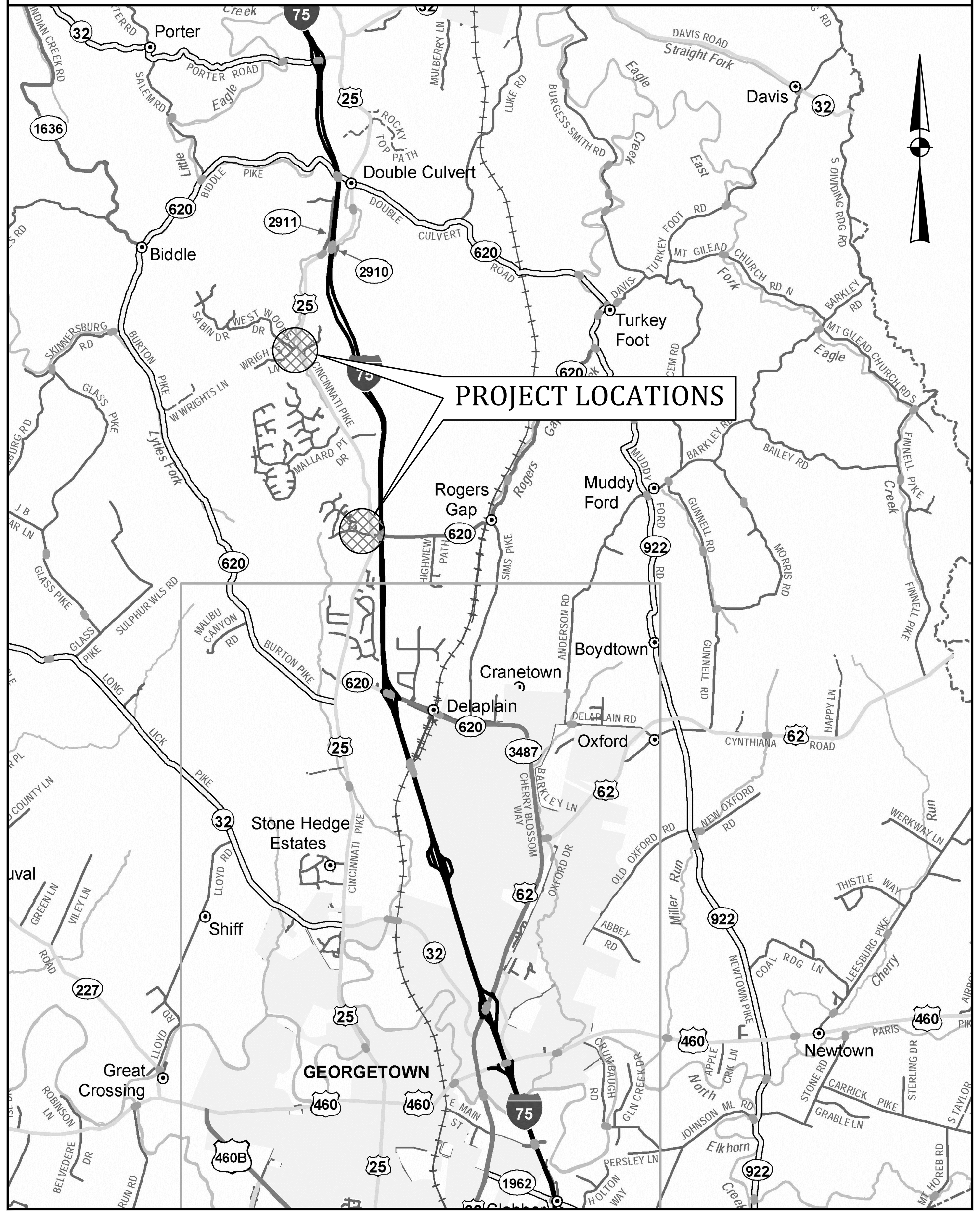
P.O. Box 1034
VERSAILLES, KENTUCKY 40383
KENTUCKY ENGINEERING GROUP, PLLC

PROJECT NO. 13009

SET NO. _____

P:\PROJECTS\GMWSS\13009-US 25, Wright Lane Pump Station\DWG\13009-C000.dwg

LOCATION MAP - NOT TO SCALE



INDEX OF DRAWINGS

LEGEND

—— – – ——	PROPERTY LINE
EOP	EDGE OF PAVEMENT
INV.	INVERT
STA.	STATION
EX./EXIST.	EXISTING
M.H.	MANHOLE
(WT)	WATER TIGHT
P.P.	POWER POLE
CAVV	COMBINATION AIR AND VACUUM RELEASE VALVE
⬡ G	GRINDER PUMP STATION
———	PROPOSED FORCE MAIN
—●—	PROPOSED SANITARY SEWER
—△—	PROPOSED COMBINATION AIR AND VACUUM RELEASE VALVE
———	EXISTING UTILITIES
●	PROPOSED MANHOLE
○	EXISTING MANHOLE
⬤	PROPOSED PUMP STATION
—►—	DIRECTION OF FLOW
⬡ 2	PLAN SHEET NUMBER
▭	PLAN SHEET COVERAGE

UTILITIES

BUD - Before You Dig
1-800-752-6007
or DIAL 811

NOTE:

IN ACCORDANCE WITH KENTUCKY STATE LAW, ANY ACTIVITY THAT RESULTS IN MOVEMENT, PLACEMENT, BORING, PROBING OR DIGGING IN OR ON THE GROUND SHALL CONTACT THE ONE CALL CENTER FOR UNDERGROUND UTILITY LOCATIONS.

P:\PROJECTS\GMWSS\13009-US 25_Wright Lane Pump Station\DWG\13009-G01.dwg KEG 9/18/13

NO.	DATE	REVISIONS	BY

DATE:	SEPTEMBER 2013
PROJECT MGR:	BKL
DRAWN BY:	CDS
CHECKED BY:	BKL
SCALE:	AS NOTED

KENTUCKY ENGINEERING GROUP, PLLC
P.O. Box 1034
VERSAILLES, KENTUCKY 40383

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
125 WEST CLINTON STREET
P.O. BOX 640
GEORGETOWN, KENTUCKY 40324

2013 WASTEWATER SYSTEM IMPROVEMENTS
US 25 - WRIGHTS LANE PUMP STATION and FORCE MAIN

LOCATION MAP, INDEX OF DRAWINGS, LEGEND and UTILITIES

STATE OF KENTUCKY — BRYAN K. LOVAN — 13540 — LICENSED PROFESSIONAL ENGINEER — 9-15-13

PROJECT NO. 13009

SHEET NO. G-1 OF 18

WATER LINE CONSTRUCTION NOTES

1. THE CONTRACTOR SHALL CONTACT ALL UTILITY COMPANIES PRIOR TO ANY EXCAVATION OR WORK NEAR THEIR LINES.
2. ALL EVIDENT UTILITIES ARE SHOWN. HOWEVER, IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD LOCATE ALL EXISTING UTILITIES WITHIN THE CONSTRUCTION LIMITS BEFORE BEGINNING CONSTRUCTION OPERATIONS. THE CONTRACTOR, AT NO ADDITIONAL EXPENSE TO THE OWNER AND/OR ENGINEER, SHALL REPLACE ANY EXISTING UTILITIES DISTURBED DURING CONSTRUCTION.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGES TO UTILITIES OCCURRING AS A RESULT OF THE CONSTRUCTION.
4. THE CONTRACTOR SHALL PROVIDE TEMPORARY COVER OR EROSION CONTROL TO ALL AREAS DISTURBED BY CONSTRUCTION AND SHALL GRADE AND SEED UPON COMPLETION OF THAT WORK.
5. THE CONTRACTOR SHALL IMPLEMENT ADEQUATE SOIL STABILIZATION PROCEDURES AND MULCHING TO SLOPES EXCEEDING 4:1 TO PREVENT EROSION OR LANDSLIDE.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY UNEXPECTED DAMAGES TO EXISTING AND PROPOSED STRUCTURES AND ROADWAY DURING CONSTRUCTION.
7. THE CONTRACTOR SHALL BE SOLELY LIABLE FOR ANY WORK PERFORMED OUTSIDE OF LEGAL EASEMENTS S OR CONSTRUCTION LIMITS.
8. THE CONTRACTOR SHALL BE LIABLE FOR ALL INJURIES OCCURRING TO WORKERS OR OTHERS DUE TO MISHANDLING OR SUBSTANDARD SAFETY PROCEDURES DURING CONSTRUCTION.
9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADEQUATE TRAFFIC CONTROL AND SAFETY DURING CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTENANCE OF TRAFFIC IN ACCORDANCE WITH CITY, COUNTY, AND STATE REQUIREMENTS.
10. EXCESS MATERIALS AND DIRT RESULTING FROM CONSTRUCTION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO DISPOSE OF OR REMOVE.
11. AREAS BEYOND THE CONSTRUCTION AREAS SHOWN BY THE DESIGN PLANS SHALL NOT BE DISTURBED UNLESS AUTHORIZED BY THE OWNER OR ENGINEER ON SITE.
12. A RECONSTRUCTION OF ANY SECTION(S) OF THE PROJECT RESULTING FROM FAILURE TO FOLLOW PLANS OR WORK SCHEDULE AS PLANNED SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
13. THERE SHALL BE NO PAY ITEM FOR EXTRA ROCK EXCAVATION.
14. ALL CONNECTIONS MUST BE STRICTLY COORDINATED WITH GMWSS.
15. NO PAY ITEM FOR EXTRA TRENCH DEPTH HAS BEEN SET UP. CONTRACTOR SHALL INCLUDE THE COST OF ADDITIONAL DEPTH IN HIS UNIT PRICE WHEN THE WATER LINE CROSSES UNDER AN EXISTING UTILITY, CULVERT, OR DRAINAGE DITCH.
16. FINAL LOCATION OF SERVICES, AIR RELEASE VALVES, METER BOXES, AND HYDRANT ORIENTATION ARE TO BE FIELD LOCATED DURING CONSTRUCTION AND APPROVED BY THE ENGINEER.
17. UNLESS OTHERWISE NOTED, A SEPARATE BID ITEM HAS NOT BEEN ESTABLISHED FOR FITTINGS. THE FITTINGS INCLUDED BUT NOT LIMITED TO ARE: TEES, BENDS, PLUGS, REDUCERS, SADDLES, CROSSES, COUPLINGS, ETC. CONTRACTOR SHALL INCLUDE THE COST OF THESE ITEMS IN THE UNIT PRICE FOR THE PIPE.
18. NEW CUSTOMER SERVICES – ACTUAL LOCATIONS OF RELOCATED SERVICES WILL BE LOCATED IN THE FIELD BY THE OWNER AND/OR GMWSS.
19. CONTRACTOR SHALL MAINTAIN A CURRENT SET OF CONSTRUCTION PLANS ON THE JOB SITE DURING ALL PHASES OF CONSTRUCTION.
20. PROVIDE 30" MINIMUM COVER FOR ALL WATER LINES PLACED IN UNPAVED AREAS. UNDER NO CIRCUMSTANCES SHALL COVER DEPTHS BE GREATER THAN 5 FEET WITHOUT GMWSS APPROVAL.
21. ALL CONSTRUCTION AND INSTALLATION OF MATERIALS BEING USED SHALL BE IN CONFORMANCE WITH THE PLANS PREPARED BY THE ENGINEER. SUBSTITUTION AND DEVIATION SHALL BE PERMITTED ONLY WHEN WRITTEN APPROVAL HAS BEEN ISSUED BY THE ENGINEER.
22. ALL DUCTILE IRON PIPE SHALL BE CLASS 50, CONFORMING TO LATEST A.W.W.A. SPECIFICATIONS. ALL PVC PIPE SHALL BE MINIMUM SDR 21, EXCEPT C900 PVC PIPE SHALL BE DR14.
23. UPON COMPLETION OF CONSTRUCTION, DISINFECTION SHALL BE STRICTLY IN ACCORDANCE WITH THE PROCEDURE DESIGNATED IN THE STATE REGULATIONS, WHICH READS AS FOLLOWS:
"ALL NEW WATER DISTRIBUTION SYSTEMS INCLUDING STORAGE DISTRIBUTION TANKS AND REPAIRED PORTIONS OF, OR ALL EXTENSIONS TO EXISTING SYSTEMS SHALL BE THOROUGHLY DISINFECTED BEFORE BEING PLACED IN SERVICE, BY THE USE OF CHLORINE OR CHLORINE COMPOUNDS IN SUCH AMOUNTS AS TO PRODUCE A CONCENTRATION OF AT LEAST FIFTY (50) PPM AND A RESIDUAL OF AT LEAST TWENTY–FIVE (25) PPM AT THE END OF 24 HOURS AND FOLLOWED BY THOROUGH FLUSHING."
24. NEW OR REPAIRED WATER DISTRIBUTION LINES SHALL NOT BE PLACED INTO SERVICE UNTIL BACTERIOLOGICAL SAMPLES TAKEN AT THE POINTS SPECIFIED IN 401 KAR 8:150 SECTION 4 ARE EXAMINED AND ARE SHOWN TO BE NEGATIVE FOLLOWING DISINFECTION.
25. ANY WATER MAIN TO BE INSTALLED IN FILL AREAS SHALL REQUIRE THE OWNER/DEVELOPER TO PROVIDE INSPECTION AND TESTING SERVICES BY A REGISTERED GEOTECHNICAL ENGINEER TO ENSURE THAT EACH LIFT IN THE PROPOSED TRENCH AREA WAS CONSTRUCTED AND COMPACTED TO 95% STANDARD PROCTOR DENSITY FROM BOTTOM OF FILL TO 30 INCHES ABOVE TOP OF PIPE. COPIES OF ALL TEST AND INSPECTION REPORTS SHALL BE CERTIFIED BY THE GEOTECHNICAL ENGINEER AND SUBMITTED TO GMWSS PRIOR TO PIPE INSTALLATION.
26. THE CONTRACTOR SHALL FURNISH AND INSTALL FIRE HYDRANTS WHERE SHOWN ON THE PLANS. HYDRANTS SHALL CONFORM IN ALL RESPECTS TO THE REQUIREMENTS OF A.W.W.A. C502–703. HYDRANTS SHALL BE MUELLER A–423 OR KENNEDY K81D. HYDRANTS SHALL BE DESIGNED FOR 150 PSI WORKING PRESSURE AND SHOP TESTED TO 300 PSI PRESSURE WITH MAIN VALVE BOTH OPENED AND CLOSED. UNDER TEST THE VALVE SHALL NOT LEAK.
27. ALL DOUBLE METER SERVICES ACROSS THE STREET OPPOSITE THE WATER MAIN ARE TO BE 1" PE TUBING ENCASED IN 2" PVC AND SET ON THE PROPERTY LINE TO SERVE TWO LOTS. SERVICE LINE CROSSING MUST HAVE A VALVE ON THE CUSTOMER END AND CORPORATION STOP TURNED ON. GMWSS WILL SET THE TUB, SETTER, AND METER WHEN CUSTOMERS CALL FOR SERVICE.
28. SINGLE METER SERVICES ACROSS THE STREET OPPOSITE WATER MAIN ARE TO BE ¾" PE TUBING ENCASED IN 2" PVC CASING PIPE.
29. ALL PVC WATER PIPE AND 2" CASING PIPES SHALL HAVE A TRACER WIRE (COPPER–SINGLE STRAND INSULATED WIRE, 12 GAUGE) TAPED TO THE LINE. SPLIT BOLT CONNECTORS SHALL BE USED AT EACH SPLICE.
30. FITTINGS SHALL BE CAST IRON MECHANICAL JOINT CLASS 250 CONFORMING TO A.W.W.A. SPECIFICATIONS C110 FOR SHORT BODY CAST FITTINGS.
31. ALL WATER AND SEWAGE FACILITIES DESIGNED HEREIN SHALL CONFORM TO THE MATERIALS, SPECIFICATIONS, CONSTRUCTION METHODS, AND STANDARD DETAILS CONTAINED IN THE WATER SYSTEM AND SEWAGE SYSTEM IMPROVEMENT SPECIFICATIONS MANUAL (LATEST EDITION). IN CASE OF CONFLICTS WITH THE PROJECTS WRITTEN SPECIFICATION OR STANDARD DETAILS, THE MORE STRINGENT SHALL APPLY. GMWSS WILL MAKE THE FINAL DECISION IN EACH CASE.
32. WATERLINES CROSSING SEWER OR STORM DRAIN PIPE MUST BE ENCASED IN STEEL OR DUCTILE IRON PIPE. ENCASEMENT PIPE MUST BE AT LEAST 4 INCHES LARGER THAN CARRIER PIPE.
33. THE CONTRACTOR SHALL INSTALL A TWO INCH BY FOUR INCH (2"x4") BY FIVE (5) FOOT TALL ABOVE GRADE, WOOD LOCATION POST AT THE ENDS OF ALL WATER LINES, INCLUDING WATER MAINS AND WATER SERVICE CONNECTIONS, SO AS TO IDENTIFY THE TERMINATION POINT OF THE LINE. THE LOCATION POST SHALL BE PAINTED BLUE AND MARKED SO AS TO IDENTIFY THE PIPE AS A WATER LINE. THE BOTTOM OF STAKES SHALL BE AT THE DEPTH OF STUB.
34. AFTER INSTALLATION AND PRIOR TO TESTING, THE COMPLETE WATER SYSTEM (INCLUDING ALL MAINS, SERVICES, HYDRANTS, BLOW–OFFS, AIR RELEASE VALVES AND ALL OTHER APPURTENANCES) SHALL BE THOROUGHLY CLEANED TO REMOVE ALL FOREIGN MATTER. GMWSS SHALL BE NOTIFIED AT LEAST 48 HOURS PRIOR TO CLEANING ACTIVITIES.
THE CLEANING OF THE PIPING SYSTEM SHALL BE ACCOMPLISHED BY THE CONTROLLED AND PRESSURIZED PASSAGE THROUGH THE SYSTEM OF A SERIES OF HYDRAULIC OR PNEUMATIC POLYURETHANE PLUGS. A POLY PIGGING PLAN SHALL BE APPROVED BY GMWSS AND ALL PIGGING OF LINES MUST BE WITNESSED BY THE GMWSS INSPECTOR. THE POLY PIGS SHALL BE REMOVED AND DISCHARGED FROM THE SYSTEM AT A POINT NEAR TO THE END OF THE SYSTEM. THE CONTRACTOR MUST DEMONSTRATE TO GMWSS THAT THIS WORK WILL BE PERFORMED BY EXPERIENCED SUPERVISORS AND PERSONNEL WHO HAVE PROVIDED THE CLEANING SERVICE OF COMPARABLE SYSTEMS.
35. WATER MAINS SHALL BE TESTED AT 150 P.S.I. IN ACCORDANCE WITH AWWA C600. TEST PRESSURE SHALL NOT VARY BY MORE THAN 5 PSI DURING THE MINIMUM TEST DURATION OF 2 (TWO) HOURS. LEAKAGE ALLOWABLE SHALL BE WITHIN THE LIMITS SET FORTH IN THE LATEST EDITION OF THE GEORGETOWN MUNICIPAL WATER AND SEWER SYSTEM SPECIFICATIONS MANUAL.
36. ON STREETS WHERE CURBS ARE REQUIRED, WATER LINES SHALL NOT BE INSTALLED UNTIL CURBS ARE CONSTRUCTED
37. CONTRACTORS SHALL NOTIFY GMWSS WHEN THERE IS A NEED TO FILL OR ISOLATE WATER LINES. WATER DISTRIBUTION SYSTEM VALVES SHALL ONLY BE OPERATED BY GMWSS PERSONNEL.

CONTAMINATION PREVENTION REQUIREMENTS

1. ALL PIPING, VALVES, FITTINGS, ETC. DELIVERED TO THE JOB SITE SHALL BE STORED ELEVATED ABOVE THE GROUND AND SHALL BE COVERED WITH PLASTIC, TARPS OR SIMILAR MEANS TO PROTECT FROM EXPOSURE TO DUST AND DEBRIS.
2. ALL PIPING, FITTINGS AND VALVES SHALL BE THOROUGHLY CLEANED OF DUST, DIRT AND DEPOSITS BY SWABBING OR OTHER MEANS ACCEPTABLE TO GMWSS. EACH COMPONENT SHALL BE CLEANED ON THE SAME DAY IT IS TO BE INSTALLED.
3. ALL OPENINGS IN THE PIPELINE SHALL BE CLOSED WITH AN APPROVED WATERTIGHT PLUG AT THE END OF EACH DAY WHEN PIPE LAYING HAS STOPPED, OR FOR OTHER REASONS SUCH AS REST OR MEAL BREAKS.

SAFETY NOTE:

1. ALL CONSTRUCTION MUST COMPLY WITH ALL LOCAL SAFETY CODES AND OSHA REGULATIONS.

WATER AND SEWER TESTING NOTE:

1. ALL WATER AND SEWER TESTING SHALL BE SCHEDULED WITH GMWSS RESIDENT INSPECTORS AND THE ENGINEERS/DEVELOPERS FIELD INSPECTORS A MINIMUM OF 48 HOURS PRIOR TO TESTING.

SANITARY SEWER CONSTRUCTION NOTES

1. ALL GRAVITY SEWER PIPE SHALL BE 8" PVC SDR 35, UNLESS NOTED OTHERWISE. ALL PVC PIPE SHALL MEET THE ASTM SPECIFICATION D 3034, TYPE PSM. ALL FORCE MAIN PIPE SHALL BE SDR–21
2. ALL BURIED PVC PIPE SHALL HAVE A NON–METALLIC LOCATOR TAPE LAID 2 FEET ABOVE THE PIPE LINE. THE TAPE SHALL HAVE THE WORD "CAUTION" PRINTED ON IT AND SHALL IDENTIFY THE PIPE AS A SEWER LINE.
3. DUCTILE IRON PIPE IS REQUIRED WHERE LINE CROSSES A STREAM AND WHERE REQUESTED BY GMWSS. THIS DUCTILE IRON PIPE SHALL CONFORM TO ASTM–A–746. FITTINGS FOR D.I. PIPE SHALL BE MECHANICAL JOINT CLASS 250 GRAY IRON CONFORMING TO ANSI A21.10 AND AWWA C110. ALL DUCTILE IRON PIPE SHALL BE LINED WITH PROTECTO 401 CERAMIC EPOXY LINING.
4. ROOF DRAINS, FOUNDATION DRAINS, SUMP PUMP DRAINS AND ALL OTHER CLEAN WATER TO THE SANITARY SEWER ARE PROHIBITED. NO BUILDING SHALL BE CONNECTED TO A SEWER LATERAL UNTIL THE BUILDING IS UNDER ROOF.
5. ALL MANHOLES SHALLOWER THAN 5 FEET SHALL BE CONSTRUCTED WITH A FLAT TOP. A STANDARD MANHOLE SHALL BE USED EVERYWHERE ELSE.
6. ALL MATERIALS, CONSTRUCTION METHODS AND TESTING PROCEDURES SHALL BE IN CONFORMANCE WITH GMWSS IMPROVEMENT SPECIFICATION MANUAL (LATEST EDITION).
7. SHOULD DUCTILE IRON PIPE BE PROPOSED IN AN AREA AND CORROSIVE SOILS ARE ENCOUNTERED, THE PIPE SHALL BE PROTECTED BY AN 8 MIL THICK POLYETHYLENE ENCASEMENT MEETING THE REQUIREMENTS OF ANSI A21.5.
8. CONTRACTOR IS RESPONSIBLE FOR ALL TESTING REQUIRED FOR APPROVAL AND ACCEPTANCE OF SANITARY SEWERS.
9. SANITARY SEWER TOP OF RIM ELEVATIONS TO BE DETERMINED BY ENGINEER AFTER GRADING IS COMPLETED.
10. THE CONTRACTOR SHALL INSTALL A TWO INCH BY FOUR INCH (2"x4") BY FIVE (5) FOOT TALL ABOVE GRADE, WOOD LOCATION POST AT ALL SANITARY SEWER PLUGS, INCLUDING SEWER MAIN AND SEWER SERVICE LATERAL CONNECTIONS, SO AS TO IDENTIFY THE TERMINATION POINT OF THE LINE. THE LOCATION POST SHALL BE PAINTED GREEN AND MARKED SO AS TO IDENTIFY THE SANITARY SEWER LINE. THE BOTTOM OF STAKES SHALL BE AT THE DEPTH OF THE STUB.
11. DOWNSTREAM MANHOLE RIM ELEVATIONS SHALL BE ONE (1) FOOT BELOW THE LOWEST FINISHED FLOOR ELEVATION OF ANY STRUCTURES CONNECTED TO THE UPSTREAM SEWER LINE.
12. ALL WATER AND SEWAGE FACILITIES DESIGNED HEREIN SHALL CONFORM TO THE MATERIALS, SPECIFICATIONS, CONSTRUCTION METHODS, AND STANDARD DETAILS CONTAINED IN THE WATER SYSTEM AND SEWAGE SYSTEM IMPROVEMENT SPECIFICATION MANUAL, LATEST EDITION. IN CASE OF CONFLICTS WITH THE PROJECTS WRITTEN SPECIFICATIONS OR STANDARD DETAILS, THE MORE STRINGENT SHALL APPLY. GMWSS WILL MAKE THE FINAL DECISION IN EACH CASE.
13. ALL SEWER LATERALS SHALL BE 6 INCH. ALL SEWER LATERALS CROSSING STREET OR LATERALS OVER 10 FEET IN LENGTH SHALL BE 6" WITH CLEAN OUT LOCATED ON THE PROPERTY. CLEANOUT HUBS AND BRASS CAPS TO BE SUPPLIED BY CONTRACTOR.
14. ALL PLASTIC FORCE MAIN PIPE SHALL HAVE A TRACER WIRE (COPPER–SINGLE STRAND INSULATED WIRE, 12 GAUGE) TAPED TO THE LINE. SPLIT BOLT CONNECTORS SHALL BE USED AT EACH SPLICE.
15. ALL PROPOSED SEWER LINES SHALL BE INSTALLED USING A LASER INSTRUMENT FOR THE VERTICAL AND HORIZONTAL ALIGNMENT.
16. ALL SEWER LINES ARE TO BE VIDEO INSPECTED TO ENSURE PROPER INSTALLATION OF ALL LINES AND CORRECT LOCATIONS OF ALL TAPS. GMWSS REQUIRES ALL TELEVISING OF SANITARY SEWERS BE IN DIGITAL VIDEO FORMAT. THIS REQUIREMENT INCLUDES AN INSPECTION REPORT AND FULL MPEG VIDEO ON CD OR DVD. THE REPORT SHALL HAVE COLOR CODED SEVERITY RATINGS FOR EACH OBSERVATION ALONG WITH AUTOMATIC VIDEO INDEXING. THIS FORMAT IS REQUIRED FOR ACCEPTANCE AND TO INSURE COMPATIBILITY WITH GMWSS GIS SYSTEM. PRIOR TO VIDEO INSPECTIONS, ALL SEWER LINES SHALL BE CLEANED WITH A PRESSURE JET NOZZLE.
17. T.V. INSPECTION SHALL BE REQUIRED ON SEWER LATERALS LONGER THAN 30 FEET, UNDER ROADS, OR AS REQUESTED BY GMWSS ENGINEER AND/OR GMWSS RESIDENT INSPECTOR.
18. LOW PRESSURE AIR TESTS SHALL CONFORM TO ASTM F1417. TEST RESULTS SHALL MEET REQUIREMENTS OF GMWSS STANDARD SPECIFICATION MANUAL, LATEST EDITION.
19. ALL MANHOLES SHALL BE TESTED USING A NEGATIVE AIR PRESSURE (VACUUM) TEST METHOD TO DEMONSTRATE THE INTEGRITY OF THE INSTALLED MATERIALS AND THE CONSTRUCTION PROCEDURES AFTER BACKFILLING. ALL TESTING PROCEDURES SHALL BE IN ACCORDANCE WITH ASTM C–1244 (LATEST REVISION). A VACUUM OF TEN (10) INCHES OF MERCURY SHALL BE DRAWN ON THE MANHOLE, THE VALVE ON THE VACUUM LINE OF THE TEST HEAD CLOSED, AND THE VACUUM PUMP SHUT OFF. THE TIME SHALL BE MEASURED FOR THE VACUUM TO DROP TO NINE (9) INCHES OF MERCURY.
20. DEFLECTION TESTS SHALL BE PERFORMED ON ALL FLEXIBLE PIPE. THE TEST SHALL BE PERFORMED AFTER FINAL BACKFILL HAS BEEN IN PLACE FOR AT LEAST 30 DAYS. THE RIGID BALL OR MANDREL SHALL BE USED IN THE DEFLECTION TEST. NO PIPE SHALL EXCEED A DEFLECTION OF 5 PERCENT. TV CAMERA INSPECTION CANNOT BE SUBSTITUTED FOR DEFLECTION TEST.
20. ALL EXISTING MANHOLES SHALL BE CORE DRILLED BY MACHINE PROCESS ONLY WITH THE CORRESPONDING BOOT AND STAINLESS STEEL STRAPS FOR CONNECTION TO SEWER PIPE.
21. FORCE MAINS SHALL BE TESTED AT 150 P.S.I. IN ACCORDANCE WITH AWWA C600. TEST PRESSURE SHALL NOT VARY BY MORE THAN 5 PSI DURING THE MINIMUM TEST DURATION OF 2 (TWO) HOURS. LEAKAGE ALLOWABLE SHALL BE WITHIN THE LIMITS SET FORTH IN THE LATEST EDITION OF THE GEORGETOWN MUNICIPAL WATER AND SEWER SYSTEM SPECIFICATIONS MANUAL.
22. ALL RESTAURANTS, FOOD PREPARATION SERVICES, OR ANY OTHER SIMILAR OPERATIONS WITH COMMERCIAL KITCHENS ARE REQUIRED TO HAVE AN EXTERIOR GREASE TRAP TANK INSTALLED. THE TANK MUST MEET GMWSS REQUIREMENTS AS SHOWN IN STANDARD DETAIL SHEETS. ALL GREASE TRAPS WILL BE A MINIMUM OF 1000 GALLONS UNLESS GMWSS DETERMINES THAT A LARGER VOLUME IS REQUIRED.
23. ANY GRAVITY SEWER MAIN OR LATERAL TO BE INSTALLED IN FILL AREAS SHALL REQUIRE THE OWNER/DEVELOPER TO PROVIDE INSPECTION AND TESTING SERVICES BY A REGISTERED GEOTECHNICAL ENGINEER TO ENSURE THAT EACH LIFT IN THE PROPOSED TRENCH AREA WAS CONSTRUCTED AND COMPACTED TO 95% STANDARD PROCTOR DENSITY FROM BOTTOM OF FILL TO 30 INCHES ABOVE TOP OF PIPE. COPIES OF ALL TEST AND INSPECTION REPORTS SHALL BE CERTIFIED BY THE GEOTECHNICAL ENGINEER AND SUBMITTED TO GMWSS PRIOR TO PIPE INSTALLATION.
24. SEWER LINE TESTING AND VIDEO INSPECTION SHALL NOT BE PERFORMED UNTIL NEW WATER LINES HAVE BEEN INSTALLED.
25. A BACKWATER VALVE SHALL BE INSTALLED ON HOUSES WITH A SEWAGE PUMP INSTALLED AND AS DIRECTED BY GMWSS.
26. ALL GRAVITY SEWER PIPE INSTALLED AT A DEPTH OF 15 FEET SHALL BE DUCTILE IRON PIPE WITH PROTECTO 401 CERAMIC EPOXY LINING.
27. GMWSS REQUIRES THAT ALL NEW MANHOLES BE INSTALLED WITHOUT STEPS.

LIST OF AWWA, UL, FM OR GMWSS APPROVED EQUAL MANUFACTURER OF WATER AND SEWER PARTS & SUPPLIES

1. HYDRANTS – MUELLER AND KENNEDY
2. METERS – SENSUS
3. VALVES – MUELLER, KENNEDY, AMERICAN FLOW CONTROL
4. MJ FITTINGS COMPACT OR FULL BODY, MJ PACKS – McWAYNE (TYLER/UNION, CLOW), GRIFFIN, US PIPE
5. DI PIPE CLASS 350 – GRIFFIN, CLOW, US PIPE, AMERICAN DI PIPE
6. PVC PIPE CLASS 200 OR C900 – JM MANUFACTURING, NAPCO, BRISTOL, VULCAN, DIAMOND
7. PVC COUPLINGS – HARRINGTON, MULTI–FITTINGS
8. PE SERVICE PIPING – ENDOT ENDOPURE – BLUE W/CLEAR CORE. ASTM–D2737 SDR 9 WITH STAINLESS STEEL INSERTS
9. EPOXY COATED OR STAINLESS STEEL TAPPING SLEEVES – FORD, SMITH & BLAIR, JCM, POWERSEAL, ROMAC "SST"
10. GALVANIZED COMPRESSION COUPLINGS – SMITH & BLAIR, DRESSER, JCM POWERSEAL
11. MECHANICAL JOINT RESTRAINTS – FORD, EBBA, SIGMA, ROMAC
12. DI DOUBLE STRAP SERVICE SADDLES – SMITH & BLAIR, MUELLER, FORD, JCM, ROMAC
13. BRASS SERVICE SADDLES – FORD, MUELLER, McDONALD
14. BOLTED CAST COUPLINGS – SMITH & BLAIR, FORD, VIKING–JOHNSON, DRESSER, JCM, POWERSEAL, ROMAC
15. FULL CIRCLE REPAIR CLAMPS(All Stainless Steel) – SMITH & BLAIR, MUELLER, FORD, POWERSEAL, CASCADE, ROMAC
16. ALL BRASS FITTINGS(AWWA Brass) – FORD, MUELLER, McDONALD
17. BRASS NIPPLES & PIPE – STATE ORIGIN
18. METER BOXES – HANCOR, ADS (WHITE), SPRINGFIELD
19. METER BOX LIDS – 2 PIECE TOP 18" AND 18"x24", 18"x30" EXTENSION RING – VESTAL & RUSSCO
20. MANHOLES FRAMES, COVERS & RINGS – J.R. HOE & SONS
21. PRESSURE REGULATOR VALVE – WILKINS, WATTS, HONEYWELL
22. AIR RELEASE VALVE (water) – A.R.I. AND G.A. INDUSTRIES
23. AIR/VACUUM RELEASE VALVE (sewer) – A.R.I.
24. ALUMINUM LID – US FABRICATION

RESIDENT INSPECTION NOTE:

THE DESIGN ENGINEER SHALL PROVIDE, TO THE SATISFACTION OF GMWSS, A FULL–TIME REPRESENTATIVE ON SITE TO OVERSEE ALL WATER AND SEWER CONSTRUCTION. THE ENGINEERS REPRESENTATIVE SHALL ENSURE THAT THE PROJECT WORK CONFORMS TO THE APPROVED DESIGN PLANS OF THE ENGINEER AND GOOD CONSTRUCTION PRACTICES. THE FIELD REPRESENTATIVE WILL COORDINATE AS NECESSARY WITH GMWSS INSPECTORS.

UTILITIES

BUD – Before You Dig
TELEPHONE:1–800–752–6007 OR DIAL 811

GEORGETOWN
MUNICIPAL WATER AND SEWER SERVICE
125 W. Clinton St. P.O. Box 640
Georgetown, Kentucky 40324

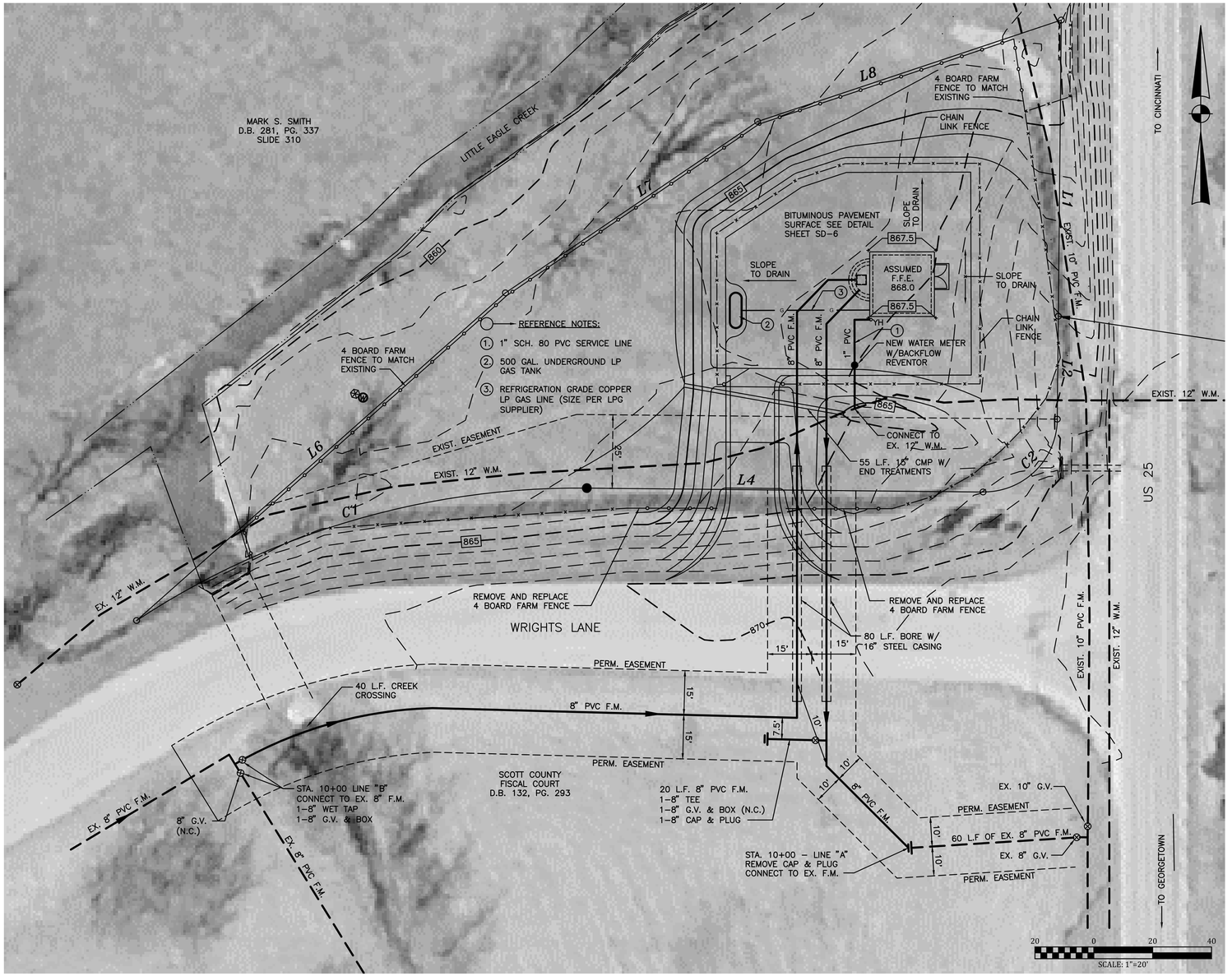
NO.	REVISION:	DATE:	BY:

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
SCOTT COUNTY, KENTUCKY

GENERAL NOTES FOR WATER & SEWER CONSTRUCTION
REVISED APRIL 2013

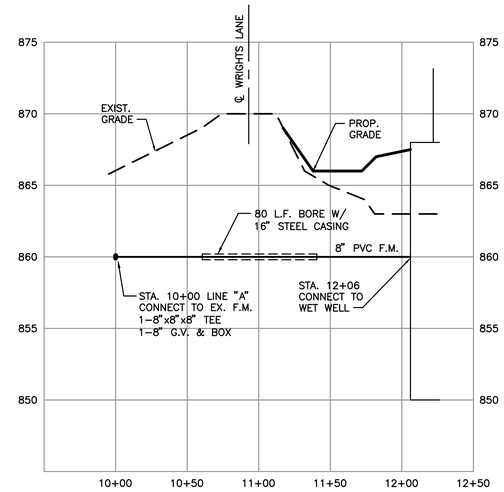
DRAWING INFORMATION
SCALE : AS NOTED
DESIGNED BY :
DRAWN BY : DDM
CHECKED BY : STAFF
PROJECT NO :
DATE : Sept 2012
CADD DWG ID :

Sheet No.
G-2



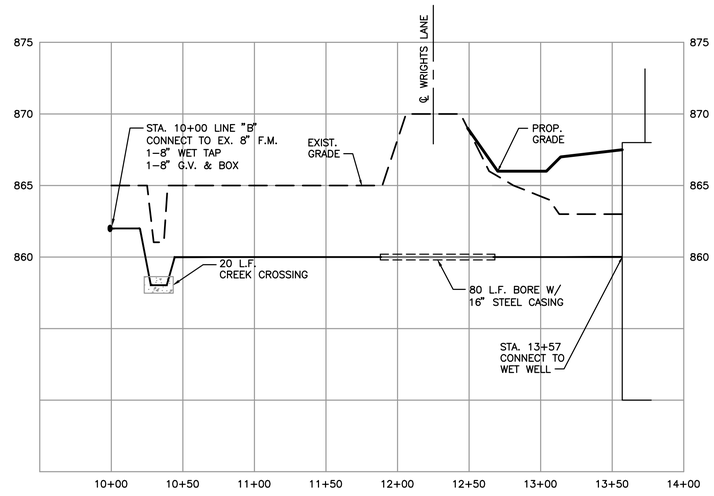
WRIGHT LANE PUMP STATION
SITE/PIPING PLAN

SCALE: 1"=20'



PROFILE - FORCE MAIN LINE "A"

SCALE: 1"=5' VERTICAL, 1"=50' HORIZONTAL



PROFILE - FORCE MAIN LINE "B"

SCALE: 1"=5' VERTICAL, 1"=50' HORIZONTAL

P:\PROJECTS\GMWSS\13009-US 25_Wright Lane Pump Station\DWG\13009-C01.dwg KEC 9/17/13

NO.	DATE	REVISIONS	BY

DATE:	SEPTEMBER 2013
PROJECT MGR:	BKL
DRAWN BY:	CDS
CHECKED BY:	BKL
SCALE:	AS NOTED

KENTUCKY ENGINEERING GROUP, PLLC
P.O. Box 1034
VERSAILLES, KENTUCKY 40383

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
125 WEST CLINTON STREET
P.O. BOX 640
GEORGETOWN, KENTUCKY 40324

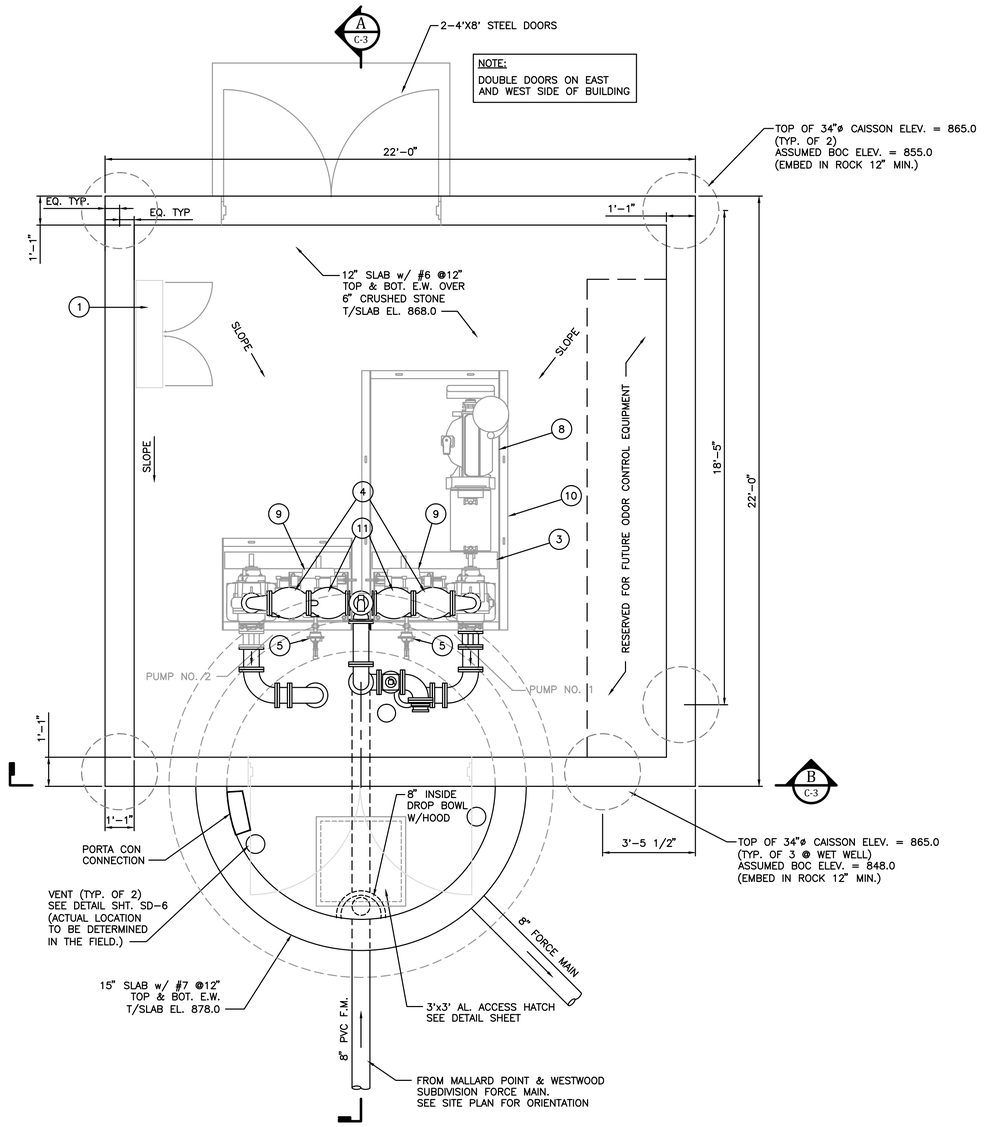
2013 WASTEWATER SYSTEM IMPROVEMENTS
US 25 - WRIGHTS LANE PUMP STATION and FORCE MAIN

WRIGHTS LANE PUMP STATION
SITE/PIPING PLAN and PROFILES

STATE OF KENTUCKY
BRYAN K. LOVAN
13540
LICENSED PROFESSIONAL ENGINEER
9-15-13

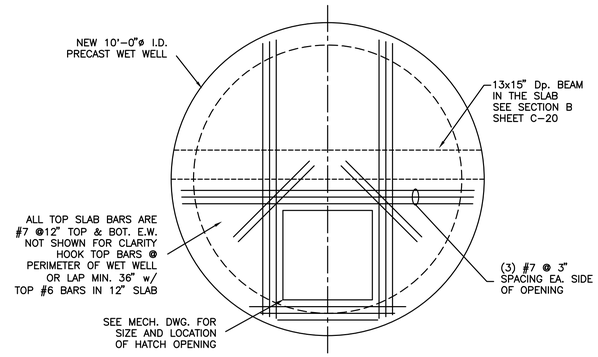
PROJECT NO.
13009

SHEET NO.
C-1
OF 18



WRIGHT LANE PUMP STATION - PLAN

SCALE: 3/8" = 1'-0"



PLAN - WET WELL TOP SLAB

SCALE: 3/8" = 1'-0"

NOTE:

THE FOLLOWING ITEMS ARE NOT SHOWN BUT SHALL BE PROVIDED AND INSTALLED BY THE CONTRACTOR.

GAUGES (4) POSITIONED RELATIVE TO EACH PUMP INDICATING SUCTION LIFT AND DISCHARGE PRESSURE. EACH GAUGE TO HAVE FLEXIBLE CONNECTION HOSE MEETING PUMP MANUFACTURE'S RECOMMENDATIONS AND IN-LINE SHUTOFF VALVE. EACH GAUGE TO FACE DOORS ON WET WELL SIDE OF BUILDING.

ITEM	DESCRIPTION	MATERIAL & SIZE
1	CONTROL PANEL	STEEL
2	PUMP	CAST IRON VS4A-B
3	BELT GUARD ASSY	STEEL
4	SECONDARY DISCHARGE CHECK VALVE	CAST IRON 6" X 6"
5	AIR RELEASE VALVE	CAST IRON 1" (SHIPPED LOOSE)
6	DISCHARGE ELBOW 90°	CAST IRON 6"
7	DISCHARGE PLUG VALVE **	CAST IRON 6" 3-WAY
8	ENGINE (LPG GAS)	LIQUID COOLED
9	MOTOR	CAST IRON
10	PUMP & MOTOR BASE ASSY	STEEL
11	PRIMARY DISCHARGE CHECK VALVE	CAST IRON 6" X 6"

** ROTATE CONTROL 90° FROM VERTICAL SUCH THAT HANDLE FACES DOORS ON WET WELL SIDE OF BUILDING

* ITEMS TO BE PROVIDED AND INSTALLED BY THE CONTRACTOR NOT SHOWN INCLUDE, BUT NOT LIMITED TO THE FOLLOWING: LOAD CENTER, POWER TRANSFORMER, EXHAUST FAN ASSY., EXHAUST VENT ASSY., EXHAUST SILENCER, CENTRIFUGAL CLUTCH, FLUORESCENT LIGHT FIXTURES, INTAKE VENT ASSY., VENT HOOD, EMERGENCY LIGHT FIXTURES, BY-PASS PLUG VALVE, OPW ADAPTER, BUILDING HEATER, SECURITY LIGHT FIXTURES

P:\PROJECTS\GMWSS\13009-US 25_Wright Lane Pump Station\DWG\13009-C02.dwg KEG 9/17/13

NO.	DATE	REVISIONS	BY

DATE:	SEPTEMBER 2013
PROJECT MGR:	BKL
DRAWN BY:	CDS
CHECKED BY:	BKL
SCALE:	AS NOTED

P.O. Box 1034
VERSAILLES, KENTUCKY 40383
KENTUCKY ENGINEERING GROUP, PLLC

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
125 WEST CLINTON STREET
P.O. BOX 640
GEORGETOWN, KENTUCKY 40324

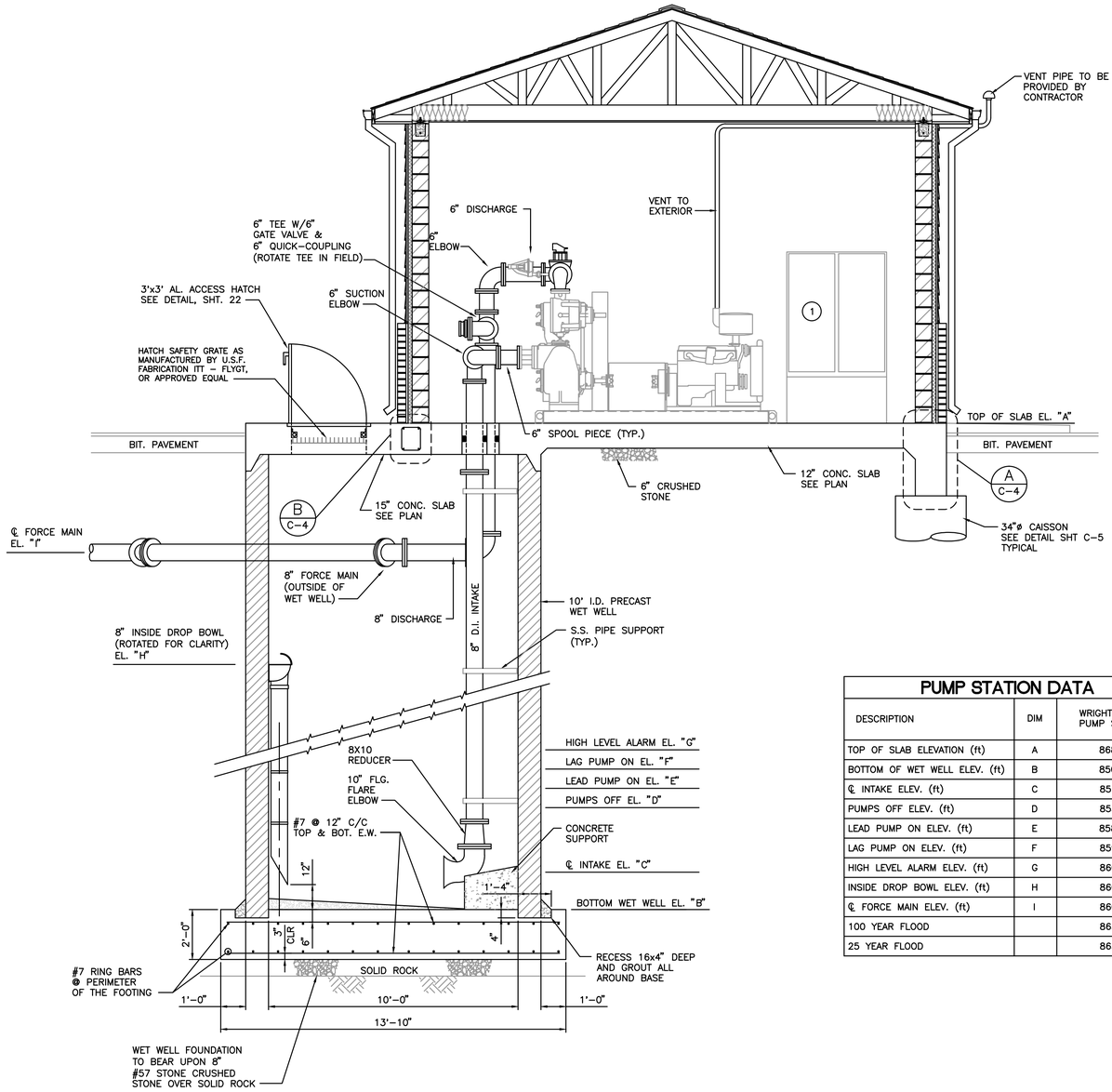
2013 WASTEWATER SYSTEM IMPROVEMENTS
US 25 - WRIGHTS LANE PUMP STATION and FORCE MAIN

WRIGHTS LANE PUMP STATION
PLAN VIEWS

STATE OF KENTUCKY
BRYAN K. LOVAN
13540
LICENSED PROFESSIONAL ENGINEER
9-25-13

PROJECT NO.
13009

SHEET NO.
C-2
OF 18



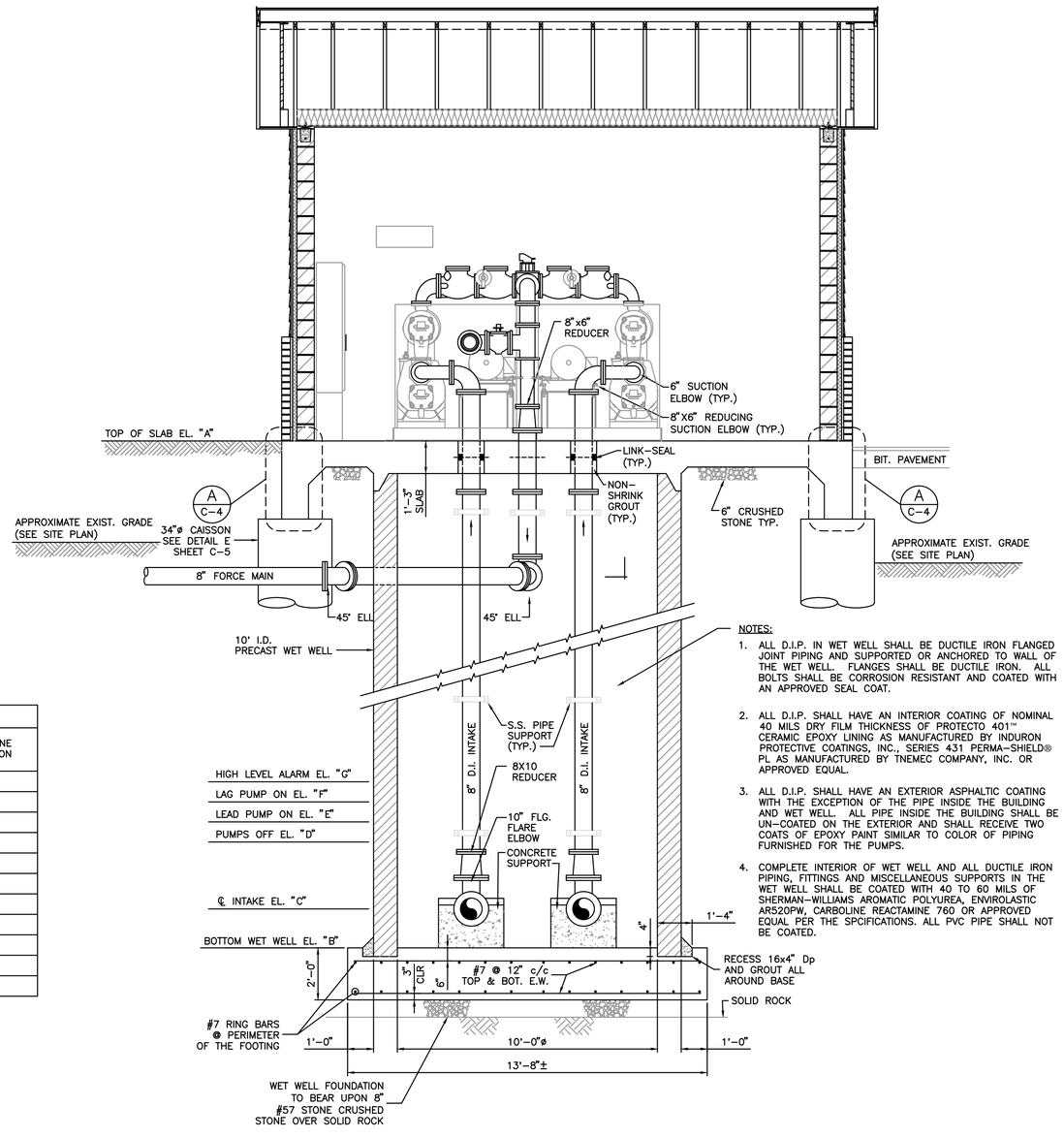
SECTION A

NOT TO SCALE

C-2

PUMP STATION DATA

DESCRIPTION	DIM	WRIGHTS LANE PUMP STATION
TOP OF SLAB ELEVATION (ft)	A	868.0
BOTTOM OF WET WELL ELEV. (ft)	B	850.0
℄ INTAKE ELEV. (ft)	C	851.5
PUMPS OFF ELEV. (ft)	D	853.0
LEAD PUMP ON ELEV. (ft)	E	858.0
LAG PUMP ON ELEV. (ft)	F	859.0
HIGH LEVEL ALARM ELEV. (ft)	G	860.0
INSIDE DROP BOWL ELEV. (ft)	H	860.0
℄ FORCE MAIN ELEV. (ft)	I	860.0
100 YEAR FLOOD		865.0
25 YEAR FLOOD		863.0



SECTION B

NOT TO SCALE

C-2

NOTES:

1. ALL D.I.P. IN WET WELL SHALL BE DUCTILE IRON FLANGED JOINT PIPING AND SUPPORTED OR ANCHORED TO WALL OF THE WET WELL. FLANGES SHALL BE DUCTILE IRON. ALL BOLTS SHALL BE CORROSION RESISTANT AND COATED WITH AN APPROVED SEAL COAT.
2. ALL D.I.P. SHALL HAVE AN INTERIOR COATING OF NOMINAL 40 MILS DRY FILM THICKNESS OF PROTECTO 401™ CERAMIC EPOXY LINING AS MANUFACTURED BY INDURON PROTECTIVE COATINGS, INC., SERIES 431 PERMA-SHIELD® PL AS MANUFACTURED BY TNEMEC COMPANY, INC. OR APPROVED EQUAL.
3. ALL D.I.P. SHALL HAVE AN EXTERIOR ASPHALTIC COATING WITH THE EXCEPTION OF THE PIPE INSIDE THE BUILDING AND WET WELL. ALL PIPE INSIDE THE BUILDING SHALL BE UN-COATED ON THE EXTERIOR AND SHALL RECEIVE TWO COATS OF EPOXY PAINT SIMILAR TO COLOR OF PIPING FURNISHED FOR THE PUMPS.
4. COMPLETE INTERIOR OF WET WELL AND ALL DUCTILE IRON PIPING, FITTINGS AND MISCELLANEOUS SUPPORTS IN THE WET WELL SHALL BE COATED WITH 40 TO 60 MILS OF SHERMAN-WILLIAMS AROMATIC POLYUREA, ENVIROLASTIC AR520PW, CARBOLINE REACTAMINE 760 OR APPROVED EQUAL PER THE SPCIFICATIONS. ALL PVC PIPE SHALL NOT BE COATED.

P:\PROJECTS\GMWSS\13009-US 25_Wright Lane Pump Station\DWG\13009-C03.dwg KEG 9/17/13

NO.	DATE	REVISIONS	BY

DATE:	SEPTEMBER 2013
PROJECT MGR:	BKL
DRAWN BY:	CDS
CHECKED BY:	BKL
SCALE:	AS NOTED

P.O. Box 1034
VERSAILLES, KENTUCKY 40383
KENTUCKY ENGINEERING GROUP, PLLC

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
125 WEST CLINTON STREET
P.O. BOX 640
GEORGETOWN, KENTUCKY 40324

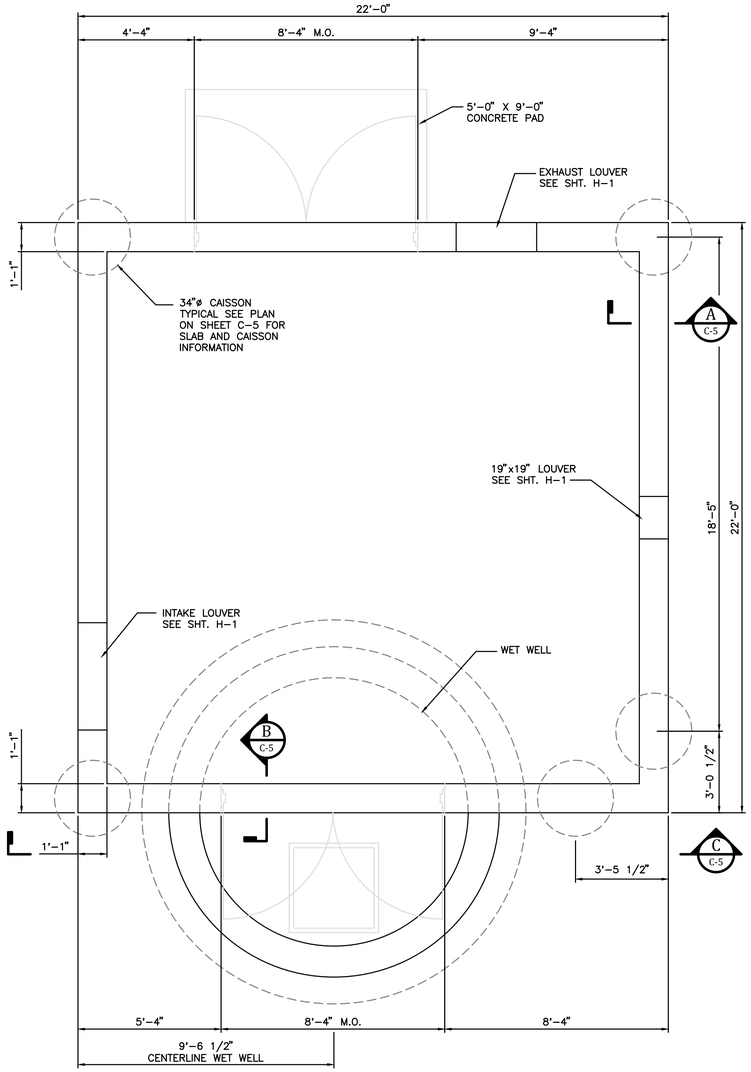
2013 WASTEWATER SYSTEM IMPROVEMENTS
US 25 - WRIGHTS LANE PUMP STATION and FORCE MAIN

WRIGHTS LANE PUMP STATION SECTIONS

STATE OF KENTUCKY
BRYAN K. LOVAN
13540
LICENSED PROFESSIONAL ENGINEER
9-15-13

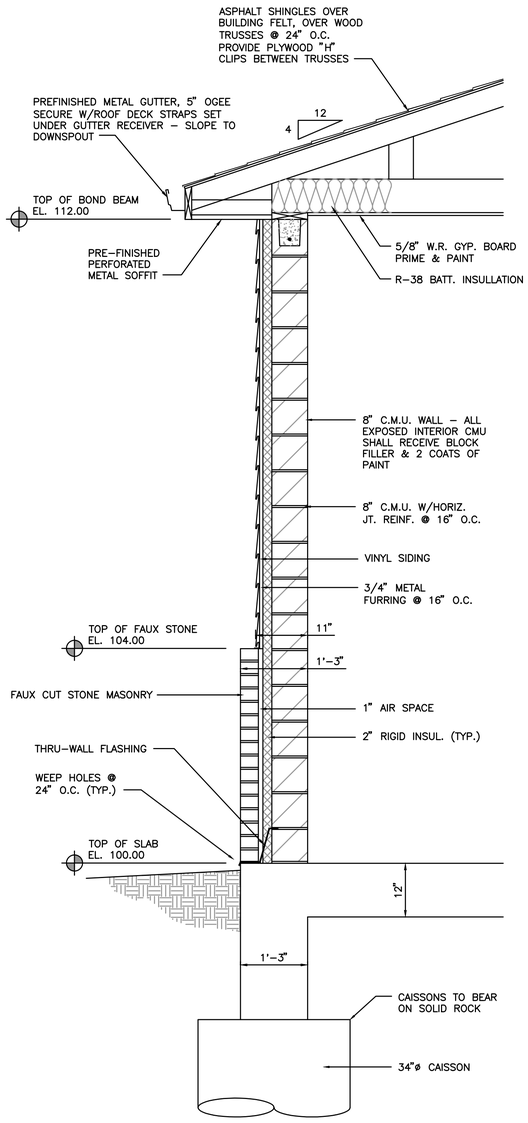
PROJECT NO. 13009

SHEET NO. C-3



WRIGHT LANE PUMP STATION - PLAN

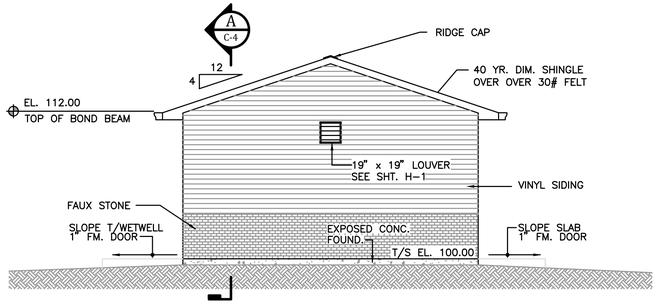
NOT TO SCALE



SECTION

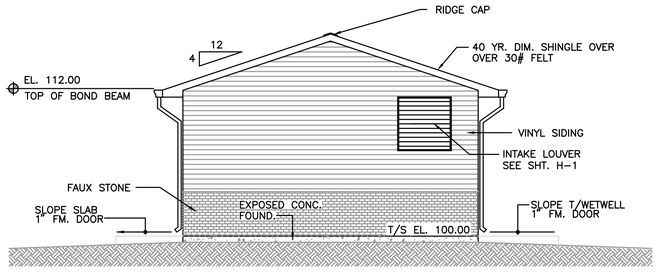
NOT TO SCALE

A C-4



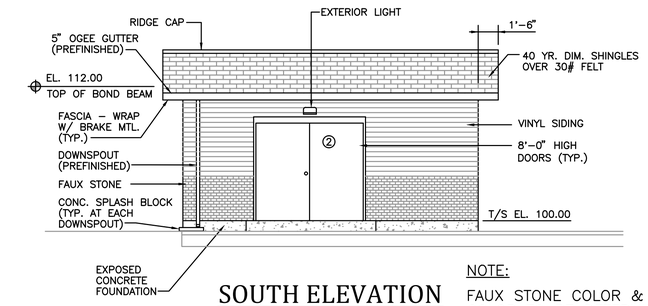
EAST ELEVATION

NOT TO SCALE



WEST ELEVATION

NOT TO SCALE

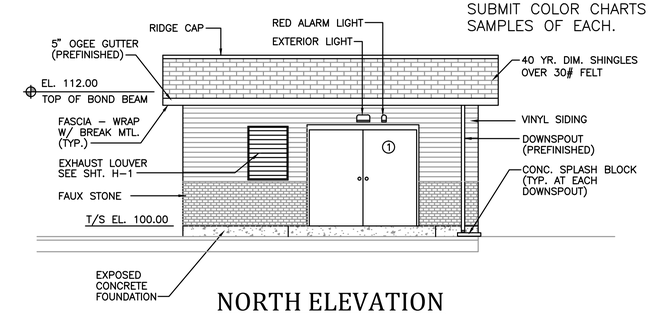


SOUTH ELEVATION

NOT TO SCALE

NOTE:

FAUX STONE COLOR & SHINGLE COLOR TO BE DETERMINED BY OWNER. CONTRACTOR SHALL SUBMIT COLOR CHARTS AND SAMPLES OF EACH.



NORTH ELEVATION

NOT TO SCALE

P:\PROJECTS\GMWSS\13009-US 25_Wright Lane Pump Station\DWG\13009-C04.dwg KEG 9/17/13

NO.	DATE	REVISIONS	BY

DATE:	SEPTEMBER 2013
PROJECT MGR:	BKL
DRAWN BY:	CDS
CHECKED BY:	BKL
SCALE:	AS NOTED

P.O. Box 1034
VERSAILLES, KENTUCKY 40383
KENTUCKY ENGINEERING GROUP, PLLC

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
125 WEST CLINTON STREET
P.O. BOX 640
GEORGETOWN, KENTUCKY 40324

2013 WASTEWATER SYSTEM IMPROVEMENTS

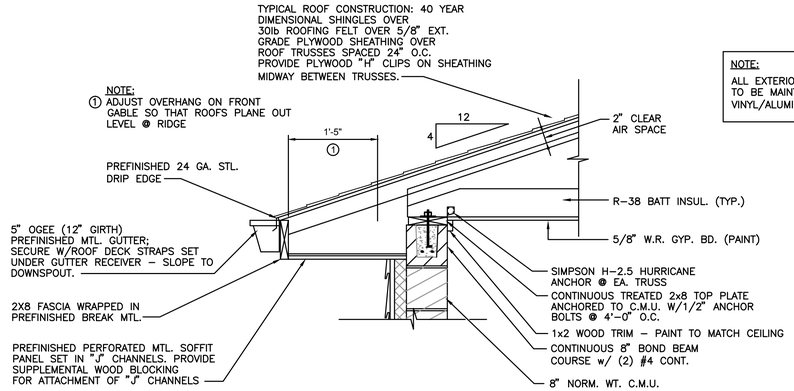
US 25 - WRIGHTS LANE PUMP STATION and FORCE MAIN

WRIGHTS LANE PUMP STATION
PLAN, SECTION and ELEVATIONS

STATE OF KENTUCKY
BRYAN K. LOWRY
13540
LICENSED PROFESSIONAL ENGINEER
9-13-13

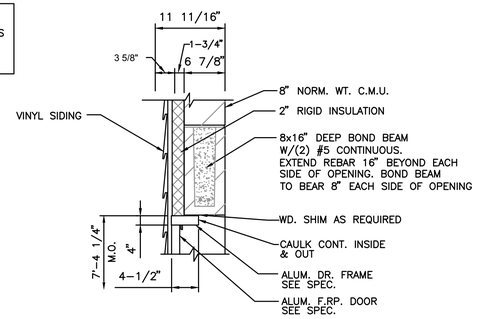
PROJECT NO.
13009

SHEET NO.
C-4
OF 18

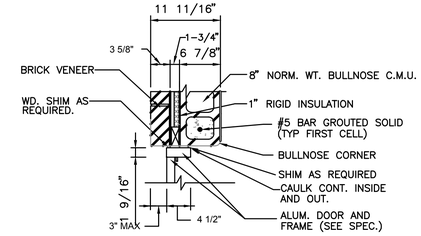


NOTE:
ALL EXTERIOR NON-MASONARY SURFACES TO BE MAINTENANCE FREE WITH VINYL/ALUMINUM CLAD COVERINGS.

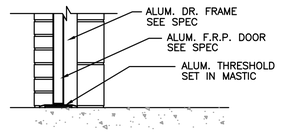
EAVE DETAIL
SCALE: 1"=1'-0"



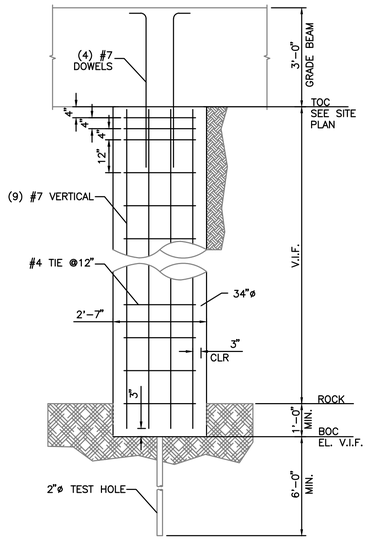
DOOR HEAD DETAIL (H-1)
SCALE: 1"=1'-0"



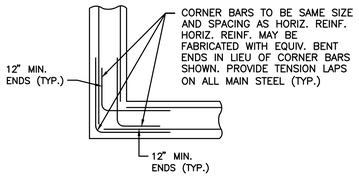
DOOR JAMB DETAIL (J-1)
SCALE: 1"=1'-0"



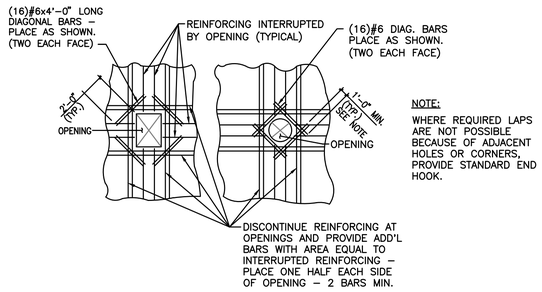
THRESHOLD DETAIL (S-1)
SCALE: 1"=1'-0"



CAISSON DETAIL
SCALE: 1/2"=1'-0"

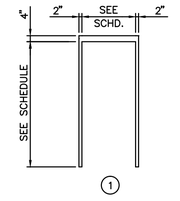


TYPICAL DETAIL OF REINF. @ COURSE
SCALE: 3/8"=1'-0"

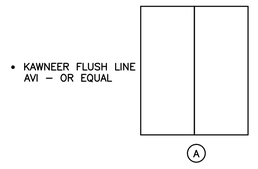


NOTE:
WHERE REQUIRED LAPS ARE NOT POSSIBLE BECAUSE OF ADJACENT HOLES OR CORNERS, PROVIDE STANDARD END HOOK.

ADD'L REINF. STEEL @ OPNGS. IN WALLS & SLABS
SCALE: 1/4"=1'-0"



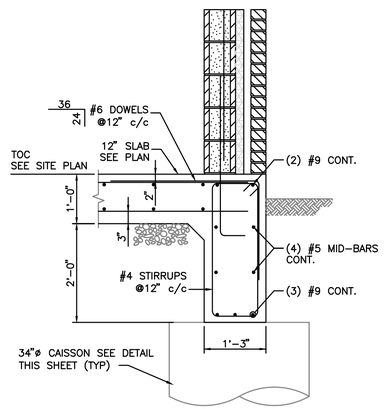
FRAME ELEVATION
SCALE: 1/4"=1'-0"



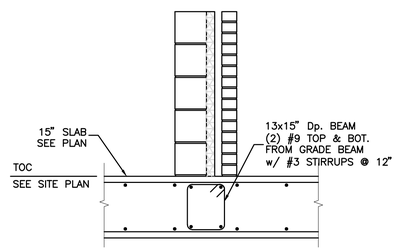
DOOR ELEVATION
SCALE: 1/4"=1'-0"

DOOR SCHEDULE

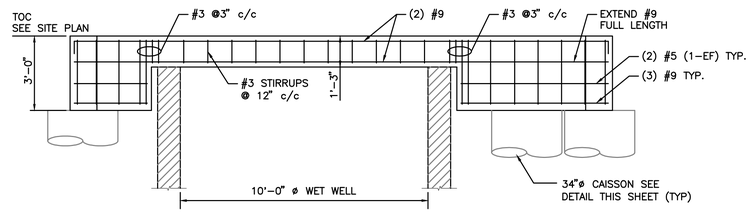
DOOR							FRAME						
DR. NO.	DOOR SIZE	DR. THK.	DR. TYPE	DR. MAT.	GLAZ.	LABEL	FRAME TYPE	FRAME MAT.	FRAME WIDTH	HEAD	JAMB	THRESH	HRDWR. SETS	REMARKS
1	PR 4'-0"x8'-0"	1 3/4"	A	ALUM	—	—	1	ALUM.	4 1/2"	H-1	J-1	S-1	1	1 REQ'D
2	PR 4'-0"x8'-0"	1 3/4"	A	ALUM	—	—	1	ALUM.	4 1/2"	H-1	J-1	S-1	1	1 REQ'D



SECTION A
C-4
SCALE: 3/4"=1'-0"



SECTION B
C-4
SCALE: 3/4"=1'-0"



SECTION C
C-4
SCALE: 3/8"=1'-0"

NO.	DATE	REVISIONS	BY

DATE:	SEPTEMBER 2013
PROJECT MGR:	BKL
DRAWN BY:	CDS
CHECKED BY:	BKL
SCALE:	AS NOTED

P.O. Box 1034
VERSAILLES, KENTUCKY 40383
KENTUCKY ENGINEERING GROUP, PLLC

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
125 WEST CLINTON STREET
P.O. BOX 640
GEORGETOWN, KENTUCKY 40324

2013 WASTEWATER SYSTEM IMPROVEMENTS
US 25 - WRIGHTS LANE PUMP STATION and FORCE MAIN

WRIGHTS LANE PUMP STATION BUILDING SECTION and DETAILS

STATE OF KENTUCKY · BRYAN K. LOVAN · 13540 · LICENSED PROFESSIONAL ENGINEER · 9-15-13

PROJECT NO. 13009

SHEET NO. C-5
OF 18

P:\PROJECTS\GMWSS\13009-US 25_Wright Lane Pump Station\DWG\13009-C05.dwg KEG 9/17/13

P:\PROJECTS\GMWSS\13009-US 25_Wright Lane Pump Station\DWG\13009-C06.dwg KEG 9/17/13

NO.	DATE	REVISIONS	BY

DATE:	SEPTEMBER 2013
PROJECT MGR:	BKL
DRAWN BY:	CDS
CHECKED BY:	BKL
SCALE:	AS NOTED

P.O. Box 1034
VERSAILLES, KENTUCKY 40383
KENTUCKY ENGINEERING GROUP, PLLC

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
125 WEST CLINTON STREET
P.O. BOX 640
GEORGETOWN, KENTUCKY 40324

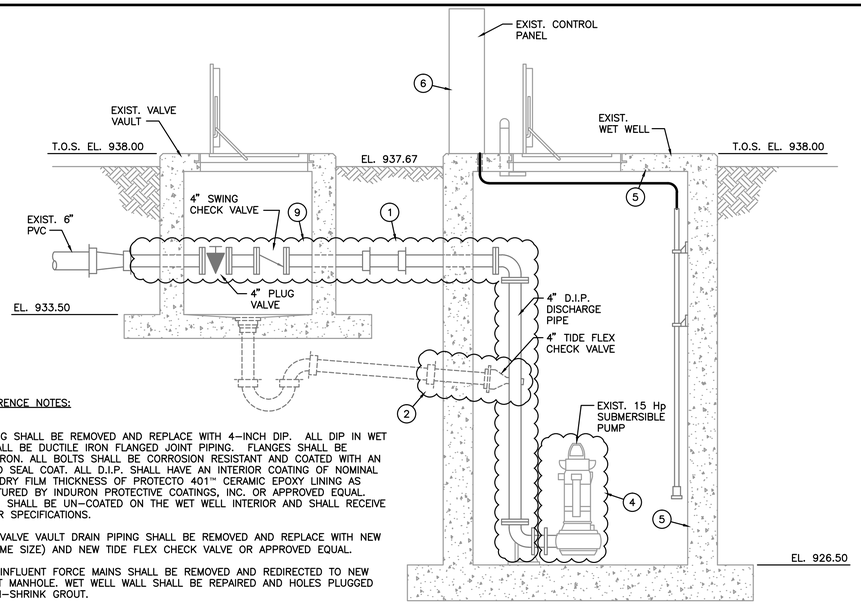
2013 WASTEWATER SYSTEM IMPROVEMENTS
US 25 - WRIGHTS LANE PUMP STATION and FORCE MAIN

HARBOR VILLAGE FORCE MAIN

STATE OF KENTUCKY
BRYAN K. LOWE
13540
LICENSED PROFESSIONAL ENGINEER
9-15-13

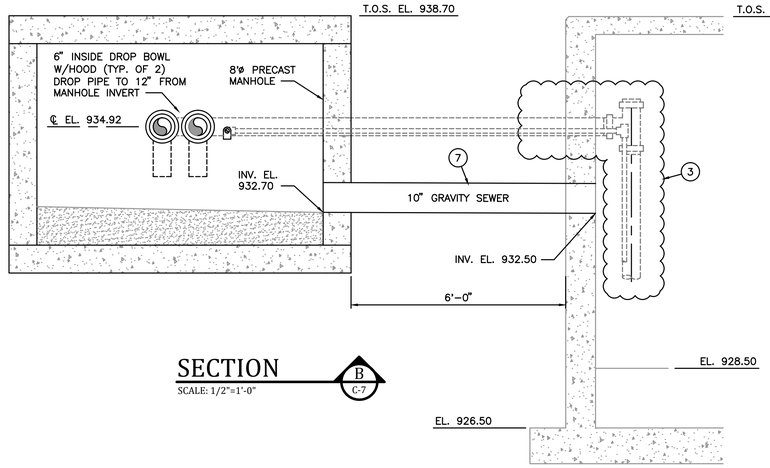
PROJECT NO. 13009

SHEET NO. C-6 OF 18



SECTION

SCALE: 1/2"=1'-0"

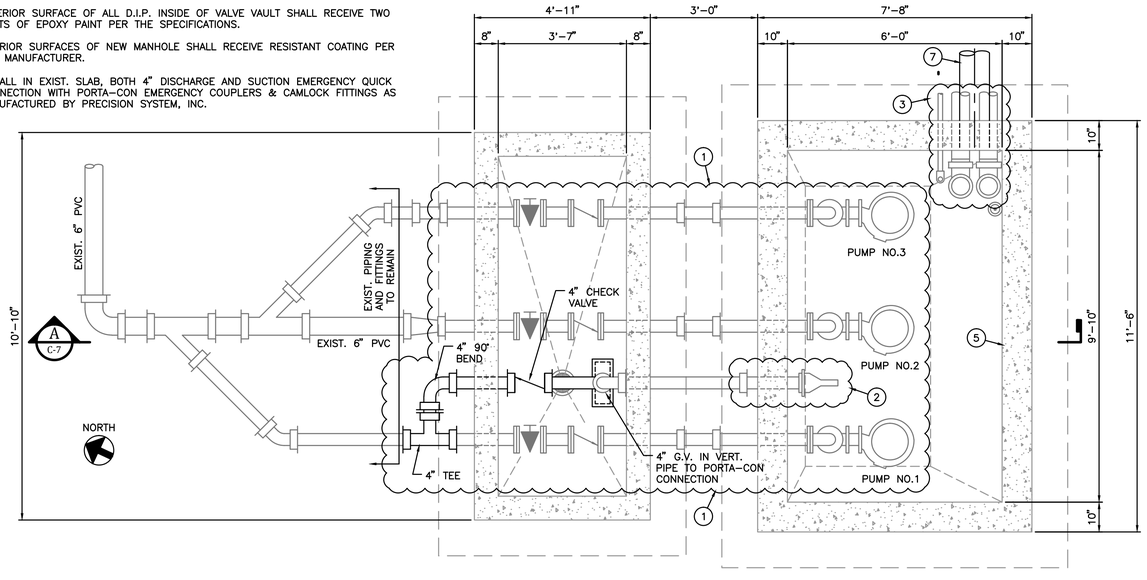


SECTION

SCALE: 1/2"=1'-0"

(X) REFERENCE NOTES:

1. ALL PIPING SHALL BE REMOVED AND REPLACE WITH 4-INCH DIP. ALL DIP IN WET WELL SHALL BE DUCTILE IRON FLANGED JOINT PIPING. FLANGES SHALL BE DUCTILE IRON. ALL BOLTS SHALL BE CORROSION RESISTANT AND COATED WITH AN APPROVED SEAL COAT. ALL D.I.P. SHALL HAVE AN INTERIOR COATING OF NOMINAL 40 MILS DRY FILM THICKNESS OF PROTECTO 401™ CERAMIC EPOXY LINING AS MANUFACTURED BY INDURON PROTECTIVE COATINGS, INC. OR APPROVED EQUAL. ALL D.I.P. SHALL BE UN-COATED ON THE WET WELL INTERIOR AND SHALL RECEIVE PAINT PER SPECIFICATIONS.
2. EXISTING VALVE VAULT DRAIN PIPING SHALL BE REMOVED AND REPLACE WITH NEW D.I.P. (SAME SIZE) AND NEW TIDE FLEX CHECK VALVE OR APPROVED EQUAL.
3. EXISTING INFLUENT FORCE MAINS SHALL BE REMOVED AND REDIRECTED TO NEW PRE-CAST MANHOLE. WET WELL WALL SHALL BE REPAIRED AND HOLES PLUGGED WITH NON-SHRINK GROUT.
4. EXISTING SUBMERSIBLE PUMP TO BE REMOVED AND REPLACE WITH NEW 7.5 HP SUBMERSIBLE PUMPS, DISCHARGE PIPING, AND DISCHARGE ELBOW.
5. PRESSURE WASH ENTIRE WET WELL WALLS AND TOP SLAB, COAT ALL CONCRETE SURFACES WITH A CEMENT-BASED, FIBER REINFORCED CALCIUM ALUMINATE MOTAR PER THE SPECIFICATIONS AND APPLY A FINISH COATING SYSTEM PER THE SPECIFICATIONS.
6. REMOVE EXISTING CONTROL PANEL AND CONDUITS. RELOCATE TO ADJANCT VALVE VAULT RE-ROUTING NEW PUMP WIRING AND CONTROL WIRING FOR NEW PUMPS.
7. INSTALL NEW 10-INCH GRAVITY SEWER MAIN AND 8-FOOT DIAMETER PRECAST MANHOLE AS SHOWN. RE-ROUTE EXISTING FORCE MAINS INTO NEW MANHOLE. MANHOLE SHALL RECEIVE THE SAME COATING SYSTEM AS THE WET WELL PRIOR TO INSTALLATION.
8. NEW SUBMERSIBLE PUMP CONTROL PANEL LOCATION AND CONCRETE PAD. CONTRACTOR TO INSTALL NEW POWER CABLES AND CONTROL WIRING TO NEW PANEL. PROVIDE NEW TRANSDUCERS AND CABLES TO NEW CONTROL PANEL.
9. EXTERIOR SURFACE OF ALL D.I.P. INSIDE OF VALVE VAULT SHALL RECEIVE TWO COATS OF EPOXY PAINT PER THE SPECIFICATIONS.
10. INTERIOR SURFACES OF NEW MANHOLE SHALL RECEIVE RESISTANT COATING PER THE MANUFACTURER.
11. INSTALL IN EXIST. SLAB, BOTH 4" DISCHARGE AND SUCTION EMERGENCY QUICK CONNECTION WITH PORTA-CON EMERGENCY COUPLERS & CAMLOCK FITTINGS AS MANUFACTURED BY PRECISION SYSTEM, INC.

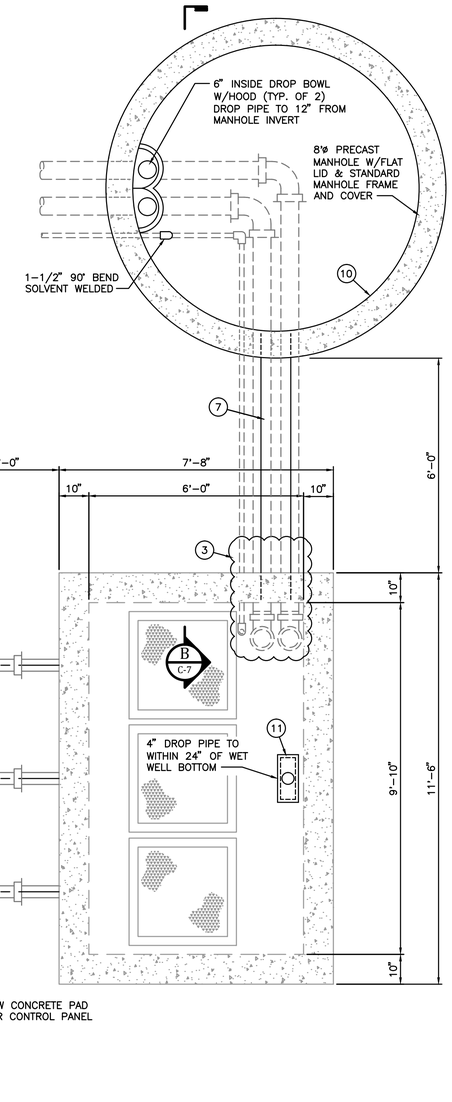


PUMP STATION & VALVE VAULT - LOWER PLAN

SCALE: 1/2"=1'-0"

GENERAL NOTES:

1. EXISTING TRIPLEX PUMPS AND PIPING TO BE REMOVED DURING WET WELL RENOVATION. EXISTING PUMPS TO BE REMOVED AND RETURNED TO OWNER.
2. CONTRACTOR SHALL INSTALL NEW MANHOLE AND RE-ROUTE EXISTING FORCE MAINS TO NEW MANHOLE PRIOR TO REMOVING EXISTING PUMPS. CONTRACTOR SHALL FURNISH A BY-PASS PUMP AND TEMPORARY POWER DURING THE RENOVATION WORK AND WET WELL MODIFICATIONS. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL FUEL AND/OR POWER COST DURING PUMP STATION MODIFICATIONS AND UNTIL THE EXISTING WET WELL AND VALVE VAULT ARE PLACED BACK IN OPERATION.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR TEMPORARY POWER AND TEMPORARY CONTROLS DURING PUMP STATION MODIFICATIONS AND CONSTRUCTION.
4. CONTRACTOR SHALL INSTALL TEMPORARY CONNECTION (OR INSTALL AS NECESSARY FOR FINAL PIPING CONNECTION) FOR THE BY-PASS PUMP DISCHARGE PRIOR TO RE-ROUTING FORCE MAIN INTO THE NEW MANHOLE.
5. CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING EQUIPMENT AND MATERIAL STAGING AREA ON THE SITE AND SHALL MINIMIZE DISTURBANCE TO THE PROPERTY. PROPERTY IS LOCATED ON AN EXISTING EASEMENT AND EXCAVATION SHALL BE KEPT TO A MINIMUM
6. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL BY-PASS PUMPING DURING MODIFICATIONS TO THE EXISTING WET WELL AND VALVE VAULT



PUMP STATION & VALVE VAULT - UPPER SLAB PLAN

SCALE: 1/2"=1'-0"

P:\PROJECTS\GMWSS\13009-US 25_Wright Lane Pump Station\DWG\13009-C07.dwg KEG 9/17/13

NO.	DATE	REVISIONS	BY

DATE:	SEPTEMBER 2013
PROJECT MGR:	BKL
DRAWN BY:	CDS
CHECKED BY:	BKL
SCALE:	AS NOTED

P.O. Box 1034
VERSAILLES, KENTUCKY 40383
KENTUCKY ENGINEERING GROUP, PLLC

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
125 WEST CLINTON STREET
P.O. BOX 640
GEORGETOWN, KENTUCKY 40324

2013 WASTEWATER SYSTEM IMPROVEMENTS
US 25 - WRIGHTS LANE PUMP STATION and FORCE MAIN

HARBOR VILLAGE PUMP STATION UPGRADE PLAN and SECTIONS

STATE OF KENTUCKY — BRYAN K. LOVAN — 13540 — LICENSED PROFESSIONAL ENGINEER — 9-15-13

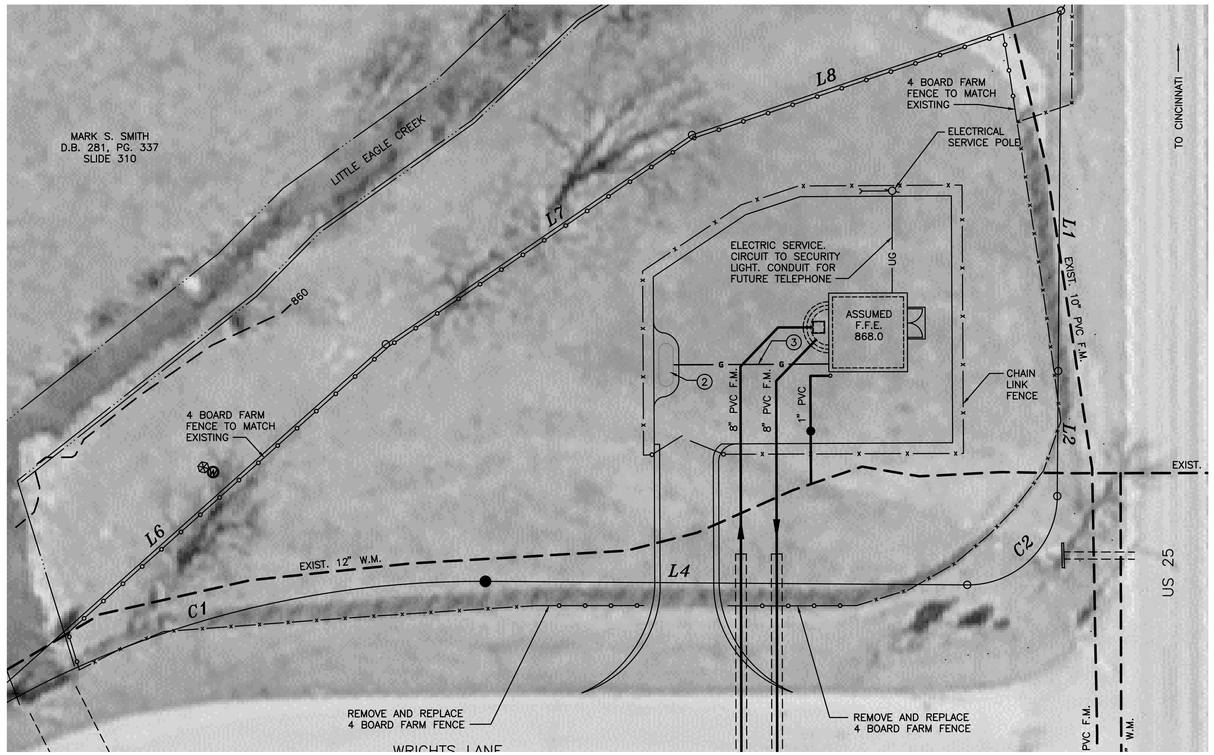
PROJECT NO. 13009

SHEET NO. C-7

SYMBOL	DESCRIPTION
$	WALL SWITCH
$M	FRACTIONAL HP MANUAL STARTER W/OVERLOAD RELAY
J	JUNCTION BOX
5	MOTOR (5 hp INDICATED)
	LIGHTING FIXTURE, TYPE AS SHOWN
	LIGHTING FIXTURE, TYPE AS SHOWN
	EMERGENCY LIGHTING FIXTURE, TYPE AS SHOWN
WP/GFI	DUPLEX RECEPTACLE, 'WP/GFI' INDICATES WEATHERPROOF AND GFI
#10	CONDUIT CONCEALED IN WALL OR CEILING WHERE POSSIBLE, NUMBER AND SIZE OF WIRE AS INDICATED. 2–#12, 1–#12GND, 3/4"C, IF NOT NOTED.
	GROUND, NEUTRAL, PHASE IN CONDUIT
5 6	TWO CIRCUIT HOMERUN TO PANEL, INDICATED AS 5 AND 6
	CONDUIT TURNED UP
	CONDUIT TURNED DOWN
	DISCONNECT SWITCH, TYPE AS SHOWN
	CIRCUIT BREAKER
— OHS —	OVERHEAD SECONDARY
— UGS —	UNDERGROUND SECONDARY
— UGT —	UNDERGROUND TELEPHONE
— UG —	UNDERGROUND CONDUIT
----------	CONDUIT RAN IN SLAB
	TRANSFORMER

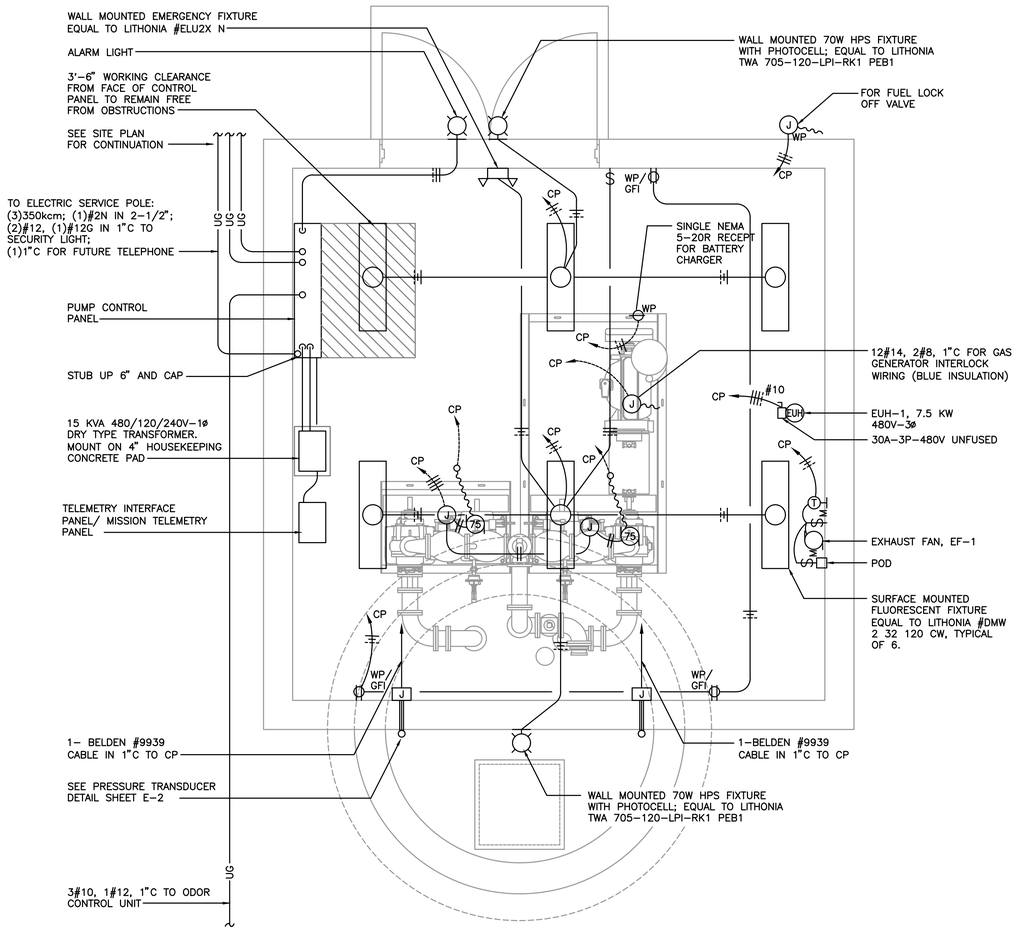
GENERAL NOTES:

1. REFER TO STRUCTURE ELECTRICAL PLANS FOR LOCATION, REQUIREMENTS, AND TERMINATION LOCATIONS.
2. ANALOG AND DIGITAL INSTRUMENTATION CABLING SHALL BE ROUTE IN SEPARATE CONDUITS.
3. POWER AND INSTRUMENTATION/COMMUNICATION CONDUITS SHALL BE INSTALLED A MINIMUM OF 12" APART.
4. PROVIDE 1800# POLYESTER PUWNG/MEASURING TAPE IN ALL UNUSED CONDUITS. GREENLEE #4436 OR EQUAL



WRIGHT LANE PUMP STATION ELECTRICAL SITE PLAN

SCALE: 1"=20'-0"



WRIGHTS LANE PUMP STATION ELECTRICAL PLAN

SCALE: 3/8"=1-0"

P:\PROJECTS\GMWSS\13009-US 25_Wright Lane Pump Station\DWG\13009-E01.dwg KEG 9/17/13

NO.	DATE	REVISIONS	BY

DATE:	SEPTEMBER 2013
PROJECT MGR:	BKL
DRAWN BY:	CDS
CHECKED BY:	BKL
SCALE:	AS NOTED

P.O. Box 1034
VERSAILLES, KENTUCKY 40383
KENTUCKY ENGINEERING GROUP, PLLC

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
125 WEST CLINTON STREET
P.O. BOX 640
GEORGETOWN, KENTUCKY 40324

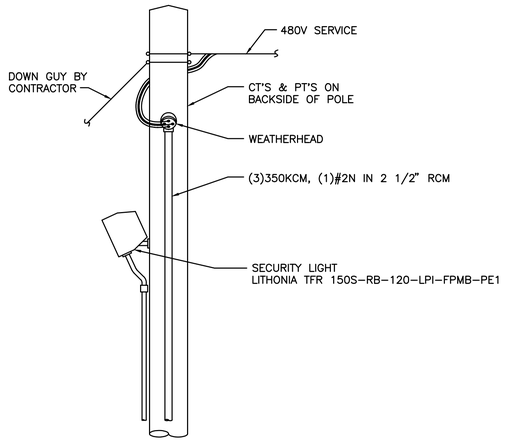
2013 WASTEWATER SYSTEM IMPROVEMENTS
US 25 - WRIGHTS LANE PUMP STATION and FORCE MAIN

WRIGHTS LANE PUMP STATON ELECTRICAL PLAN

STATE OF KENTUCKY
BRYAN K. LOWRY
13540
LICENSED PROFESSIONAL ENGINEER
9-13-13

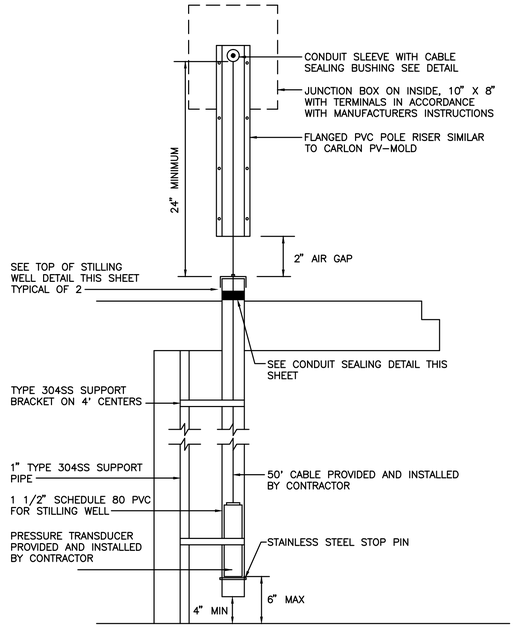
PROJECT NO. 13009

SHEET NO. E-1
OF 18



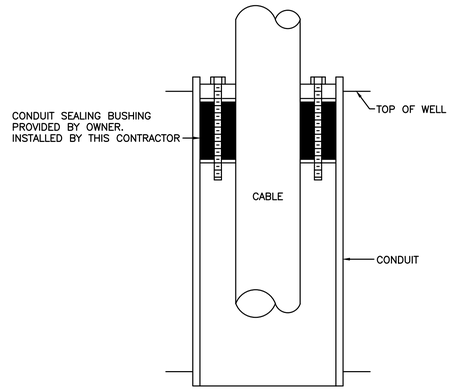
ELECTRIC SERVICE POLE DETAIL

NOT TO SCALE



PRESSURE TRANSDUCER DETAIL

NOT TO SCALE - (TYPICAL OF 2)

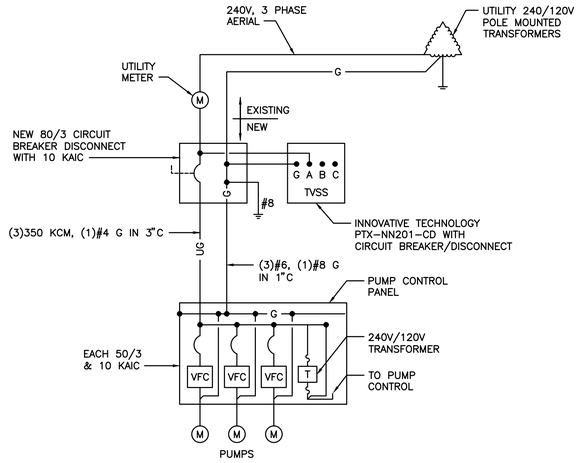


CONDUIT SEALING DETAIL

NOT TO SCALE - (TYPICAL OF 2)

HAZARD CLASSIFICATION NOTES:

1. THE WET WELLS AT THE PUMP STATIONS ARE CLASSIFIED AS CLASS I, DIVISION 1, GROUP D.
2. CLASS I LOCATIONS ARE THOSE IN WHICH FLAMMABLE GASES OR VAPORS ARE OR MAY BE PRESENT IN THE AIR, IN QUANTITIES SUFFICIENT TO PRODUCE EXPLOSIVE OR IGNITABLE MIXTURES.
3. DIVISION 1 LOCATIONS ARE THOSE IN WHICH IGNITABLE CONCENTRATIONS OF FLAMMABLE GASES OR VAPORS CAN EXIST UNDER ABNORMAL OPERATING CONDITIONS OR EXIST FREQUENTLY DUE TO MAINTENANCE OR LEAKAGE.
4. GROUP D FLAMMABLE GAS, LIQUID PRODUCED VAPOR, OR COMBUSTIBLE LIQUID-PRODUCED VAPOR MIXED WITH AIR THAT MAY BURN OR EXPLODE.
5. SEALOFFS, ALTHOUGH NOT SHOWN SHALL BE PROVIDED AND INSTALLED IN ACCORDANCE WITH ALL APPLICABLE CODES OF THE NATIONAL ELECTRICAL CODE.

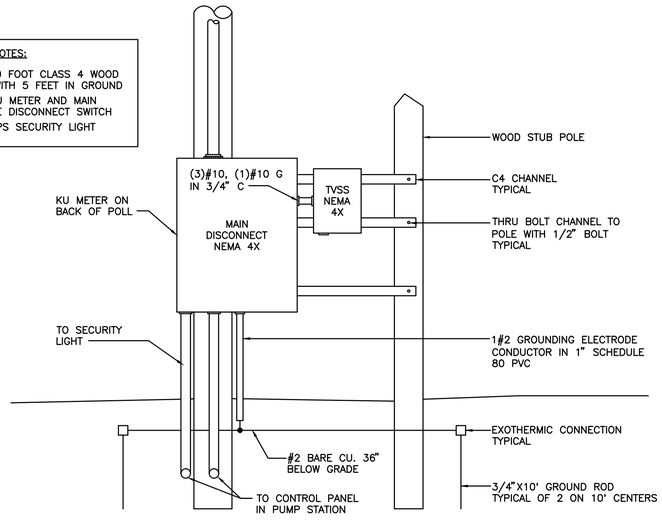


HARBOR VILLAGE PUMP STATION ONE-LINE DIAGRAM

NOT TO SCALE

GENERAL NOTES:

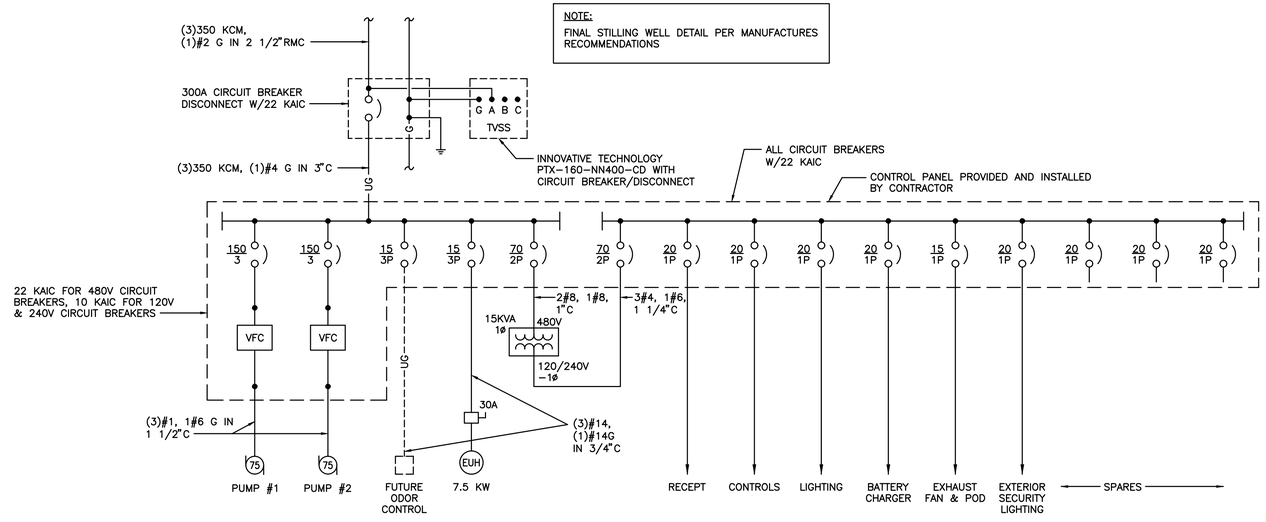
1. NEW 30 FOOT CLASS 4 WOOD POLE WITH 5 FEET IN GROUND
2. NEW KU METER AND MAIN SERVICE DISCONNECT SWITCH
3. NEW HPS SECURITY LIGHT



SERVICE RACK DETAIL

NOT TO SCALE

NOTE:
FINAL STILLING WELL DETAIL PER MANUFACTURES RECOMMENDATIONS



WRIGHT LANE PUMP STATION - ONE-LINE DIAGRAM

NOT TO SCALE

P:\PROJECTS\GMWSS\13009-US 25_Wright Lane Pump Station\DWG\13009-E02.dwg KEG 9/17/13

NO.	DATE	REVISIONS	BY

DATE:	SEPTEMBER 2013
PROJECT MGR:	BKL
DRAWN BY:	CDS
CHECKED BY:	BKL
SCALE:	AS NOTED

P.O. Box 1034
VERSAILLES, KENTUCKY 40383
KENTUCKY ENGINEERING GROUP, PLLC

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
125 WEST CLINTON STREET
P.O. BOX 640
GEORGETOWN, KENTUCKY 40324

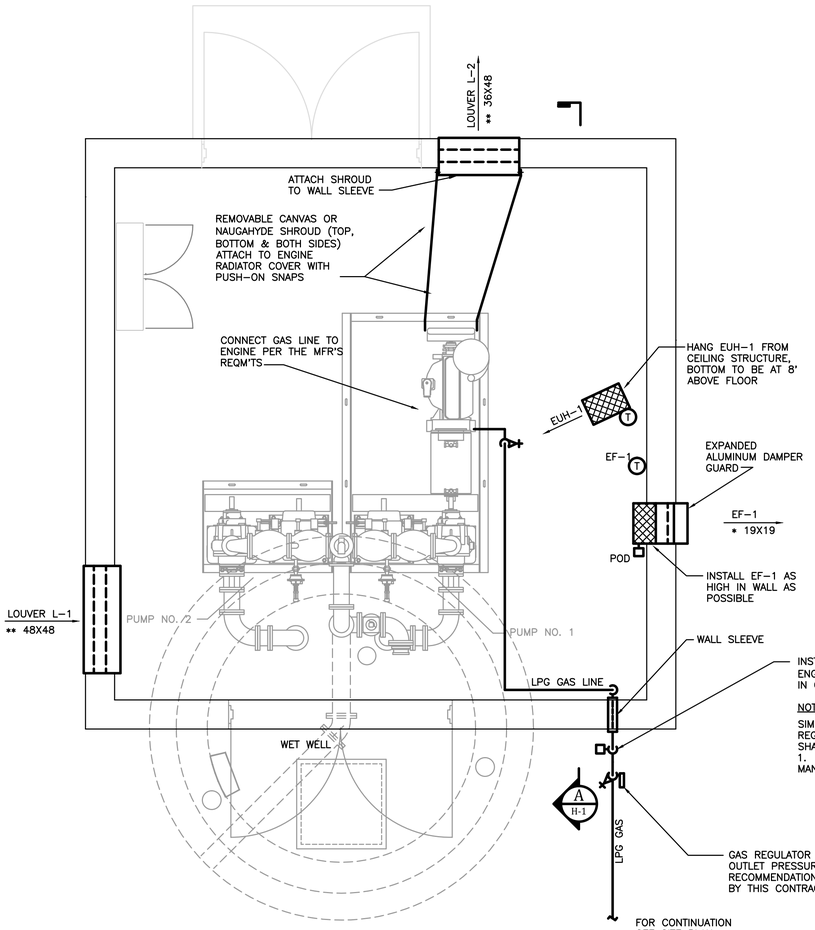
2013 WASTEWATER SYSTEM IMPROVEMENTS
US 25 - WRIGHTS LANE PUMP STATION and FORCE MAIN

WRIGHTS LANE PUMP STATION
ONE-LINE DIAGRAM and DETAILS

STATE OF KENTUCKY
BRYAN K. LOVAN
13540
LICENSED PROFESSIONAL ENGINEER
9-15-13

PROJECT NO. 13009

SHEET NO. E-2
OF 18



PUMP STATION PLAN

SCALE: 3/8" = 1'-0"

GENERAL NOTES:

1. THE CONTRACTOR SHALL MAINTAIN EXISTING UTILITIES AT ALL TIMES. THE CONTRACTOR SHALL WORK CONTINUOUSLY TO RESTORE ANY OUTAGE. SCHEDULED SHUT-DOWNS SHALL REQUIRE 24 HOUR PRIOR NOTIFICATION. COORDINATE ALL RELATED WORK WITH THE OWNER AND THE UTILITY COMPANIES AS REQUIRED.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL REQUIRED CODE REVIEW SUBMITTALS, PERMITS, TESTING, AND INSPECTIONS.
3. VERIFY ROUTING OF PIPING WITH OTHER TRADES PRIOR TO CONSTRUCTION/FABRICATION. CONTACT THE ENGINEER IN THE EVENT OF A CONFLICT.
4. COORDINATE THE SIZE AND LOCATIONS OF OPENINGS IN THE BUILDING FOR EQUIPMENT WITH OTHER TRADES.
5. SEAL ALL PENETRATION THROUGH EXTERIOR WALLS WITH SILICONE SEALANT.
6. ALL CONTROL WIRING SHALL BE IN CONDUIT.
7. INSTALL LPG GAS LINE AND ACCESSORIES IN ACCORDANCE WITH THE NATIONAL FUEL GAS CODE, THE LPG GAS SUPPLIER, AND THE LPG ENGINE MANUFACTURER.
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE INSTALLATION AND ALL COST RELATED TO THE NEW LPG GAS SERVICE FOR THIS BUILDING. THE CONTRACTOR SHALL COORDINATE WITH THE LPG SUPPLIER. LPG LOAD SHALL BE BASED ON RECOMMENDATION FROM PUMP/ENGINE MANUFACTURER.
9. GAS PIPING ABOVE GRADE: SCH. 40 BLACK IRON. PRIME COAT AND PAINT WITH OIL BASE ENAMEL PAINT, COLOR SELECTION BY THE OWNER.
10. DOUBLE CULVERT LANDFILL PUMP STATION NO. 1 HEATING AND VENTILATION PLAN SHALL BE SIMILAR TO MARKS PUMP STATION AS ILLASTRATED ON THIS SHEET WITH MODIFICATIONS AND CHANGES AS REQUIRED BY PUMP MANUFACTURER FOR THE FRP ENCLOSURE. ACTUAL FAN AND LOUVER SIZE SHALL BE SUBJECT TO CHANGE BASED ON THE APPROVED ENGINE/PUMP MANUFACTURER'S REQUIREMENTS.

LEGEND

	NEW PIPING AND OR EQUIPMENT
EUH-1	EQUIPMENT WITH DESIGNATION
T EF-1	THERMOSTAT
G	NATURAL OR LPG GAS PIPING
	ELBOW UP, DOWN
	TEE UP, DOWN

ELECTRIC UNIT HEATER SCHEDULE

HEATER No.	KW	AMPS	ELEMENTS VOLTS-PH-HZ	"MARKEL" MODEL NO.
EUH-1	7.5	9.1	480-3-60	P3P5507TS

REMARKS:

1. WASH DOWN HEATER, CORROSION RESISTANT CONSTRUCTION
2. BUILT-IN NEMA 4X THERMOSTAT AND CONTROLS.
3. CEILING/WALL MOUNTING BRACKET KIT, AND ALL HARDWARE.

FAN SCHEDULE

FAN #	GREENHECK #	RPM	CFM	S.P.(in.)	H.P.	VOLTS-PH-HZ	WALL OPENING	WALL MOUNTED
EF-1	SE1-12-432-A4	860	1,160	0.25"	1/4	120-1-60	* 19X19	MASONRY

NOTES:

1. WALL MOUNTED PROPELLER FAN WITH WALL SLEEVE AND FAN GUARD.
2. CONTROL WITH WALL THERMOSTAT (NEMA 4X) SET TO START AT 85°F. (ADJUSTABLE).
3. LOW LEAKAGE POWER OPERATED DAMPER AND ALUMINUM DAMPER GUARD.
4. PROVIDE SILL, HEAD, SIDE CLOSURES, AND ALL MOUNTING HARDWARE.
5. PROTECTIVE CLEAR COATINGS FOR CORROSIVE AND HIGH MOISTURE ATMOSPHERE

* ACTUAL WALL OPENING SIZE SHALL BE SUBJECT TO CHANGE BASED ON THE APPROVED FAN MANUFACTURER'S REQUIREMENTS.

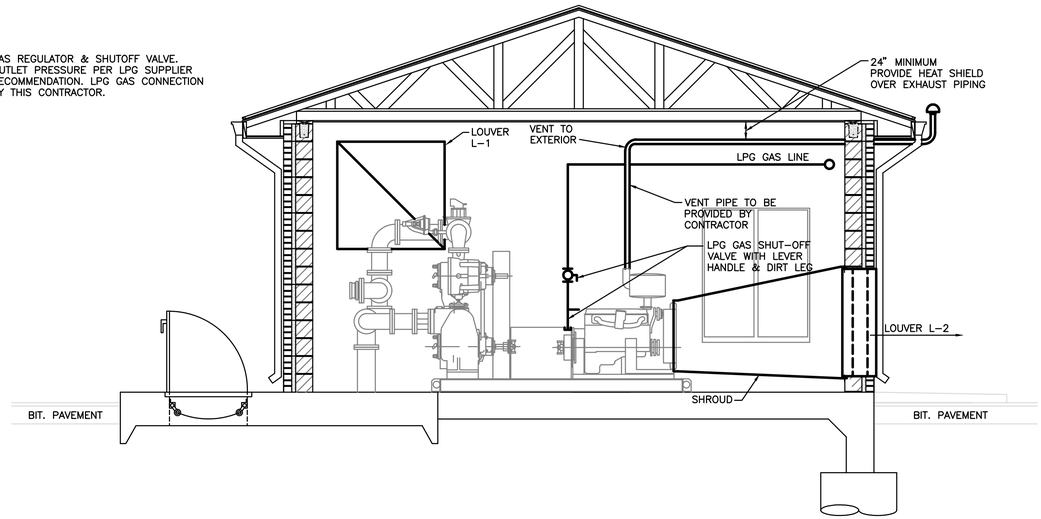
LOUVER SCHEDULE

LOUVER No.	SERVICE	CFM	PRESS. LOSS IN'S W.C.	SIZE (WXHXD) INCHES	MINIMUM FREE AREA (SQ. FT.)	MOUNTING
L-1	INTAKE	7,204	0.14"	** 48X48X4	8.5	MASONRY
L-2	EXHAUST	7,204	0.25"	** 36X48X4	6.3	MASONRY

NOTES:

a) ALL ALUMINUM CONSTRUCTION, MILL FINISH
b) LOW LEAKAGE ADJUSTABLE WEIGHTED GRAVITY BACKDRAFT DAMPER.
c) PROTECTIVE CLEAR COATINGS FOR CORROSIVE AND HIGH MOISTURE ATMOSPHERE
d) "RUSKIN" MODEL # ELF 375DX, DRAINABLE BLADE, STATIONARY ALUMINUM LOUVER OR EQUAL
e) BIRD SCREEN
f) WALL MOUNTING COLLAR, SLEEVE, EXTENDED SILL, SIDE CLOSURES, AND ALL MOUNTING HARDWARE

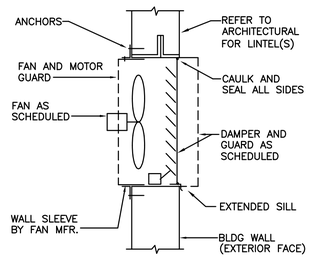
** LOUVER SIZE SHALL BE SUBJECT TO CHANGE BASED ON THE APPROVED ENGINE/PUMP MANUFACTURER'S REQUIREMENTS.



SECTION

SCALE: 3/8"=1'-0"

A
H-1



WALL MOUNTED FAN DETAIL

NOT TO SCALE

P:\PROJECTS\GMWSS\13009-US 25_Wright Lane Pump Station\DWG\13009-H01.dwg KEG 9/17/13

NO.	DATE	REVISIONS	BY

DATE:	SEPTEMBER 2013
PROJECT MGR:	BKL
DRAWN BY:	CDS
CHECKED BY:	BKL
SCALE:	AS NOTED

P.O. Box 1034
VERSAILLES, KENTUCKY 40383
KENTUCKY ENGINEERING GROUP, PLLC

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
125 WEST CLINTON STREET
P.O. BOX 640
GEORGETOWN, KENTUCKY 40324

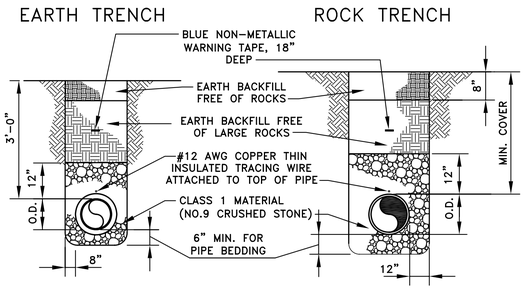
2013 WASTEWATER SYSTEM IMPROVEMENTS
US 25 - WRIGHTS LANE PUMP STATION and FORCE MAIN

WRIGHTS LANE PUMP STATION
HEATING and VENTILATION

STATE OF KENTUCKY
BRYAN K. LOVAN
13540
LICENSED PROFESSIONAL ENGINEER
9/17/13

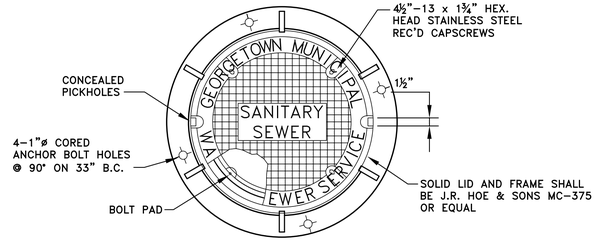
PROJECT NO. 13009

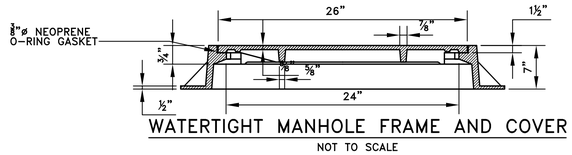
SHEET NO. H-1
OF 18



TYPICAL CASE I BACKFILL

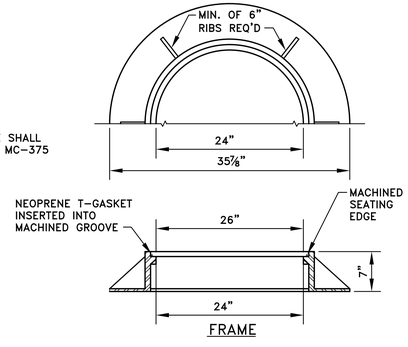
NOT TO SCALE



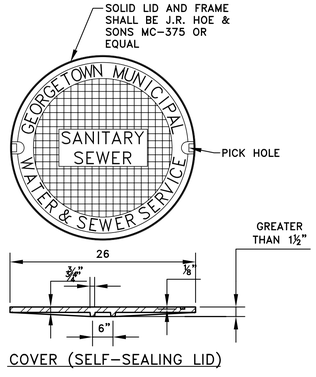


WATERTIGHT MANHOLE FRAME AND COVER

NOT TO SCALE



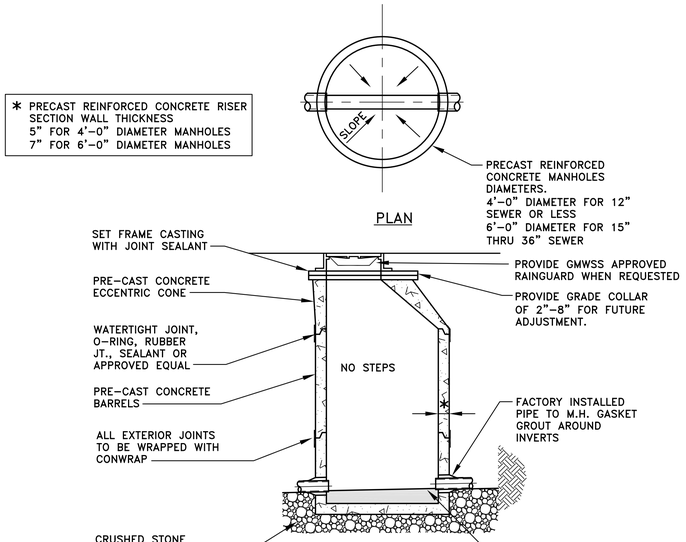
FRAME



COVER (SELF-SEALING LID)

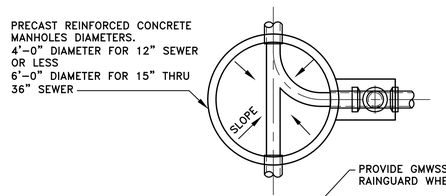
STANDARD MANHOLE FRAME AND COVER

NOT TO SCALE



STANDARD MANHOLE

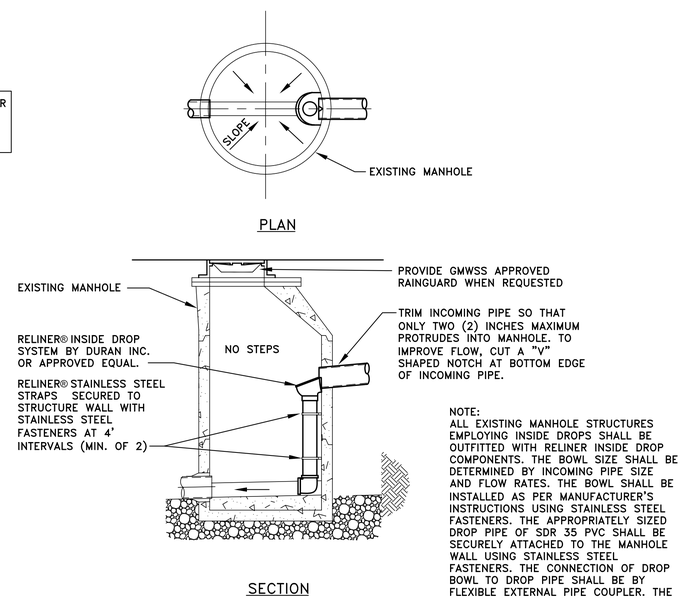
NOT TO SCALE



* PRECAST REINFORCED CONCRETE RISER SECTION WALL THICKNESS
5" FOR 4'-0" DIAMETER MANHOLES
7" FOR 6'-0" DIAMETER MANHOLES

DROP MANHOLE

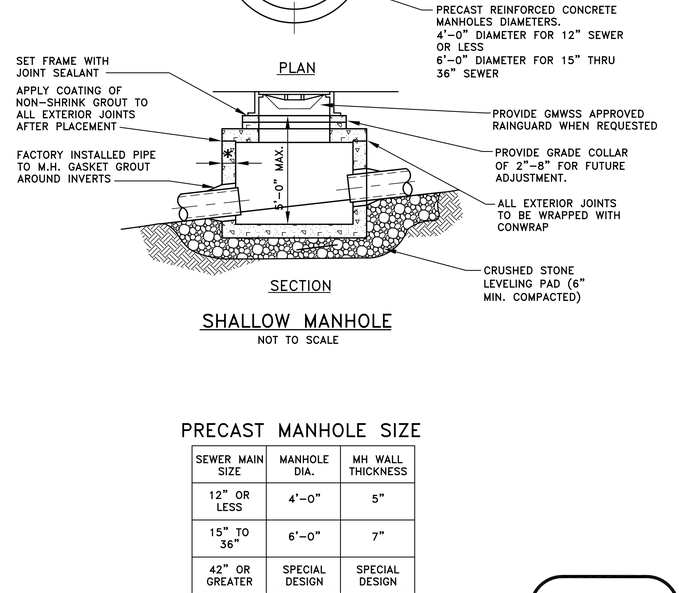
NOT TO SCALE



NOTE:
ALL EXISTING MANHOLE STRUCTURES EMPLOYING INSIDE DROPS SHALL BE OUTFITTED WITH RELINER INSIDE DROP COMPONENTS. THE BOWL SIZE SHALL BE DETERMINED BY INCOMING PIPE SIZE AND FLOW RATES. THE BOWL SHALL BE INSTALLED AS PER MANUFACTURER'S INSTRUCTIONS USING STAINLESS STEEL FASTENERS. THE APPROPRIATELY SIZED DROP PIPE OF SDR 35 PVC SHALL BE SECURELY ATTACHED TO THE MANHOLE WALL USING STAINLESS STEEL FASTENERS. THE CONNECTION OF DROP BOWL TO DROP PIPE SHALL BE BY FLEXIBLE EXTERNAL PIPE COUPLER. THE TURN-OUT AT THE BASE END OF THE DROP PIPE SHALL BE ACCOMPLISHED WITH AN APPROPRIATELY ANGLED PVC PIPE ELBOW.

DROP IN EXISTING MANHOLE

NOT TO SCALE



SHALLOW MANHOLE

NOT TO SCALE

PRECAST MANHOLE SIZE

SEWER MAIN SIZE	MANHOLE DIA.	MH WALL THICKNESS
12" OR LESS	4'-0"	5"
15" TO 36"	6'-0"	7"
42" OR GREATER	SPECIAL DESIGN	SPECIAL DESIGN

GEORGETOWN
MUNICIPAL WATER AND SEWER SERVICE
125 W. Clinton St. P.O. Box 640
Georgetown, Kentucky 40324

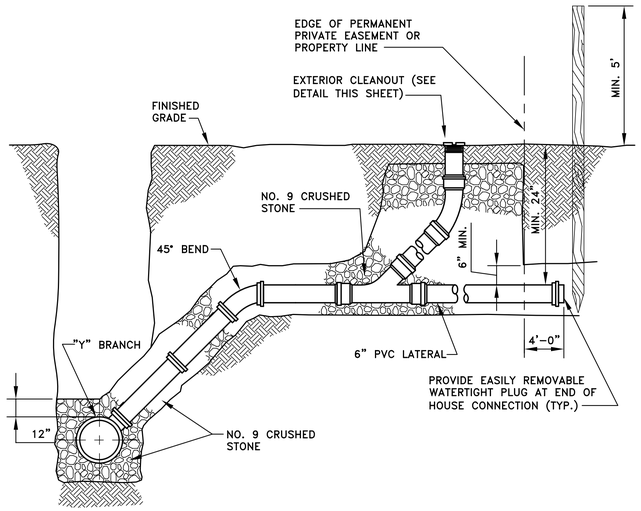
NO.	REVISION:	BY:	DATE:

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
SCOTT COUNTY, KENTUCKY

STANDARD SEWER LINE DETAILS
REVISED OCTOBER 2012

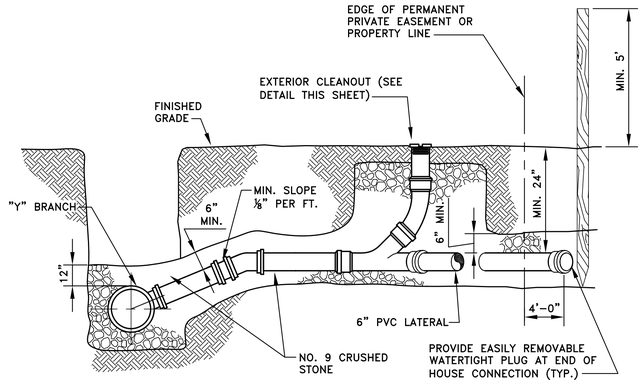
DRAWING INFORMATION
SCALE : AS NOTED
DESIGNED BY : DLC
DRAWN BY : DDM
CHECKED BY : STAFF
PROJECT NO : :
DATE :
CADD DWG ID : :

Sheet No.
SD1



STANDARD LATERAL FOR DEEP MAIN (OVER 6') IN EARTH OR ROCK

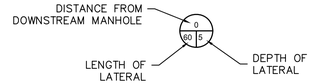
NOT TO SCALE



NOTES:
1. FOR MAINS LAID ON PRIVATE PROPERTY, ONLY THE "Y" BRANCH, CLEANOUT AND PLUG SHALL BE INSTALLED.
2. FOR MAINS LAID ON PUBLIC RIGHT-OF-WAY, THE LATERAL SHALL BE LAID TO THE PROPERTY LINE AND BEYOND TO THE DISTANCE INDICATED WITH CLEANOUT.
3. ALSO SEE GENERAL NOTES.

SIAMESE "Y" BRANCH OR LATERAL FOR SHALLOW MAIN (0-6') IN EARTH OR ROCK

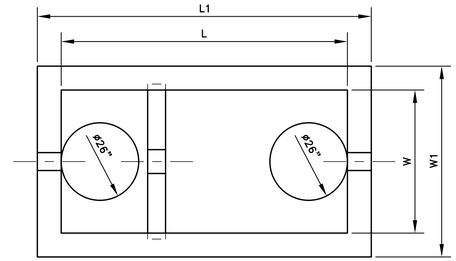
NOT TO SCALE



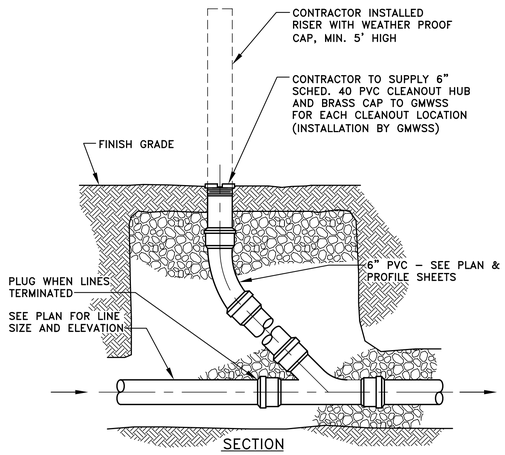
LATERAL KEY

NOT TO SCALE

TANK SIZE	H	H1	L	L1	W	W1	D
1000 GALLON	5.33'	6.66'	8.00'	9.33'	4.00'	5.33'	4.25'
1250 GALLON	6.33'	7.66'	8.00'	9.33'	4.00'	5.33'	5.25'
1500 GALLON	7.50'	8.83'	8.00'	9.33'	4.00'	5.33'	6.41'
2000 GALLON	4.66'	5.50'	12.0'	12.8'	6.00'	6.83'	3.75'
2500 GALLON	5.66'	6.08'	12.0'	12.8'	6.00'	6.83'	4.75'
3000 GALLON	6.50'	7.33'	12.0'	12.8'	6.00'	6.83'	5.58'
3500 GALLON	4.83'	6.16'	16.0'	17.3'	8.00'	9.33'	3.75'
4000 GALLON	5.33'	6.66'	16.0'	17.3'	8.00'	9.33'	4.25'
4500 GALLON	5.83'	7.16'	16.0'	17.3'	8.00'	9.33'	4.75'
5000 GALLON	6.33'	7.66'	16.0'	17.3'	8.00'	9.33'	5.25'



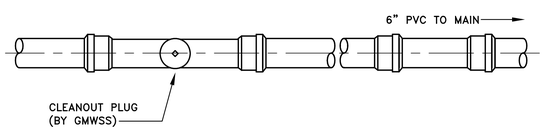
PLAN



SECTION

EXTERIOR CLEANOUT

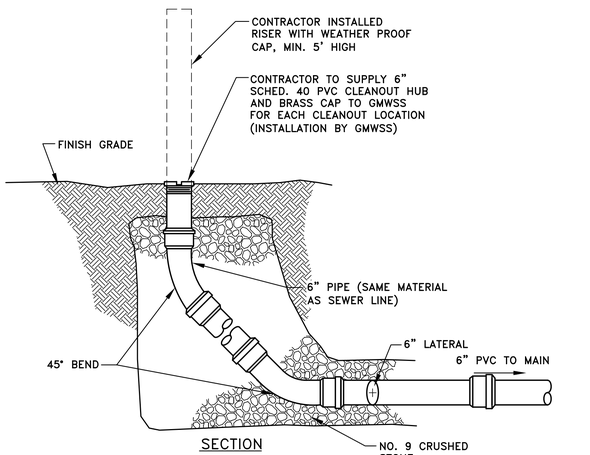
NOT TO SCALE



PLAN

EXTERIOR CLEANOUT

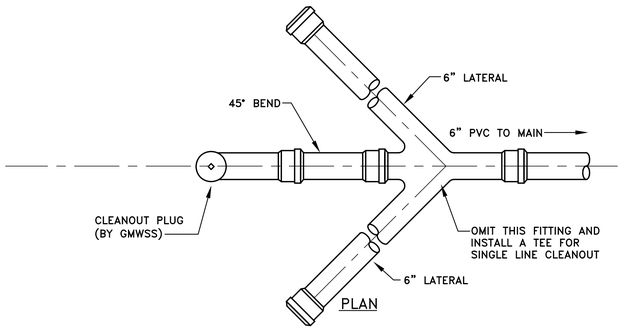
NOT TO SCALE



SECTION

EXTERIOR CLEANOUT

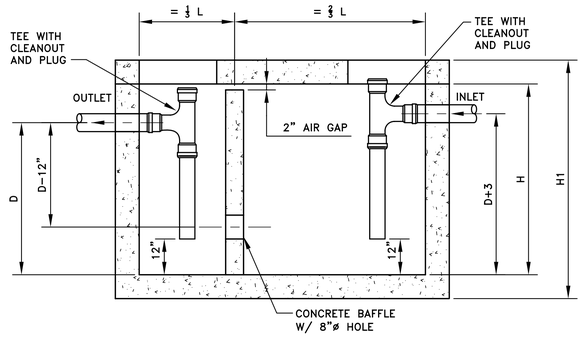
NOT TO SCALE



PLAN

EXTERIOR CLEANOUT

NOT TO SCALE



SECTION

TYPICAL GREASE TRAP

NOT TO SCALE

NOTES:
1. GREASE TRAP SHALL BE MANUFACTURED TO MEET MATERIAL REQUIREMENTS IN ASTM C-931
2. CONCRETE SHALL BE 4500 PSI
3. NO STEPS SHALL BE INSTALLED
4. BOX SHALL BE ABLE TO ACCOMMODATE HS-20 LIVE LOADS
5. RISER OR GRADE RINGS CAN BE USED TO MEET FINISHED GRADE
6. OPENINGS CAN VARY TO ACCOMMODATE VARIOUS PIPE DIAMETERS.
7. FLEXIBLE WATERTIGHT CONNECTIONS SHALL BE PROVIDED FOR INLET AND OUTLET PIPING.
8. MINIMUM GREASE TRAP SIZE IS 1000 GAL. GMWSS TO DETERMINE SIZE REQUIRED ABOVE MINIMUM.

GEORGETOWN
MUNICIPAL WATER AND SEWER SERVICE
125 W. Clinton St. P.O. Box 640
Georgetown, Kentucky 40324

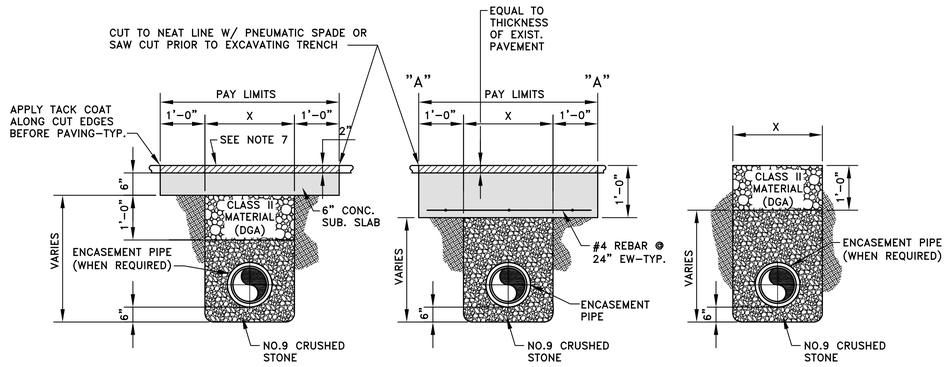
NO.	REVISION:	BY:	DATE:

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
SCOTT COUNTY, KENTUCKY

STANDARD SEWER LINE DETAILS
REVISED OCTOBER 2012

DRAWING INFORMATION	
SCALE	: AS NOTED
DESIGNED BY	: DLC
DRAWN BY	: DDM
CHECKED BY	: STAFF
PROJECT NO	:
DATE	:
CADD DWG ID	:

Sheet No.
SD2



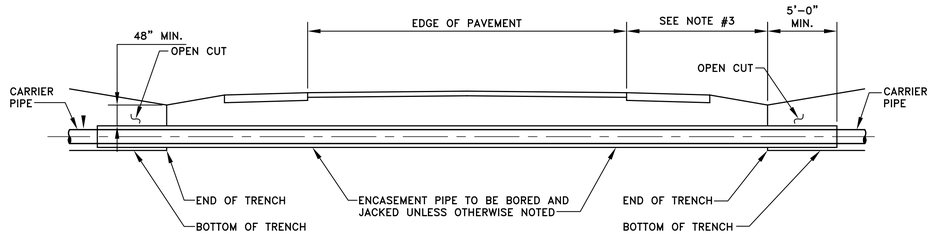
BITUMINOUS SURFACE | CONCRETE PAVEMENT | CRUSHED STONE PAVEMENT

NEW PAVEMENT & PAVEMENT REPLACEMENT TRENCH DETAILS

NOT TO SCALE

NOTES:

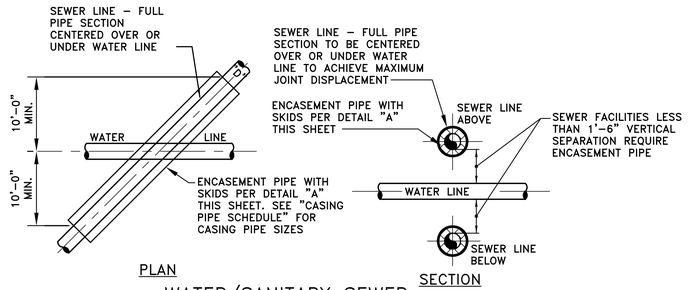
1. REPLACE BITUMINOUS PAVEMENT WITH SAME TYPE AND THICKNESS (2" MIN.) AS EXISTING PAVEMENT.
2. IF ROCK IS ENCOUNTERED, A MINIMUM OF 6" NO.9 CRUSHED STONE MUST BE PLACED UNDER THE PIPE.
3. X = MAX. WIDTH OF TRENCH AT SURFACE UNDER NORMAL CONDITIONS (3" + PIPE O.D.)
4. FROM POINTS "A" TO NEAREST JOINT OR BREAK IN PAVEMENT MUST BE AT LEAST SIX (6) FEET OR MORE. IF LESS THAN SIX (6) FEET, REMOVE PAVEMENT TO JOINT OR BREAK AND REPLACE ENTIRE SLAB.
5. NO.610 CRUSHED STONE MAY BE SUBSTITUTED FOR MECHANICALLY TAMPED EARTH BACKFILL WITH PRIOR APPROVAL OF THE ENGINEER.
6. SEE DETAIL "A" FOR PLACEMENT OF CARRIER PIPE IN CASING PIPE
7. 1' SAW CUT OUTSIDE OF TRENCH LINES, BITUMINOUS PATCH PLACED IN 2" LIFTS WITH TACK COAT ON EACH SIDE, EACH LIFT COMPACTED WITH SMALL ROLLER.
8. CONTRACTOR MUST ABIDE BY AND OBTAIN ALL PERMITS REQUIRED BY THE CITY OF GEORGETOWN.



NOTE:
1. SEE DETAIL "A" FOR PLACEMENT OF CARRIER PIPE IN CASING PIPE

CROSS SECTION OF ENCASED ROAD CROSSING – TYPICAL

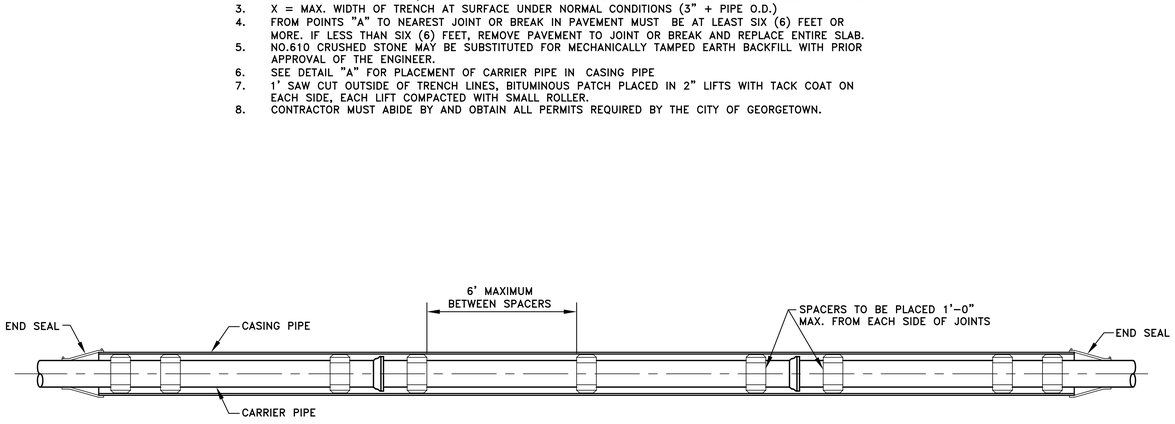
NOT TO SCALE



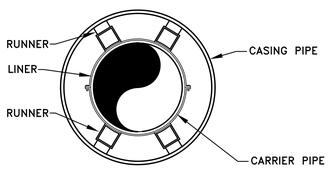
PLAN | SECTION

WATER/SANITARY SEWER CROSSING – ENCASEMENT

NOT TO SCALE



PLAN



ELEVATION

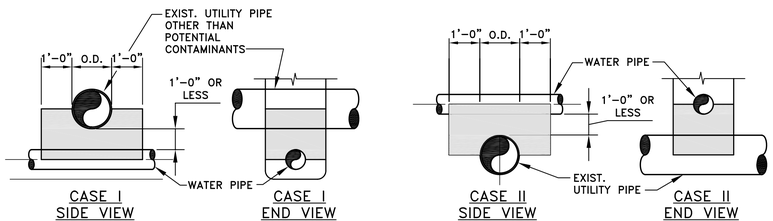
ENCASEMENT PIPE SPACER DETAIL "A"

NOT TO SCALE

NOTES:

1. ALL JOINTS SHALL BE SOLIDLY WELDED. END OF CASING SHALL BE SEALED AFTER LINE HAS BEEN INSTALLED AND TESTED.
2. MINIMUM DEPTHS MAY INCREASE IN AREAS WHICH REQUIRE MINIMUM SEPARATION WITH OTHER FACILITIES.
3. OPEN TRENCH NO CLOSER THAN THE DITCHLINE OR TOE OF FILL FROM THE EDGE OF THE PAVEMENT OR AS DIRECTED BY STATE, COUNTY OR MUNICIPAL SPECIFICATIONS.
4. HIGHWAY CROSSINGS SHALL UTILIZE STEEL CASING PIPE. STEEL CASING PIPES 4" AND LESS SHALL BE NEW SCHEDULE 40. STEEL CASING PIPES LARGER THAN 4" SHALL HAVE MINIMUM WALL THICKNESS OF 0.25". ALL BORED AND JACKED ENCASEMENT PIPE SHALL BE INSTALLED IN BORE HOLES NO LARGER THAN THE OUTSIDE DIAMETER OF THE ENCASEMENT PIPE.
5. ENCASEMENT PIPE TO BE PAID PER LINEAR FOOT OF WATER MAIN ENCASED

CASING PIPE SCHEDULE		
CARRIER PIPE SIZE	CASING PIPE SIZE	MINIMUM WALL THICKNESS (INCHES)
2"	6"	0.250
3"	8"	0.250
4"	12"	0.250
6"	14"	0.312
8"	16"	0.312
10"	18"	0.312
12"	20"	0.375
14"	24"	0.375
16"	26"	0.500
20"	30"	0.500
24"	34"	0.500
30"	40"	0.500



UTILITY CROSSING CONCRETE SEPARATOR

NOT TO SCALE

W = WIDTH OF CONC. FROM UNDISTURBED

NOTES:

1. CONCRETE SEPARATOR SHALL BE USED WHEN CLEARANCE BETWEEN WATER LINE AND UTILITY PIPE IS 12" OR LESS.
2. "UTILITY PIPE" INCLUDES UNDERGROUND WATER, NATURAL GAS, TELEPHONE, ELECTRICAL CONDUITS, STORM SEWER OR TYPICALLY NON-CONTAMINATING FACILITIES. WHEN CROSSING SANITARY SEWER OR POTENTIAL CONTAMINANTS SEE DETAIL "WATER/SANITARY SEWER CROSSING".
3. STEEL ENCASEMENT PIPE MAY BE USED IN LIEU OF CONCRETE ENCASEMENT AS SHOWN IN WATER/SANITARY SEWER CROSSING –ENCASEMENT DETAIL.

GEORGETOWN
MUNICIPAL WATER AND SEWER SERVICE
125 W. Clinton St. P.O. Box 640
Georgetown, Kentucky 40324

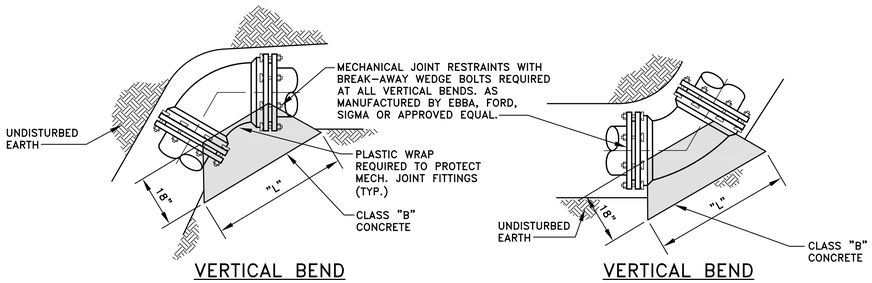
NO.	REVISION:	BY:	DATE:

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
SCOTT COUNTY, KENTUCKY

STANDARD SEWER LINE DETAILS
REVISED OCTOBER 2012

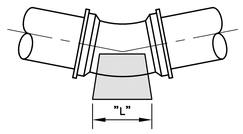
DRAWING INFORMATION
SCALE : AS NOTED
DESIGNED BY : DLC
DRAWN BY : DDM
CHECKED BY : STAFF
PROJECT NO. :
DATE :
CADD DWG ID :

Sheet No.
SD3

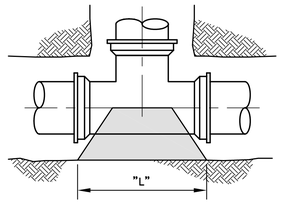


VERTICAL BEND
(SEE THRUST BLOCK SCHEDULE FOR DIMENSIONS OF BLOCKING)

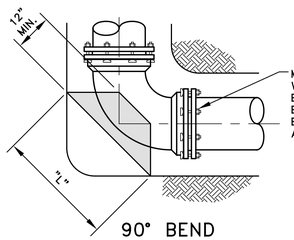
VERTICAL BEND
(SEE THRUST BLOCK SCHEDULE FOR DIMENSIONS OF BLOCKING)



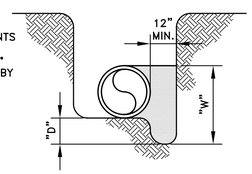
1 1/4°, 22 1/2° AND 45° BEND THRUST BLOCKS
(SEE THRUST BLOCK SCHEDULE FOR DIMENSIONS OF BLOCKING)



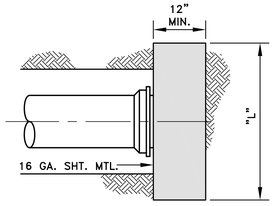
TEE THRUST BLOCKS
(SEE THRUST BLOCK SCHEDULE FOR DIMENSIONS OF BLOCKING)



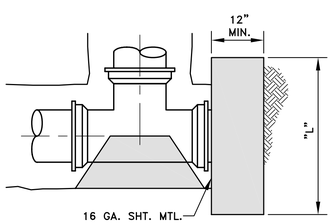
90° BEND THRUST BLOCKS
(SEE THRUST BLOCK SCHEDULE FOR DIMENSIONS OF BLOCKING)



SECTION–TYP. THRUST BLOCK
(SEE THRUST BLOCK SCHEDULE FOR DIMENSIONS OF BLOCKING)



END OF MAIN THRUST BLOCKS
(SEE THRUST BLOCK SCHEDULE FOR DIMENSIONS OF BLOCKING)

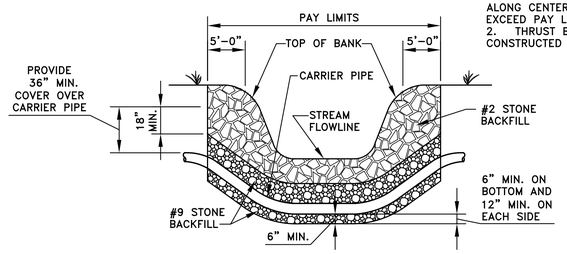


PLUGGED TEE THRUST BLOCKS
(SEE THRUST BLOCK SCHEDULE FOR DIMENSIONS OF BLOCKING)

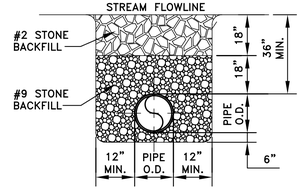
THRUST BLOCK SCHEDULE

SIZE	90° Bend			45° Bend			22 1/2° Bend			11 1/4° Bend			Tee & End Main		
	D	W	L	D	W	L	D	W	L	D	W	L	D	W	L
2"	6"	10"	4"	4"	7"	3"	4"	7"	3"	4"	7"	3"	6"	10"	4"
3"	6"	10"	8"	4"	8"	6"	4"	8"	3"	4"	8"	3"	6"	10"	6"
4"	6"	11"	9"	6"	11"	7"	4"	9"	5"	4"	9"	3"	6"	11"	8"
6"	8"	15"	13"	6"	13"	12"	4"	11"	8"	4"	11"	4"	8"	15"	10"
8"	10"	21"	19"	8"	17"	17"	6"	15"	10"	4"	13"	6"	10"	21"	21"
10"	10"	23"	29"	8"	20"	22"	6"	17"	13"	6"	17"	7"	10"	23"	30"
12"	12"	27"	31"	10"	24"	27"	10"	23"	14"	6"	19"	9"	12"	27"	36"
14"	14"	31"	38"	13"	29"	31"	12"	27"	17"	6"	21"	12"	14"	31"	42"
16"	15"	34"	44"	15"	33"	36"	14"	31"	19"	8"	25"	13"	17"	36"	48"
18"	21"	42"	45"	18"	38"	39"	17"	36"	21"	10"	29"	14"	21"	41"	54"
20"	22"	45"	53"	21"	43"	42"	18"	39"	24"	10"	31"	16"	22"	44"	60"

NOTES:
1. TO BE PAID PER LINEAR FOOT OF CASING AS MEASURED ALONG CENTERLINE OF PIPE. NOT TO EXCEED PAY LIMITS.
2. THRUST BLOCKING SHALL BE CONSTRUCTED AT ALL BENDS.

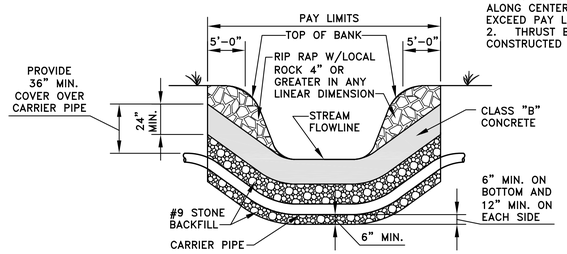


TYPE "A" CREEK CROSSING IN EARTH OR LOOSE ROCK

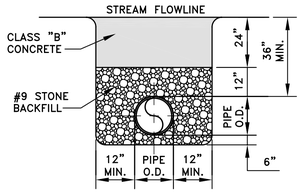


TYPICAL SECTION–TYPE "A" CREEK CROSSING IN EARTH OR LOOSE ROCK

NOTES:
1. TO BE PAID PER LINEAR FOOT OF CASING AS MEASURED ALONG CENTERLINE OF PIPE. NOT TO EXCEED PAY LIMITS.
2. THRUST BLOCKING SHALL BE CONSTRUCTED AT ALL BENDS.

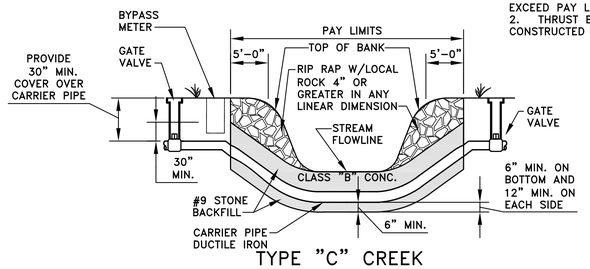


TYPE "B" CREEK CROSSING WITH CONCRETE CAP

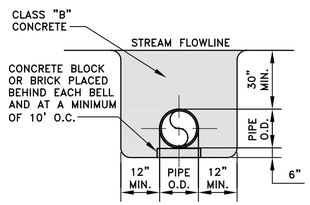


TYPICAL SECTION–TYPE "B" CREEK CROSSING WITH CONCRETE CAP

NOTES:
1. TO BE PAID PER LINEAR FOOT OF CASING AS MEASURED ALONG CENTERLINE OF PIPE. NOT TO EXCEED PAY LIMITS.
2. THRUST BLOCKING SHALL BE CONSTRUCTED AT ALL BENDS.



TYPE "C" CREEK CROSSING WITH CONCRETE ENCASEMENT



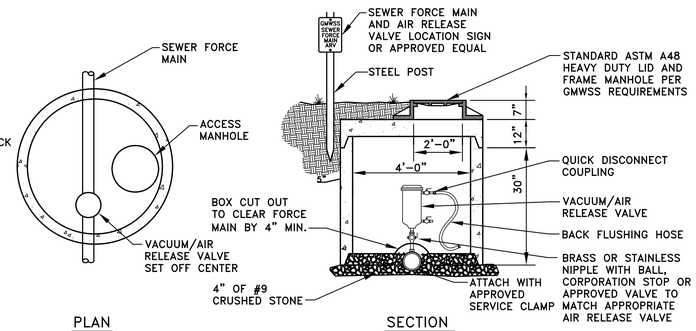
TYPICAL SECTION–TYPE "C" CREEK CROSSING WITH CONCRETE ENCASEMENT

SEWER VACUUM/AIR RELEASE VALVE AND BOXES

AIR RELEASE VALVES SHALL BE THE COMBINED VACUUM AND AIR RELEASE TYPE AND SHALL BE EQUIPPED WITH STAINLESS STEEL OR PLASTIC BODY AND COVER, STAINLESS STEEL FLOAT, BUNA–N SEAT AND BRONZE LINKAGE. BACK FLUSHING ATTACHMENTS INCLUDE: ONE 2" NPT ISOLATION BALL VALVE WITH LEVER, ONE 1" BLOW OFF BALL VALVE WITH LEVER, AND ONE 1/2" NPT FLUSH BALL VALVE WITH QUICK DISCONNECT COUPLING. ALL WITH CONNECTION NIPPLES AND A HOSE FOR BACK FLUSHING. VALVE SHALL HAVE A 1" STAINLESS STEEL THREADED INLET AND BE SUITABLE FOR 150 PSI WORKING PRESSURE. VALVE SHALL BE A.R.I. D–025 OR APPROVED EQUAL.

AT HIGH POINTS IN SEWER FORCE MAINS WHERE AIR CAN ACCUMULATE, PROVISIONS SHALL BE MADE TO REMOVE THE AIR BY MEANS OF VACUUM/AIR RELIEF VALVE. AUTOMATIC VACUUM/AIR RELIEF VALVES SHALL NOT BE USED IN SITUATIONS WHERE FLOODING OF THE MANHOLE OR CHAMBER MAY OCCUR. THEY SHALL BE CONNECTED TO THE FORCE MAIN BY A CORPORATION STOP WITH INSIDE I.P.S. THREADED OUTLET. THE INLET PIPE TO THE VACUUM/AIR RELEASE VALVE SHALL BE ASTM B43 EXTRA STRONG SEAMLESS RED BRASS PIPE WITH I.P.S. MALE THREADED ENDS OR EQUAL IN STAINLESS STEEL. ISOLATION VALVE WILL BE A STAINLESS BALL VALVE WITH LEVER.

THE VACUUM/AIR RELEASE VALVE BOX OR CHAMBER SHALL BE A 30" CONCRETE BARREL SECTION WITH A 4' INSIDE DIA. AS PER ASTM C–478 SPECIFICATIONS. THE TOP SLAB SHALL BE A 4'–10" DIA. X 12" WITH A OFF SET 2' HOLE AS PER ASTM C–478–93 SPECIFICATIONS. THE CONCRETE BARREL SECTION SHALL BE SET ON NO. 9 CRUSHED STONE OR GRAVEL BASE. THE VACUUM/AIR RELEASE VALVE SHALL BE SET OFF CENTER IN THE CHAMBER DUE TO ACCESS. MANHOLE LID SHALL BE LEVEL WITH GRADE AND MARKED WITH A SEWER FORCE MAIN SIGN.



SEWER VACUUM/AIR RELEASE VALVE CHAMBER
NOT TO SCALE

GEORGETOWN
MUNICIPAL WATER AND SEWER SERVICE
125 W. Clinton St. P.O. Box 640
Georgetown, Kentucky 40324

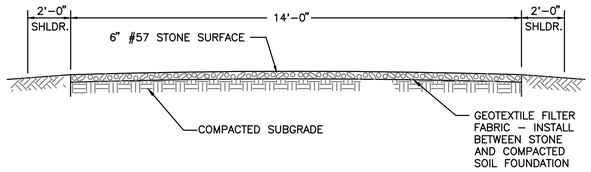
NO.	REVISION:	BY:	DATE:

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
SCOTT COUNTY, KENTUCKY

STANDARD FORCE MAIN DETAILS
REVISED OCTOBER 2012

DRAWING INFORMATION	
SCALE	: AS NOTED
DESIGNED BY	: DLC
DRAWN BY	: DDM
CHECKED BY	: STAFF
PROJECT NO.	:
DATE	:
CADD DWG ID	:

Sheet No.
SD4

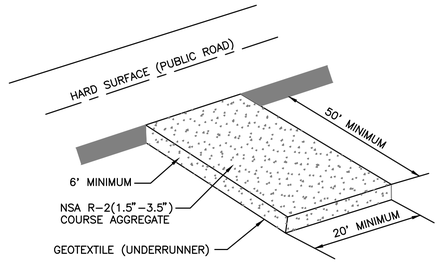


CONSTRUCTION ROAD STABILIZATION
TYPICAL GRAVEL DRIVEWAY SECTION

NOT TO SCALE

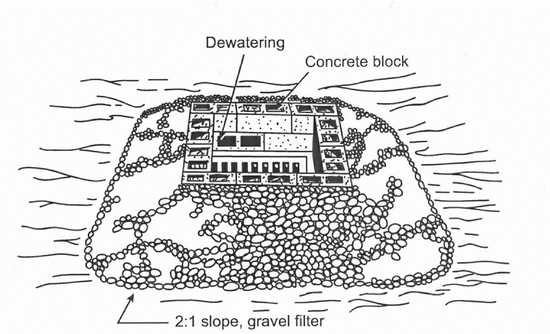
NOTES:

1. TREES, STUMPS, ROOTS, BRUSH, WEEDS, AND OTHER OBJECTIONABLE MATERIALS SHALL BE REMOVED FROM THE WORK AREA.
2. UNSUITABLE MATERIAL SHALL BE REMOVED FROM THE ROADBED AND PARKING AREAS.
3. GRADING, SUBGRADE PREPARATION, AND COMPACTION SHALL BE DONE AS NEEDED. FILL MATERIAL SHALL BE DEPOSITED IN LAYERS NOT TO EXCEED 9 INCHES AND COMPACTED WITH THE CONTROLLED MOVEMENT OF COMPACTING AND EARTH MOVING EQUIPMENT.
4. THE ROADBED SHALL BE GRADED TO THE REQUIRED ELEVATION. SUBGRADE PREPARATION AND PLACEMENT OF THE SURFACE COURSE SHALL BE IN ACCORDANCE WITH SOUND ROADWAY CONSTRUCTION.
5. ALL CUT AND FILLS SHALL BE 2:1 OR FLATTER TO THE EXTENT POSSIBLE.
6. WATER BREAKS OR BARS MAY BE USED TO CONTROL SURFACE RUNOFF.
7. ROADS SHALL BE LAID OUT ACCORDING TO GOOD LANDSCAPE MANAGEMENT PRINCIPLES.
8. ALL ROADSIDE DITCHES, CUTS, FILLS, AND DISTURBED AREAS ADJACENT TO ROADS SHALL BE STABILIZED WITH APPROPRIATE TEMPORARY OR PERMANENT VEGETATION.



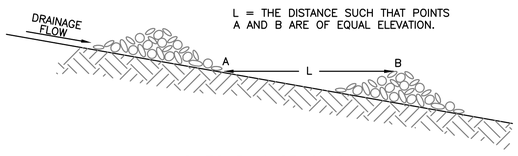
CRUSHED STONE CONSTRUCTION EXIT

NOT TO SCALE



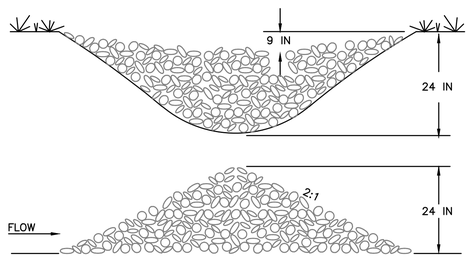
INLET SEDIMENT TRAP -
BLOCK & GRAVEL DROP INLET PROTECTION

NOT TO SCALE



CHECKDAM SPACING

N.T.S.



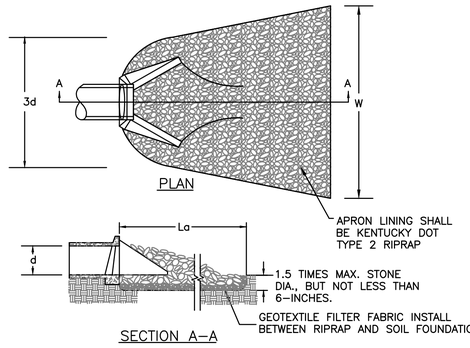
NOTES:

1. ROCK CHECK DAMS SHOULD BE CONSTRUCTED OF GRADED 5 TO 10 INCH STONE. MECHANICAL OR HAND PLACEMENTS SHALL BE REQUIRED TO ENSURE COMPLETE COVERAGE OF THE ENTIRE WIDTH OF DITCH OR SWALE AND THAT THE CENTER OF THE DAM IS LOWER THAN THE EDGES.
2. INSPECT BEHIND RIPRAP CHECKDAM DAILY AND CLEAN WHEN COLLECTED DEBRIS EXCEEDS HALF OF ITS DEPTH.

ROCK CHECK DAM

NOT TO SCALE

OUTLET APRON SIZING TABLE			
PIPE – DIAM.(d)	3d (FT)	La	W
15"	4	5	8
18"	5	10	15
24"	6	20	24

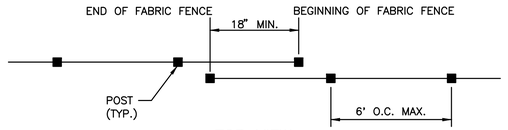


NOTES:

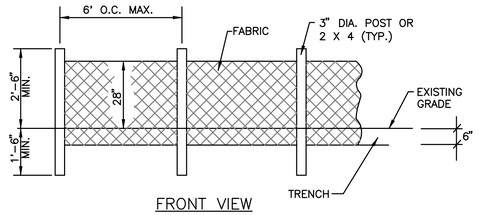
1. INSPECT OUTLET STRUCTURES AFTER HEAVY RAINS TO SEE IF EROSION AROUND OR BELOW RIPRAP HAS TAKEN PLACE OR IF STONES HAVE BEEN DISLODGED. IMMEDIATELY MAKE REPAIRS TO PREVENT FUTURE DAMAGE.
2. ALL PIPES AND FITTINGS SIZE AS SHOWN ON DRAWINGS.
3. SEE SHEETS C–5 THRU C–7 FOR PIPE INVERT ELEVATIONS.
4. INSPECT INLETS AND OUTLETS DAILY AND AFTER RAINFALL. REPAIR AS NECESSARY AND CLEAN WHEN DEBRIS COLLECTS.

STORM DRAIN OUTLET PROTECTION

NOT TO SCALE



TOP VIEW
OVERLAP @ FABRIC ENDS



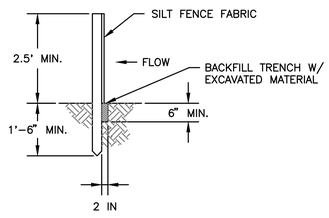
FRONT VIEW

NOTES:

1. SILT FENCE FABRIC SHALL MEET THE REQUIREMENTS OF KENTUCKY DOT STD. SPECIFICATIONS. APPROVED SILT FENCE FABRICS ARE LISTED IN KENTUCKY DOT. THE MANUFACTURER SHALL HAVE EITHER AN APPROVED COLOR MARK YARN IN THE FENCE OR LABEL THE FABRICATED SILT FENCE WITH BOTH THE MANUFACTURER AND FABRIC NAME EVERY 100 FEET.
2. THE CONTRACTOR SHALL MAINTAIN THE SILT FENCE UNTIL THE PROJECT IS VEGETATED OR ACCEPTED. FILTER FABRIC SHALL BE REPLACED WHENEVER IT HAS DETERIORATED TO THE EXTENT THAT EFFECTIVENESS IS REDUCED.
3. INSPECT SILT FENCES REGULARLY AND FOLLOWING RAIN EVENTS. CLEAN WHEN COLLECTED SEDIMENT EXCEEDS HALF THE DEPTH OF THE SILT FENCE.

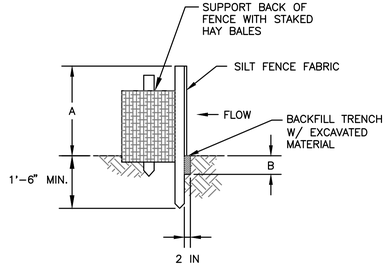
SEDIMENT BARRIER

NOT TO SCALE



TRENCH DETAIL FOR SEDIMENT FENCE

NOT TO SCALE



TRENCH DETAIL FOR HAY BALE SEDIMENT FENCE

NOT TO SCALE

P:\PROJECTS\GMWSS\13009-US 25_Wright Lane Pump Station\DWG\13009-SD5.dwg KEG 9/17/13

NO.	DATE	REVISIONS	BY

DATE:	SEPTEMBER 2013
PROJECT MGR:	BKL
DRAWN BY:	CDS
CHECKED BY:	BKL
SCALE:	AS NOTED

P.O. Box 1034
VERSAILLES, KENTUCKY 40383
KENTUCKY ENGINEERING GROUP, PLLC

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
125 WEST CLINTON STREET
P.O. BOX 640
GEORGETOWN, KENTUCKY 40324

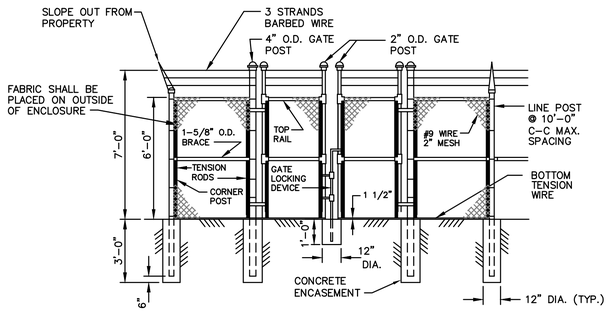
2013 WASTEWATER SYSTEM IMPROVEMENTS
US 25 - WRIGHTS LANE PUMP STATION and FORCE MAIN

MISCELLANEOUS DETAILS

STATE OF KENTUCKY
BRYAN K. LOWRY
13540
LICENSED PROFESSIONAL ENGINEER
9-15-13

PROJECT NO. 13009

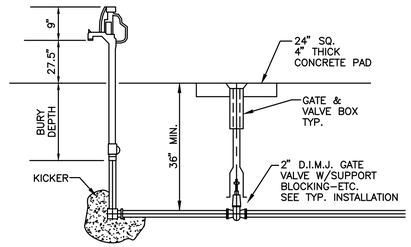
SHEET NO. SD-5
OF 18



NOTE: TAMPER PROOF FASTENING REQUIRED THROUGHOUT

SECURITY FENCE W/SWINGING GATES

NOT TO SCALE



FREEZEPROOF YARD HYDRANT

NOT TO SCALE

COMMERCIAL ENTRANCE APPROACH

ALL COMMERCIAL ENTRANCES MUST BE PAVED FROM THE EDGE OF DRIVING LANE TO A POINT PAST THE DITCH LINE AS SHOWN USING THE MINUMUM PAVEMENT DEPTHS BELOW UNLESS OTHERWISE PERMITTED BY THE ENGINEER.

ASPHALT ENTRANCE APPROACH

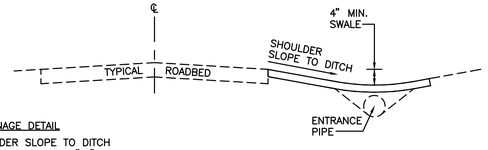
SURFACE MATERIAL:
1½" ASPHALT SURFACE CL I 0.38 E PG. 64-22

BASE MATERIAL:
3" ASPHALT BASE CL I 1.0 E PG 64-22

SUB BASE MATERIAL:
8" DENSE GRADED AGGREGRATE (DGA)

SPECIAL NOTES:

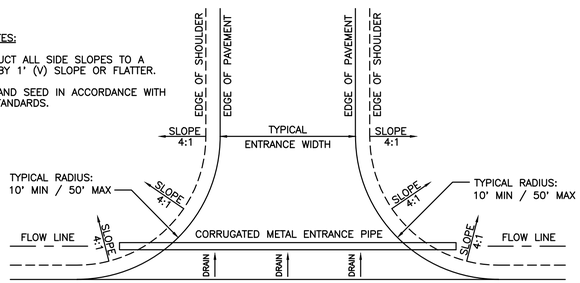
1. CONSTRUCT ENTRANCE SO THAT ALL RUNOFF WILL DRAIN AWAY FROM ROADWAY AND IS NOT ALLOWED ONTO THE SHOULDER OR DRIVING LANE.
2. DITCHING OR OTHER EXCAVATION MAY BE NECESSARY TO ASSURE PROPER PIPE COVERAGE AND PROVIDE POSITIVE DRAINAGE.
3. MINIMUM DITCH FLOWLINE SLOPE OF 1/2' PER 100'.
4. USE CORRUGATED METAL ENTRANCE PIPE.
5. PIPE SIZE SHALL BE 15-INCH MINIMUM.
6. CONSTRUCT 4:1 AT PIPE ENDS.



ROADWAY DRAINAGE DETAIL

EXTEND SHOULDER SLOPE TO DITCH (1/2":1' PAVED OR STONE, 1":1" EARTH) AND CONSTRUCT SWALE OR LOW POINT OVER PIPE.

TYPICAL APPROACH SECTION



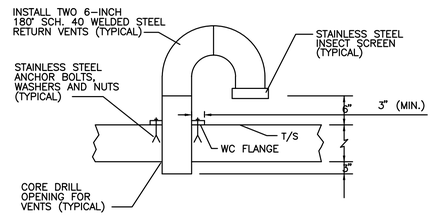
SPECIAL NOTES:

1. CONSTRUCT ALL SIDE SLOPES TO A 4' (H) BY 1' (V) SLOPE OR FLATTER.
2. DRESS AND SEED IN ACCORDANCE WITH KYTC STANDARDS.

TYPICAL PIPE SECTION

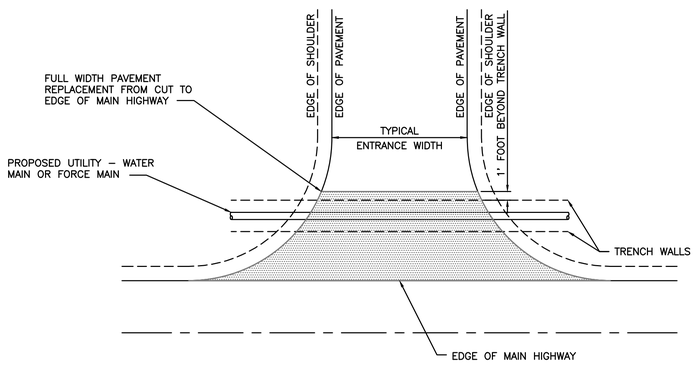
COMMERCIAL ENTRANCE DETAIL

NOT TO SCALE



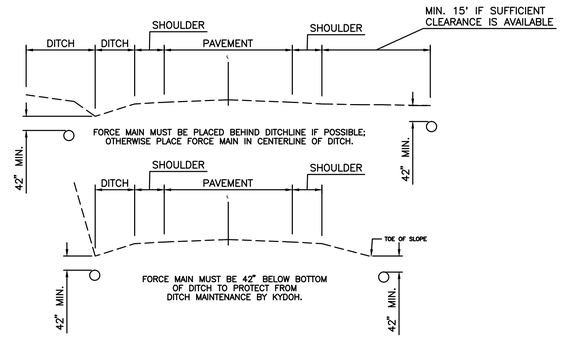
VENT/GRAVITY

NOT TO SCALE



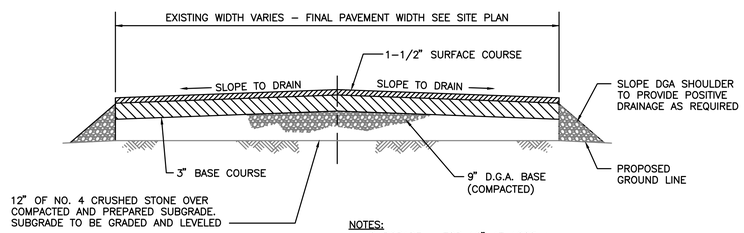
SINGLE SEAM PAVEMENT REPLACEMENT

NOT TO SCALE



TYPICAL CONSTRUCTION ON KDOH RIGHT-OF-WAYS

NOT TO SCALE



NOTES:

1. SUBGRADE – TOP 12" AT 100% *
2. SUBGRADE – FILL BELOW TOP 12" IN 6" LIFTS @ 95% *
3. FOR DISTURBED SOIL – 12" OF NO. 4 CRUSHED STONE OVER COMPACTED SUBGRADE

* PERCENT COMPACTION AASHTO T-180-D

TYPICAL BITUMINOUS PAVEMENT & ACCESS ROAD SECTION - WRIGHTS LANE PUMP STATION

NOT TO SCALE

P:\PROJECTS\GMWSS\13009-US 25_Wright Lane Pump Station\DWG\13009-SD6.dwg KEG 9/17/13

NO.	DATE	REVISIONS	BY

DATE:	SEPTEMBER 2013
PROJECT MGR:	BKL
DRAWN BY:	CDS
CHECKED BY:	BKL
SCALE:	AS NOTED

P.O. Box 1034
VERSAILLES, KENTUCKY 40383
KENTUCKY ENGINEERING GROUP, PLLC

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
125 WEST CLINTON STREET
P.O. BOX 640
GEORGETOWN, KENTUCKY 40324

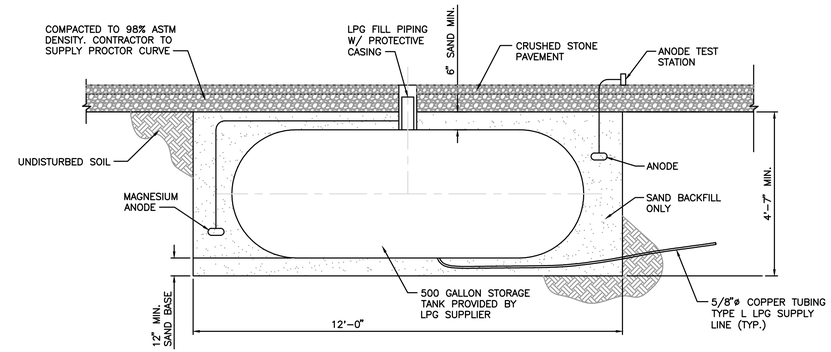
2013 WASTEWATER SYSTEM IMPROVEMENTS
US 25 - WRIGHTS LANE PUMP STATION and FORCE MAIN

MISCELLANEOUS DETAILS

STATE OF KENTUCKY
BRYAN K. LOWE
13540
LICENSED PROFESSIONAL ENGINEER
9/15/13

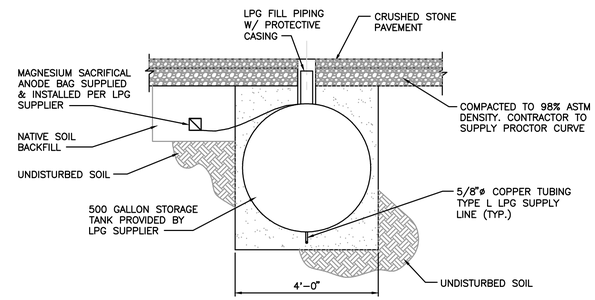
PROJECT NO.
13009

SHEET NO.
SD-6
OF 18



NOTES:

1. TANK SHALL BE A MIN. 18" BELOW GRADE.
2. ANODE TEST STATION SHALL BE LOCATED AWAY FROM VEHICULAR TRAFFIC
3. TANK SHALL MEET NFPA 58 STANDARDS.
4. THE TANK SHALL BE SETUP BASED UPON LIQUID WITHDRAWAL SYSTEM (TYP.). WITHDRAWAL SYSTEM PER PROPANE SUPPLIER



LPG STORAGE TANK

NOT TO SCALE

P:\PROJECTS\GMWSS\13009-US 25_Wright Lane Pump Station\DWG\13009-SD7.dwg KEG 9/17/13

NO.	DATE	REVISIONS	BY

DATE:	SEPTEMBER 2013
PROJECT MGR:	BKL
DRAWN BY:	CDS
CHECKED BY:	BKL
SCALE:	AS NOTED

P.O. Box 1034
VERSAILLES, KENTUCKY 40383
KENTUCKY ENGINEERING GROUP, PLLC

GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
125 WEST CLINTON STREET
P.O. BOX 640
GEORGETOWN, KENTUCKY 40324

2013 WASTEWATER SYSTEM IMPROVEMENTS
US 25 - WRIGHTS LANE PUMP STATION and FORCE MAIN

MISCELLANEOUS DETAILS

STATE OF KENTUCKY
BRYAN K. LOWRY
13540
LICENSED PROFESSIONAL ENGINEER
9/15/13

PROJECT NO.
13009

SHEET NO.
SD-7
OF 18