R-552-2020
Contract # 229-2020

CONTRACT DOCUMENTS
AND
SPECIFICATIONS

DIVISION OF WATER QUALITY

FOR

West Hickman BPR Improvements

Bid No. 97-2020

Edition – Contract Documents

PREPARED BY:
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424 Lewis Hargett Circle, Suite 110
Lexington, Kentucky 40503

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PART 1

ADVERTISEMENT FOR BIDS

1. INVITATION

Sealed proposals for the **West Hickman BPR Improvements** will be received by the Lexington-Fayette Urban County Government (LFUCG) via Ion Wave until 2:00 p.m., local time, **October 22, 2020**, for furnishing all labor and/or materials and performing all work as set forth by this advertisement, Ion Wave Q&A, conditions (general and special), specifications, and/or the drawings prepared by and for Lexington-Fayette Urban County Government, Division of Water Quality. Immediately following the scheduled closing time for reception of bids, all proposals which have been submitted in accordance with the above will be opened electronically and a bid tab sheet will be posted via Ion Wave.

Due to the current environment and recommendations for social distancing, LFUCG will only be accepting bids on-line through Ion Wave for this solicitation. Base bid and alternate totals (if required) should be provided on the appropriate line items tab on Ion Wave. Submissions without line item totals (if required) may be rejected and deemed non-responsive. All forms normally provided with bid submission should be downloaded from Ion Wave, filled out and attached with bid submission. All notary requirements are waived for this solicitation. A copy of bid bond must be included with submission. THESE INSTRUCTIONS SUPERCEDE ALL OTHER BID SUBMISSION INSTRUCTIONS PROVIDED IN THIS PACKAGE. PLEASE SUBMIT ALL QUESTIONS VIA THE Q&A MODULE ON ION WAVE.

2. DESCRIPTION OF WORK

The project includes providing all construction supervision, labor, materials, tools, and test equipment necessary for **West Hickman BPR Improvements** as shown on the Drawings and described in the Specifications.

The major work items include, but is not limited to, the following:

- Installation of new submersible mixers in the BPR Basins. This will include the removal of the existing mixers and accessories,
- Installation of a new process analyzer system (Two – Chemscan units) including eight sample pumps and associated sample piping.
- The installation of new sodium aluminate feed pumps and associated piping.

3. OBTAINING PLANS, SPECIFICATIONS, AND BID DOCUMENTS

Plans, Specifications, and Contract Documents may be obtained from the official bid document distributor, LYNN IMAGING, 328 Old Vine Street, Lexington, KY 40507, (859) 255-1021 or (www.lynnimaging.com) and click on plan room for a non-refundable price of reproduction for each full set of plans and documents.

Specifications, Plans, and Bid Documents may be examined at the following places:

LFUCG
Division of Central Purchasing
200 East Main Street
Third Floor, Room 338
Lexington, Kentucky 40507
(859) 258-3320

Builders Exchange
1035 Strader Drive, Suite 100
Lexington, Kentucky, 40505

LFUCG
Division of Water Quality
125 Lisle Industrial Avenue
Lexington, Kentucky 40511
(859) 425-2400

Dodge Data & Analytics
2321 Fortune Drive, Suite 112-A
Lexington, Kentucky 40509

4. METHOD OF RECEIVING BIDS

Bids will be received from Prime Contracting firms on a **Lump Sum Price Basis** for total Project Area. Bidder must include a price for all bid items to be considered. **Bids shall be submitted in the manner and subject to the conditions as set forth and described in the Instruction to Bidders and Special Conditions.**

Bids/proposals should be submitted online via Ion Wave.

5. METHOD OF AWARD

The Contract, if awarded, will be to the lowest responsive and responsible bidder for the total project whose qualifications indicate the award will be in the best interest of the OWNER and whose bid/proposal complies with all the prescribed requirements. No Notice of Award will be given until the OWNER has concluded such investigation as

deemed necessary to establish the responsibility, qualifications and financial ability of Bidders to do the work in accordance with the Contract Documents to the satisfaction of the OWNER within the time prescribed. The OWNER reserves the right to reject the Bid of any Bidder who does not pass such investigation to the OWNER's satisfaction. The OWNER reserves the right to reject the Bid of any Bidder that is deemed to be unbalanced or front loaded. In analyzing Bids, the OWNER may take into consideration alternate and unit prices, if requested by the Bid forms.

6. BID WITHDRAWAL

No bidder may withdraw his bid for a period of one hundred twenty (120) calendar days after the closing date for receipt of bids. Errors and omissions will not be cause for withdrawal of bid without forfeit of bid bond.

7. BID SECURITY

If the bid is $50,000 or greater, bid shall be accompanied by a certified check or bid bond payable to the Lexington-Fayette Urban County Government in an amount not less than Five Percent (5%) of the base bid. Bid bond shall be executed by a Surety Company authorized to do business in the Commonwealth of Kentucky and countersigned by a licensed Kentucky Resident Agent, representing the Surety Company. Bid Bonds are not required for bids under $50,000. A cashier's check or irrevocable letter of credit is an acceptable form of bid security.

8. SUBMISSION OF BIDS

CONTRACTORS shall submit their bids via Ion Wave not later than 2:00 p.m. local time, **October 22, 2020**. Bids will remain sealed until **October 22, 2020, 2:00 p.m.**, the official Bid closure time. Bids received after the scheduled closing time for receipt of bids will not be accepted.

9. RIGHT TO REJECT

The Lexington-Fayette Urban County Government reserves the right to reject any and all bids and to waive all informalities and/or technicalities where the best interest of the Lexington-Fayette Urban County Government may be served.

10. NOTIFICATION TO THE LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT FOR AFFIRMATIVE ACTION PLAN AND CURRENT WORKFORCE

The successful bidder must submit the following to the Lexington-Fayette Urban County Government:

1. Affirmative Action Plan for his/her firm.
2. Current Workforce Analysis Form

Failure to submit this as required herein may result in disqualification of the Bidder from the award of the contract.

11. NOTICE CONCERNING MWDBE and Veteran Goals

Notice of requirement for Affirmative Action to ensure Equal Employment Opportunities and Disadvantaged Business Enterprises (DBE) Contract participation. Disadvantaged Business Enterprises (DBE) consists of Minority-Owned Business Enterprises (MBE) and Woman-Owned Business Enterprises (WBE).

The Lexington-Fayette Urban County Government has set a goal that not less than ten percent (10%) of the total value of this Contract be subcontracted to Disadvantaged Business Enterprises, which is made up of MBEs and WBEs, and set a goal that not less than three percent (3%) of the total value of this Contract be subcontracted to Veteran-Owned Small Businesses. The goals for the utilization of Disadvantaged Business Enterprises and Veteran-Owned Small Businesses as subcontractors are recommended goals. Contractor(s) who fail to meet such goals will be expected to provide written explanations to the Director of the Division of Purchasing of efforts they have made to accomplish the recommended goal, and the extent to which they are successful in accomplishing the recommended goal will be a consideration in the procurement process. Depending on the funding source, other DBE goals may apply.

For assistance in locating Disadvantaged Business Enterprise and Veteran-Owned Small Businesses as Subcontractors contact:

Sherita Miller, Division of Central Purchasing
Lexington-Fayette Urban County Government
200 East Main Street, 3rd Floor, Room 338
Lexington, Kentucky 40507
859-258-3323
smiller@lexingtonky.gov

12. PRE-BID CONFERENCE

Non-mandatory pre-bid meeting is scheduled for **October 1, 2020, 11:00 a.m.** on site at the West Hickman Wastewater Treatment Plant. The meeting is for a site visit and walk through. No questions will be answered during the meeting. All questions shall be submitted via the Q&A module on Ion Wave.

13. CONSENT DECREE REQUIREMENTS

The work to be provided through this bid will assist the **LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT** (the **"OWNER"**) in successfully implementing the **PROJECT** and complying with any requirements which are related to the Consent Decree entered in a case styled *United States & Commonwealth of Kentucky* v. *Lexington Fayette Urban County Government,* United States District Court for the Eastern District of Kentucky, Civil Action No. 5:06-cv-386-KSF (the **"CONSENT DECREE"**). The services provided through this bid are hereinafter referred to as the **PROJECT. The primary goal of the PROJECT is to provide the OWNER with the technical support and/or construction services necessary to successfully meet the obligations and deadlines of the CONSENT DECREE.**

The **BIDDER** shall familiarize itself with and shall at all times comply with the **CONSENT DECREE**, and all federal, state and local laws, ordinances, and regulations that in any manner affect the **PROJECT**. Time is of the essence in the performance of this **PROJECT**. **BIDDER** is aware that the **OWNER** is subject to penalties for non-compliance with the **CONSENT DECREE** deadlines.

If delays result solely by reason of acts of the BIDDER, the BIDDER shall be held liable for any financial penalties incurred by the **OWNER** as a result of the delay, **including but not limited to those assessed pursuant to the CONSENT DECREE**. In the event the parties cannot mutually agree upon the cause(s) associated with delays in completing project deliverables; the **BIDDER** must immediately notify the **OWNER** in the event of such delay, and provide the **OWNER** a written action plan within five (5) business days on how it will attempt to resolve the delay.

In the event that **Bidder's** delay or other nonperformance of its obligations hereunder results in the imposition of penalties against the **OWNER** pursuant to the **CONSENT DECREE**, or the **OWNER** otherwise suffers damage as a result of such delay or nonperformance, **BIDDER** shall be solely liable to **OWNER** for any and all such damages, including any costs and attorney's fees.

An electronic version of the Consent Decree is available on the LFUCG web page for review or to print a copy at no charge.

END OF SECTION

PART II

INFORMATION FOR BIDDERS

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PART II

INFORMATION FOR BIDDERS

1. RECEIPT AND OPENING OF BIDS

The Lexington-Fayette Urban County Government (herein called the OWNER) invites bids from firms on the project described in the Advertisement for Bids. The OWNER will receive bids at the Division of Purchasing, at the time and in the manner set forth in the Advertisement for Bids, and the Bids will then be publicly opened and read aloud. The OWNER may consider informal any bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities or reject any and all bids. Any bid may be withdrawn prior to the scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered. No bidder may withdraw a bid within 60 days after the actual time and date of the bid opening, but OWNER may, in its sole discretion, release any bid and return the Bid Security prior to that date.

The Lexington-Fayette Urban County Government assumes no responsibility for bids that are not addressed and delivered as indicated above. Bids that are not delivered to the Division of Central Purchasing by the stated time and date will be rejected.

2. PREPARATION OF BID

Each bid must be submitted on the prescribed Form of Proposal. All blank spaces for the bid prices must be filled in, either in ink or typewritten, for both unit prices and extensions. Totals for each bid item must be added to show the total amount of the bid. Each bid must be submitted in a sealed envelope bearing on the outside the name of the bidder, their address, the name of the project, the invitation number and time and date for which the bid is submitted. Bids must be addressed to the Director of Purchasing, Lexington-Fayette Urban County Government, Third Floor, 200 East Main Street, Lexington, Kentucky 40507. If forwarded by mail, the sealed envelope containing the bid must be enclosed in another envelope addressed as specified above.

3. SUBCONTRACTS

The bidder is specifically advised that any person, firm, or other party to whom it is proposed to award a subcontract under this Contract must be acceptable to the OWNER. All proposed subcontractors must be identified on the Form of Proposal. Prior to the award of Contract, the OWNER or the OWNER'S representative will advise the CONTRACTOR of the acceptance and approval thereof or of any action necessary to be taken. Should any Subcontractor be rejected by the OWNER, the CONTRACTOR shall present a new name and/or firm to the OWNER at no change in the Contract Price.

4. QUALIFICATION OF BIDDER

The OWNER may make such investigations as the OWNER deems necessary to determine the ability of the bidder to perform the Work, and the bidder shall furnish to the OWNER all such information and data for this purpose as the OWNER may request. The OWNER reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the OWNER that such bidder is properly qualified to carry out the obligations of the Contract and to complete the Work contemplated therein. Conditional bids will not be accepted.

In evaluating Bids, OWNER shall consider the qualifications of the BIDDERS, whether or not the Bids comply with the prescribed requirements, and alternatives and unit prices, as requested. OWNER may consider maintenance requirements, performance data, and disruption or damage to private property. It is OWNER'S intent to accept alternatives, if requested by the bid forms, in the order in which they are listed in the Bid Form but OWNER may accept or decline them in any order or combination. The contract, if awarded, will be awarded to the lowest, qualified, responsible BIDDER based upon OWNER'S evaluation which indicates that the award will be in the best interest of OWNER and the general public.

In the event there is any question as to the bidder's qualifications and ability to complete the work, a final determination will be made in accordance with a fair evaluation by the Urban County Government of the above listed elements.

A. If the OWNER requires filling out a detailed financial statement, the bidder may provide its current certified financial statement(s) for the required time interval.

B. Corporate firms are required to be registered and in good standing with the requirements and provisions of the Office of the Secretary of State, Commonwealth of Kentucky.

C. Good standing with Public Works Act - any CONTRACTOR and/or subcontractors in violation of any wage or work act provisions (KRS 337.510 to KRS 337.550) are prohibited by Statutory Act (KRS 337.990) from bidding on or working on any and all public works contracts, either in their name or in the name of any other company, firm or other entity in which he might be interested. No bid from a prime contractor in violation of the Act can be considered, nor will any subcontractor in violation of the Act be approved and/or accepted. The responsibility for the qualifications of the subcontractor is solely that of the prime contractor.

D. Documents Required of CONTRACTOR - (1) A sworn statement signed by the President or owner of the Company regarding all current work in progress anywhere; (2) A document showing the percent of completion of each project and the total worth of each project; and (3) Documentation showing the percentage of the DBE employment levels on each project of the Bidder's current work force, and DBE participation levels for Subcontractors.

E. Optional OWNER Requirements - The OWNER, at its discretion, may require the BIDDER/CONTRACTOR to provide: (1) a current detailed financial statement for a period including up to 3 prior years; (2) financial security or insurance in amounts and kinds acceptable to the OWNER to meet the financial responsibility requirements for the CONTRACTOR to indemnify the OWNER. (3) Additional information and/or DBE work force data, as well as DBE participation data.

Each bidder agrees to waive any claim it has or may have against the Owner, the Architect/Engineer, and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any bid.

5. BID SECURITY

A. Each bid must be accompanied by a bid bond prepared on a Form of Bid Bond and attached hereto, duly executed by the bidder as principal and having as surety thereon a surety company approved by the OWNER, in the amount of 5% of the bid. Such bid bond will be returned to the unsuccessful bidder(s) only upon written request to the Director of Central Purchasing within seven (7) days of opening of bids. Bid bond shall be made payable to the Lexington-Fayette Urban County Government. Bid security is not required for projects under $50,000.

B. Bonds shall be placed with an agent licensed in Kentucky with surety authorized to do business within the state. When the premium is paid for such coverage, the full commission payable shall be paid to such local agent who shall not divide such commission with any person other than a duly licensed resident local agent.

6. LIQUIDATED DAMAGES FOR FAILURE TO ENTER INTO CONTRACT

The successful bidder, upon his failure or refusal to execute and deliver the Contract and bonds required within ten (10) days after he has received notice of the acceptance of his bid, shall forfeit to the OWNER, as liquidated damages for such failure or refusal, the security deposited with his bid.

7. TIME OF COMPLETION AND LIQUIDATED DAMAGES

Bidder must agree to commence work on or before a date to be specified in a written "Notice to Proceed" from the OWNER and to fully complete the Project within the time as specified in the Contract. Bidder must agree also to pay $1,000.00 per day as liquidated damages, or the sum as specified in the Contract for each consecutive calendar day thereafter as hereinafter provided in the General Conditions.

8. EXAMINATION OF CONTRACT DOCUMENTS AND SITE

A. It is the responsibility of each Bidder before submitting a Bid, to (a) examine the Contract Documents thoroughly, (b) visit the site(s) to become familiar with local conditions that may affect cost, progress, performance or furnishing of the work, (c) consider Federal, State and Local laws and regulations that may affect cost, progress, performance or furnishing of the work, (d) study and carefully correlate Bidder's observations with the Contract Documents, and (e) notify Engineer of all conflicts, errors or discrepancies in the Contract Documents.

B. Bidders should examine the requirements of section 4 of the General Conditions for information pertaining to subsurface conditions, underground structures, underground facilities, and availability of lands, easements, and rights-of-way. The completeness of data, presented in the Contract Documents, pertaining to subsurface conditions, underground structures, and underground facilities for the purposes of bidding or construction is not assured. The Bidder will, at Bidder's own expense, make or obtain any additional examinations, investigations, explorations, tests and studies and obtain any additional information and data which pertain to the physical conditions (surface and subsurface) which may affect cost, progress, performance or furnishing of the Work and which Bidder deems necessary to determine its Bid for performing and furnishing the Work in accordance with the time, price, and other terms and conditions of the Contract Documents. On request in advance, OWNER will provide access to the site to conduct such explorations and tests as each Bidder deems necessary for submission of a bid. Bidder shall fill all holes, clean up and restore the site to its former condition upon completion of such explorations.

C. The submission of a Bid will constitute an incontrovertible representation by the Bidder that Bidder has complied with every requirement of this paragraph 8; that without exception the Bid is premised upon furnishing and performing the Work required by the Contract Documents and such means, methods, techniques, sequences or procedures of construction as may be indicated in or required by the Contract Documents; and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

9. ADDENDA AND INTERPRETATIONS

No interpretation of the meaning of the Contract Documents will be made to any bidder orally. Every request for such interpretation should be in writing addressed to the Director of Central Purchasing, who in turn will have an Addendum issued for the Lexington-Fayette Urban County Government, and to be given consideration must be received 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. Acknowledgement of the receipt of addenda must be included with all submitted bids. Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the Contract Documents.

10. SECURITY FOR FAITHFUL PERFORMANCE

A. Simultaneously with his delivery of the executed Contracts, the CONTRACTOR shall furnish a surety bond or bonds as security for the faithful performance of this Contract and for payment of all persons performing labor on the Project under this Contract and furnishing materials in connection with this Contract, as specified in the General Conditions. The surety on such bond or bonds shall be a duly authorized surety company satisfactory to the OWNER and authorized to do business in the Commonwealth of Kentucky.

B. All bonds required by this Contract and laws of this State shall be placed with agents licensed in the State of Kentucky. When the premium is paid for such coverage's, the full commission shall be paid to such local agent who shall not divide such commission with any person other than a duly licensed resident local agent.

C. **Contractor shall use standard Performance and Payment Bond forms such as documents provided with this contract book or AIA form A312-1984 (or later). Each document will be for 100% of the Contract Bid Amount.**

11. POWER OF ATTORNEY

Attorney-in-fact who signs bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

12. TAXES AND WORKMEN'S COMPENSATION

The CONTRACTOR and subcontractor will be required to accept liability for payment of all payroll taxes, sales and use tax, and all other taxes or deductions required by local, state or federal law, such as old age pension, social security, or annuities measured by wages. Each shall carry Workmen's Compensation Insurance to the full amounts as required by Statutes and shall include the cost of all foregoing items in the proposal. The CONTRACTOR will not otherwise be reimbursed or compensated for such tax payments. The CONTRACTOR is urged to ascertain at his own risk his actual tax liability in connection with the execution or performance of his Contract.

13. LAWS AND REGULATIONS

The bidder's attention is directed to the fact that all applicable state laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the Contract throughout, and they will be deemed to be included in the contract, the same as though herein written out in full.

14. EROSION AND SEDIMENT CONTROL AND PERMITS

The CONTRACTOR and Subcontractors performing work on projects on behalf of the OWNER shall also comply with all applicable federal, state, and local environmental regulations and all requirements and conditions set forth in "special" permits including but not limited to Corp of Engineers 404 permits, 401 Water Quality Certifications,

Stream Crossing and Floodplain Encroachment Permits as described in Part 4 General Conditions Paragraph 5.17.

15. PREVAILING WAGE LAW AND MINIMUM HOURLY RATES

Federal or state wage rates and regulations, if required for this Project, will be as described in the Special Conditions.

16. AFFIRMATIVE ACTION PLAN

The successful Bidder must submit with their bid, the following items to the Urban County Government:

1. Affirmative Action Plan of the firm

2. Current Work Force Analysis Form

3. Good Faith Effort Documentation

4. List of Disadvantaged Business Enterprise Subcontractors and the Dollar Value of each Subcontract

A Work Force Analysis Form shall be submitted for each Contract. Failure to submit these items as required herein may result in disqualification of the Bidder from award of the Contract.

All submissions should be directed to:

Director, Division of Central Purchasing
Lexington-Fayette Urban County Government
200 East Main Street, Third Floor
Lexington, KY 40507

17. CONTRACT TIME

The number of calendar days within which the Work is to be substantially completed and ready for final payment (the Contract Time) is set forth in the Form of Proposal and the Agreement.

18. SUBSTITUTE OR "OR-EQUAL" ITEMS

The Contract, if awarded, will be on the basis of materials and equipment described in the Drawings or specified in the Specifications without consideration of possible substitute or "or-equal" items. Whenever it is indicated in the Drawings or specified in the Specifications that a substitute or "or-equal" item of material or equipment may be furnished or used by the CONTRACTOR if acceptable to the ENGINEER and OWNER, application for such acceptance will not be considered by the ENGINEER and OWNER until after the effective date of the Agreement. The procedure for submission of any such application by the CONTRACTOR and consideration by the ENGINEER and OWNER is set forth in the General Conditions.

19. ALTERNATE BIDS

Bidders shall submit alternate bids/proposals only if and when such alternate bids/proposals have been specifically requested in an Invitation for Bids. If alternate bids/proposals are requested in an Invitation for Bids, the form of submission of such alternate bid and the conditions under which such alternate bids will be considered for award of a contract will be established in the Invitation.

Any Bidder who submits a bid incorporating an alternate proposal when alternate bids/proposals have not been requested in the Invitation for Bids shall have his/her bid rejected as non-responsive.

Any Bidder who submits a bid incorporating two (2) or more prices for an item or groups of items (unless such method of pricing is requested in the Invitation for Bids), or which imposes conditions for acceptance other than those established in the Invitation for Bids, shall have their bid rejected as non-responsive.

20. SIGNING OF AGREEMENT

When OWNER gives a Notice of Award to the successful Bidder, it will be accompanied by the required number of unsigned counterparts of the Agreement with all other written Contract Documents attached. Within ten days thereafter, CONTRACTOR shall sign and deliver the required number of counterparts of the Agreement and attached documents to OWNER with the required Bonds, Certificate of Insurance, and Power of Attorney. The OWNER will deliver one fully signed counterpart to CONTRACTOR at such time as it has been signed by the Mayor.

21. ASSISTANCE TO BE OFFERED TO DISADVANTAGED BUSINESS ENTERPRISE (MWDBE) CONTRACTORS

A. Outreach for MWDBE(s)

The Lexington-Fayette Urban County Government (LFUCG) maintains a database of MWDBE contractors and organizations. When a LFUCG construction project is advertised for bidding, notices are sent to companies registered at https://lexingtonky.ionwave.net. The notices describe the project and indicate the deadline for submitting bids.

If you wish to be added to the LFUCG MWDBE contractor database, please contact:

Sherita Miller, Minority Business Enterprise Liaison
Division of Central Purchasing
Lexington-Fayette Urban County Government
200 East Main Street, Room 338
Lexington, Kentucky 40507
smiller@lexingtonky.gov

B. Bid Bond Assistance for MWDBE(s)

For those MWDBE contractors who wish to bid on LFUCG project, bid bond assistance is available. This bid bond assistance is in the form of a "Letter of Certification" which is accepted by the LFUCG's Division of Purchasing, in lieu of a bid bond. The "Letter of Certification" must be included in the bid package when it is submitted to the Division of Purchasing. The "Letter of Certification" will reference the specific project for which the bid is being submitted, and the time and date on which the bid is due. Bid bond assistance must be requested from the Lexington-Fayette Urban County Government's Division of Central Purchasing.

C. Eligibility for Bid Bond Assistance for MWDBE(s)

In order to be eligible for any Bid bonding assistance, a MWDBE construction company must be owned or controlled at the level of 51% or more by a member or members of a minority group or females. Prior to receiving assistance, a statement providing evidence of ownership and control of the company by a member or members of a minority group or females must be signed by the Owner or corporate officer and by an attorney or accountant submitted to:

Sherita Miller, Minority Business Enterprise Liaison
Division of Central Purchasing
Lexington-Fayette Urban County Government
200 East Main Street, Room 338
Lexington, Kentucky 40507
smiller@lexingtonky.gov

D. MWDBE and Veteran Subcontractors

The LFUCG will, upon request, assist prime contractors in the procurement of eligible DBE subcontractors in an effort to achieve 10% minimum MWDBE and 3% minimum veteran goal.

For a list of eligible subcontractors, please contact:

Sherita Miller, Minority Business Enterprise Liaison
Division of Central Purchasing
Lexington-Fayette Urban County Government
200 East Main Street, Room 338
Lexington, Kentucky 40507
smiller@lexingtonky.gov

PART III

FORM OF PROPOSAL

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**** LFUCG will only be accepting bids on-line through Ion Wave for this solicitation. Base bid and alternate totals (if required) should be provided on the appropriate line items tab on Ion Wave. Submissions without line item totals (if required) may be rejected and deemed non-responsive.**

PART III

Invitation to Bid No. 97-2020

West Hickman BPR Improvements
(title of bid)

1. FORM OF PROPOSAL

Place: Lexington, Kentucky

Date: 10/22/20

The following Form of Proposal shall be followed exactly in submitting a proposal for this Work.

This Proposal Submitted by Smith Contractors, Inc.

P.O. Box 480, Lawrenceburg, KY 40342
(Name and Address of Bidding Contractor)

(Hereinafter called "Bidder"), organized and existing under the laws of the State of Kentucky, doing business as "a corporation"
"a corporation," "a partnership", or an "individual" as applicable.

To: Lexington-Fayette Urban County Government
(Hereinafter called "OWNER")
Office of the Director of Purchasing
200 East Main Street, 3rd Floor
Lexington, KY 40507

Gentlemen:

The Bidder, in compliance with your Invitation for Bids for West Hickman BPR Improvements having examined the Plans and Specifications with related documents, having examined the site for proposed Work, and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of materials and labor, hereby proposes to furnish all labor, materials, and supplies, and to construct the Project in accordance with the Contract Documents, within the time set forth therein, and at the lump sum and/or unit prices stated hereinafter. These prices are to cover all expenses incurred in performing the Work required under the Contract Documents, of which this proposal is a part. The OWNER will issue work orders for work to be performed under this Contract.

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 time provided in the Purchase Order or Work Orders issued by the OWNER. BIDDER further agrees to pay liquidated damages, the sum of $1,000.00 for each consecutive calendar day thereafter.

The Bidder hereby acknowledges receipt of the following addenda:

Addendum No. 1 Date 10/05/20

Addendum No. 2 Date 10/15/20

Addendum No. ____ Date _____

Addendum No. ____ Date _____

Addendum No. ____ Date _____

Addendum No. ____ Date _____

Addendum No. ____ Date _____

Addendum No. ____ Date _____

Insert above the number and the date of any Addendum issued and received. If none has been issued and received, the word "NONE" should be inserted.

2. LEGAL STATUS OF BIDDER

Bidder Smith Contractors, Inc.

Date 10/22/20

* 1. A corporation duly organized and doing business under the laws of the State of Kentucky, for whom Kerry Smith, bearing the official title of President, whose signature is affixed to this Bid/Proposal, is duly authorized to execute contracts.

* 2. A Partnership, all of the members of which, with addresses are: (Designate general partners as such)

_____

_____

_____

_____

_____

* 3. An individual, whose signature is affixed to this Bid/Proposal (please print name)

_____

_____

*(The Bidder shall fill out the appropriate form and strike out the other two.)

3. BIDDERS AFFIDAVIT

Comes the Affiant, Smith Contractors, Inc., and after being first duly sworn, states under penalty of perjury as follows:

1. His/her name is Kerry Smith and he/she is the individual submitting the bid or is the authorized representative of Smith Contractors, Inc., the entity submitting the bid (hereinafter referred to as "Bidder").
2. Bidder will pay all taxes and fees, which are owed to the Lexington-Fayette Urban County Government at the time the bid is submitted, prior to award of the contract and will maintain a "current" status in regard to those taxes and fees during the life of the contract.
3. Bidder will obtain a Lexington-Fayette Urban County Government business license, if applicable, prior to award of the contract.
4. Bidder has authorized the Division of Central Purchasing to verify the above-mentioned information with the Division of Revenue and to disclose to the Urban County Council that taxes and/or fees are delinquent or that a business license has not been obtained.
5. Bidder has not knowingly violated any provision of the campaign finance laws of the Commonwealth of Kentucky within the past five (5) years and the award of a contract to the Bidder will not violate any provision of the campaign finance laws of the Commonwealth.
6. Bidder has not knowingly violated any provision of Chapter 25 of the Lexington-Fayette Urban County Government Code of Ordinances, known as the "Ethics Act."
7. Bidder acknowledges that "knowingly" for purposes of this Affidavit means, with respect to conduct or to circumstances described by a statute or ordinance defining an offense, that a person is aware or should have been aware that his conduct is of that nature or that the circumstance exists.

Further, Affiant sayeth naught.

Kerry Smith
(Affiant)

STATE OF Kentucky

COUNTY OF Anderson

The foregoing instrument was subscribed, sworn to and acknowledged before me by Kerry Smith on this the 22nd day of October, 2020.

My Commission expires: 7-16-22

Sandra Guffey
NOTARY PUBLIC, STATE AT LARGE

4. BID SCHEDULE – SCHEDULE OF VALUES

The Bidder agrees to perform all the Work described in the Specifications and shown on the Plans for the following proposed lump sum and/or unit prices, if applicable, which shall include the furnishing of all labor, materials, supplies, equipment and/or vehicle usage, services, all items of cost, overhead, taxes (federal, state, local), and profit for the Contractor and any Subcontractor involved, within the time set forth herein. If unit prices are applicable, Bidder must make the extensions and additions showing the total amount of bid.

Form of proposal must include unit bid prices written in words, unit price written in numbers and total amount bid (unit price x quantity) per line item OR bid may be considered non-responsive. In case of price discrepancy, unit bid price written in words will prevail followed by unit price written in numbers then total amount bid per line item.

If a discrepancy between the unit price and the item total exists, the unit price prevails except:

> If the unit price is illegible, omitted, or the same as the item total, item total prevails and the unit price is the quotient of the item total and the quantity.

If the unit price and the item total are illegible or are omitted, the bid may be determined nonresponsive. If a lump sum total price is illegible or is omitted, the bid may be determined nonresponsive.

For a lump sum based bid, the item total is the bid amount the Division uses for bid comparison.

For a unit price based bid, the sum of the item totals is the bid amount the Division uses for bid comparison.

The LFUCG's decision on the bid amount is final.

The contract, if awarded, will be on the basis of materials and equipment specified in the specifications without consideration of possible substitute or "or equal" items.

The estimated quantities of items of unit price work are not guaranteed and are solely for the purpose of comparison of bids and determining an initial Contract price. Determination of the actual quantities and classification of unit price work performed by the Contractor will be made by the Engineer in accordance with the General Conditions.

Item No.	Description w/Unit Bid Price Written in Words	Estimated Quantity	Unit	Unit Price	Total Bid Amount
1.	Installation of BPR Mixers _____ Dollars _____ Cents (Lump Sum)	1	LS	$ **	$ **
2.	Installation of the Online Nutrient Process Monitoring System and Associated Equipment _____ Dollars _____ Cents (per Lump Sum)	1	LS	$ **	$ **
3.	Installation of the Chemical Feed Pumps and Associated Equipment _____ Dollars _____ Cents (per Lump Sum)	1	LS	$ **	$ **
4.	Allowance - Instrumentation One Hundred Thirty-Six Thousand Dollars Zero Cents (per Lump Sum)	1	LS	$ 136,000	$ 136,000

TOTAL OF ALL BID PRICES FOR West Hickman BPR Improvements Project (Items 1 through 4) in words and figures. In case of discrepancy, the amount shown in words will govern.

**

_____ ($ **).

**** LFUCG will only be accepting bids on-line through Ion Wave for this solicitation. Base bid and alternate totals (if required) should be provided on the appropriate line items tab on Ion Wave. Submissions without line item totals (if required) may be rejected and deemed non-responsive.**

Event Number	Bid 97-2020 Addendum 2	**Organization**	Lexington-Fayette Urban County Government
Event Title	West Hickman BPR Improvements	**Workgroup**	Purchasing
Event Description		**Event Owner**	Brian Marcum
Event Type	Bid	**Email**	BrianM@lexingtonky.gov
Issue Date	9/25/2020 11:30:00 AM (ET)	**Phone**	(859) 2583325
Close Date	10/22/2020 02:00:00 PM (ET)	**Fax**	(859) 2583322

Responding Supplier	City	State	Response Submitted	Lines Responded	Response Total
Smith Contractors, Inc.	Lawrenceburg	KY	10/22/2020 01:19:33 PM (ET)	4	$1,526,000.00
JUDY CONSTRUCTION COMPAN	CYNTHIANA	KY	10/22/2020 01:50:35 PM (ET)	4	$1,795,000.00

Please note: Lines Responded and Response Total only includes responses to specification. No alternate response data is included.

1	Installation of BPR Mixers								
	Supplier	**QTY**	**UOM**	**Estimated**	**Price**	**Extended**	**Supplier Notes**	**Manufacturer**	**Manufacturer #**
	Smith Contractors, Inc.	1	Lump Sum		$300,000.00	$300,000.00			

2	Installation of the Online Nutrient Process Monitoring System and Associated Equipment								
	Supplier	**QTY**	**UOM**	**Estimated**	**Price**	**Extended**	**Supplier Notes**	**Manufacturer**	**Manufacturer #**
	Smith Contractors, Inc.	1	Lump Sum		$900,000.00	$900,000.00			

3	Installation of the Chemical Feed Pumps and Associated Equipment								
	Supplier	**QTY**	**UOM**	**Estimated**	**Price**	**Extended**	**Supplier Notes**	**Manufacturer**	**Manufacturer #**
	Smith Contractors, Inc.	1	Lump Sum		$190,000.00	$190,000.00			

4	Allowance - Instrumentation								
	Supplier	**QTY**	**UOM**	**Estimated**	**Price**	**Extended**	**Supplier Notes**	**Manufacturer**	**Manufacturer #**
	Smith Contractors, Inc.	1	Lump Sum		$136,000.00	$136,000.00			

Submitted by: Smith Contractors, Inc.

Firm

P.O. Box 480

Address

Lawrenceburg, KY 40342

City, State & Zip

Bid must be signed:
(original signature)

- President

Signature of Authorized Company Representative – Title

Kerry Smith

Representative/s Name (Typed or Printed)

(502) 839-4196 (502) 839-8348

Area Code – Phone – Extension *Fax #*

ks@sci82.com

E-Mail Address

OFFICIAL ADDRESS:

Smith Contractors, Inc.

P.O. Box 480

Lawrenceburg, KY 40342

_____ (Seal if Bid is by Corporation)

By signing this form you agree to ALL terms, conditions, and associated forms in this bid package

5. STATEMENT OF BIDDER'S QUALIFICATIONS

The following statement of the Bidder's qualifications is required to be filled in, executed, and submitted with the Proposal:

1. Name of Bidder: Smith Contractors, Inc.

2. Permanent Place of Business: 1241 Bypass N., Lawrenceburg, KY 40342

3. When Organized: 01/27/1982

4. Where Incorporated: Kentucky

5. Construction Plant and Equipment Available for this Project:

see attached

(Attach Separate Sheet If Necessary)

6. Financial Condition:

If specifically requested by the OWNER, the apparent low Bidder is required to submit its latest three (3) years audited financial statements to the OWNER'S Division of Central Purchasing within seven (7) calendar days following the bid opening.

7. In the event the Contract is awarded to the undersigned, surety bonds will be furnished by:

Liberty Mutual Insurance Company (Surety)

Signed: [signature] (Representative of Surety)

8. The following is a list of similar projects performed by the Bidder: (Attach separate sheet if necessary).

NAME	LOCATION	CONTRACT SUM
Attached		

9. The Bidder has now under contract and bonded the following projects:

NAME	LOCATION	CONTRACT SUM
Attached		

10. List Key Bidder Personnel who will work on this Project.

NAME	POSITION DESCRIPTION	NO. OF YEARS WITH BIDDER
Attached		

11. DBE Participation on current bonded projects under contract:

SUBCONTRACTORS (LIST)	PROJECT (SPECIFIC TYPE)	DBE	% of WORK
Attached			

(USE ADDITIONAL SHEETS IF NECESSARY)

12. We acknowledge that, if we are the apparent low Bidder, we may be required to submit to the OWNER within 7 calendar days following the Bid Opening, a sworn statement regarding all current work on hand and under contract, and a statement on the OWNER'S form of the experience of our officers, office management and field management personnel. Additionally, if requested by the OWNER, we will within 7 days following the request submit audited financial statements and loss history for insurance claims for the 3 most recent years (or a lesser period stipulated by the OWNER).

6. LIST OF PROPOSED SUBCONTRACTORS

The following list of proposed subcontractors is required by the OWNER to be executed, completed and submitted with the BIDDER'S FORM OF PROPOSAL. All subcontractors are subject to approval of the Lexington-Fayette Urban County Government. Failure to submit this list completely filled out may be cause for rejection of bid.

BRANCH OF WORK - LIST EACH MAJOR ITEM Such as: Grading, bituminous paving, concrete, seeding and protection, construction staking, etc.	**SUBCONTRACTOR**	**DBE Yes/No**	**% of Work**
1. Electrical	Name: TEM Address: Louisville Ky	yes	25%
2. _____	Name: _____ Address: _____	____	____
3. _____	Name: _____ Address: _____	____	____
4. _____	Name: _____ Address: _____	____	____
5. _____	Name: _____ Address: _____	____	____
6. _____	Name: _____ Address: _____	____	____
7. _____	Name: _____ Address: _____	____	____

(Attach additional sheet(s) if necessary.)

7. **Lexington-Fayette Urban County Government**
MWDBE PARTICIPATION GOALS

A. GENERAL

1) The LFUCG request all potential contractors to make a concerted effort to include Minority-Owned (MBE), Woman-Owned (WBE), Disadvantaged (DBE) Business Enterprises and Veteran-Owned Small Businesses (VOSB) as subcontractors or suppliers in their bids.

2) Toward that end, the LFUCG has established 10% of total procurement costs as a Goal for participation of Minority-Owned, Woman-Owned and Disadvantaged Businesses on this contract.

3) **It is therefore a request of each Bidder to include in its bid, the same goal (10%) for MWDBE participation and other requirements as outlined in this section.**

4) The LFUCG has also established a 3% of total procurement costs as a Goal for participation for of Veteran-Owned Businesses.

5) **It is therefore a request of each Bidder to include in its bid, the same goal (3%) for Veteran-Owned participation and other requirements as outlined in this section.**

B. PROCEDURES

1) The successful bidder will be required to report to the LFUCG, the dollar amounts of all payments submitted to Minority-Owned, Woman-Owned or Veteran-Owned subcontractors and suppliers for work done or materials purchased for this contract. (See Subcontractor Monthly Payment Report)

2) Replacement of a Minority-Owned, Woman-Owned or Veteran-Owned subcontractor or supplier listed in the original submittal must be requested in writing and must be accompanied by documentation of Good Faith Efforts to replace the subcontractor / supplier with another MWDBE Firm; this is subject to approval by the LFUCG. (See LFUCG MWDBE Substitution Form)

3) For assistance in identifying qualified, certified businesses to solicit for potential contracting opportunities, bidders may contact:

   a) The Lexington-Fayette Urban County Government, Division of Central Purchasing (859-258-3320)

4) The LFUCG will make every effort to notify interested MWDBE and Veteran-Owned subcontractors and suppliers of each Bid Package, including information on the scope of work, the pre-bid meeting time and location, the bid date, and all other pertinent information regarding the project.

C. DEFINITIONS

1) A Minority-Owned Business Enterprise (MBE) is defined as a business which is certified as being at least 51% owned, managed and controlled by persons of African American, Hispanic, Asian, Pacific Islander, American Indian or Alaskan Native Heritage.

2) A Woman-Owned Business Enterprise (WBE) is defined as a business which is certified as being at least 51% owned, managed and controlled by one or more women.

3) A Disadvantaged Business (DBE) is defined as a business which is certified as being at least 51% owned, managed and controlled by a person(s) that are economically and socially disadvantaged.

4) A Veteran-Owned Small Business (VOSB) is defined as a business which is certified as being at least 51% owned, managed and controlled by a veteran and/or a service disabled veteran.

5) Good Faith Efforts are efforts that, given all relevant circumstances, a bidder or proposer actively and aggressively seeking to meet the goals, can reasonably be expected to make. In evaluating good faith efforts made toward achieving the goals, whether the bidder or proposer has performed the efforts outlined in the Obligations of Bidder for Good Faith Efforts outlined in this document will be considered, along with any other relevant factors.

D. OBLIGATION OF BIDDER FOR GOOD FAITH EFFORTS

1) **The bidder shall make a Good Faith Effort to achieve the Participation Goal for MWDBE and Veteran-Owned subcontractors/suppliers. The failure to meet the goal shall not necessarily be cause for disqualification of the bidder; however, bidders not meeting the goal are required to furnish with their bids written documentation of their Good Faith Efforts to do so.**

2) Award of Contract shall be conditioned upon satisfaction of the requirements set forth herein.

3) The Form of Proposal includes a section entitled "MWDBE Participation Form". The applicable information must be completed and submitted as outlined below.

4) **Failure to submit this information as requested may be cause for rejection of bid or delay in contract award.**

E. DOCUMENTATION REQUIRED FOR GOOD FAITH EFFORTS

1) Bidders reaching the Goal are required to submit only the MWDBE Participation Form." The form must be fully completed including names and telephone number of participating MWDBE firm(s); type of work to be performed; estimated value of the contract and value expressed as a percentage of the total Lump Sum Bid Price. The form must be signed and dated, and is to be submitted with the bid.

2) Bidders not reaching the Goal must submit the "MWDBE Participation Form", the "Quote Summary Form" and a written statement documenting their Good Faith Effort to do so. If bid includes no MWDBE and/or Veteran participation, bidder shall enter "None" on the subcontractor / supplier form). In addition, the bidder must submit written proof of their Good Faith Efforts to meet the Participation Goal:

a. Advertised opportunities to participate in the contract in at least two (2) publications of general circulation media; trade and professional association publications; small and minority business or trade publications; and publications or trades targeting minority, women and disadvantaged businesses not less than fifteen (15) days prior to the deadline for submission of bids to allow MWDBE firms and Veteran-Owned businesses to participate.

b. Included documentation of advertising in the above publications with the bidders good faith efforts package

c. Attended LFUCG Central Purchasing Economic Inclusion Outreach event

d. Attended pre-bid meetings that were scheduled by LFUCG to inform MWDBEs and/or Veteran-Owned businesses of subcontracting opportunities

e. Sponsored Economic Inclusion event to provide networking opportunities for prime contractors and MWDBE firms and Veteran-Owned businesses.

f. Requested a list of MWDBE and/or Veteran subcontractors or suppliers from LFUCG and showed evidence of contacting the companies on the list(s).

g. Contacted organizations that work with MWDBE companies for assistance in finding certified MWBDE firms and Veteran-Owned businesses to work on this project. Those contacted and their responses should be a part of the bidder's good faith efforts documentation.

h. Sent written notices, by certified mail, email or facsimile, to qualified, certified MWDBEs and/or Veteran-Owned businesses soliciting their participation in the contract not less than seven (7) days prior to the deadline for submission of bids to allow them to participate effectively.

i. Followed up initial solicitations by contacting MWDBEs and Veteran-Owned Businesses to determine their level of interest.

j. Provided the interested MWBDE firm and/or Veteran-Owned business with adequate and timely information about the plans, specifications, and requirements of the contract.

k. Selected portions of the work to be performed by MWDBE firms and/or Veteran-Owned businesses in order to increase the likelihood of meeting the contract goals. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate MWDBE and Veteran participation, even when the prime contractor may otherwise perform these work items with its own workforce

l. Negotiated in good faith with interested MWDBE firms and Veteran-Owned businesses not rejecting them as unqualified without sound reasons based on a thorough investigation of their capabilities. Any rejection should be so noted in writing with a description as to why an agreement could not be reached.

m. Included documentation of quotations received from interested MWDBE firms and Veteran-Owned businesses which were not used due to uncompetitive pricing or were rejected as unacceptable and/or copies of responses from firms indicating that they would not be submitting a bid.

n. Bidder has to submit sound reasons why the quotations were considered unacceptable. The fact that the bidder has the ability and/or desire to perform the contract work with its own forces will not be considered a sound reason for rejecting a MWDBE and/or Veteran-Owned business's quote. Nothing in this provision shall be construed to require the bidder to accept unreasonable quotes in order to satisfy MWDBE and Veteran goals.

o. Made an effort to offer assistance to or refer interested MWDBE firms and Veteran-Owned businesses to obtain the necessary equipment, supplies, materials, insurance and/or bonding to satisfy the work requirements of the bid proposal

p. Made efforts to expand the search for MWBE firms and Veteran-Owned businesses beyond the usual geographic boundaries.

q. Other--any other evidence that the bidder submits which may show that the bidder has made reasonable good faith efforts to include MWDBE and Veteran participation.

Note: **Failure to submit any of the documentation requested in this section may be cause for rejection of bid. Bidders may include any other documentation deemed relevant to this requirement which is subject to review by the MBE Liaison. Documentation of Good Faith Efforts must be submitted with the Bid, if the participation Goal is not met.**

MINORITY BUSINESS ENTERPRISE PROGRAM

Sherita Miller, MPA
Minority Business Enterprise Liaison
Division of Central Purchasing
Lexington-Fayette Urban County Government
200 East Main Street
Lexington, KY 40507
smiller@lexingtonky.gov
859-258-3323

OUR MISSION: The mission of the Minority Business Enterprise Program is to facilitate the full participation of minority and women owned businesses in the procurement process and to promote economic inclusion as a business imperative essential to the long term economic viability of Lexington-Fayette Urban County Government.

To that end the city council adopted and implemented Resolution 484-2017 – A Certified Minority, Women and Disadvantaged Business Enterprise ten percent (10%) minimum goal and a three (3%) minimum goal for Certified Veteran-Owned Small Businesses and Certified Service Disabled Veteran – Owned Businesses for government contracts.

The resolution states the following definitions shall be used for the purposes of reaching these goals (a full copy is available in Central Purchasing):

Certified Disadvantaged Business Enterprise (DBE) *– a business in which at least fifty-one percent (51%) is owned, managed and controlled by a person(s) who is socially and economically disadvantaged as define by 49 CFR subpart 26.*

Certified Minority Business Enterprise (MBE) *– a business in which at least fifty-one percent (51%) is owned, managed and controlled by an ethnic minority (i.e. African American, Asian American/Pacific Islander, Hispanic Islander, Native American/Native Alaskan Indian) as defined in federal law or regulation as it may be amended from time-to-time.*

Certified Women Business Enterprise (WBE) *– a business in which at least fifty-one percent (51%) is owned, managed and controlled by a woman.*

Certified Veteran-Owned Small Business (VOSB) *– a business in which at least fifty-one percent (51%) is owned, managed and controlled by a veteran who served on active duty with the U.S. Army, Air Force, Navy, Marines or Coast Guard.*

Certified Service Disabled Veteran Owned Small Business (SDVOSB) *– a business in which at least fifty-one percent (51%) is owned, managed and controlled by a disabled veteran who served on active duty with the U.S. Army, Air Force, Navy, Marines or Coast Guard.*

The term "Certified" shall mean the business is appropriately certified, licensed, verified, or validated by an organization or entity recognized by the Division of Purchasing as having the appropriate credentials to make a determination as to the status of the business.

We have compiled the list below to help you locate certified MBE, WBE and DBE certified businesses. Below is a listing of contacts for LFUCG Certified MWDBEs and Veteran-Owned Small Businesses in (https://lexingtonky.ionwave.net)

Business	Contact	Email Address	Phone
LFUCG	Sherita Miller	smiller@lexingtonky.gov	859-258-3323
Commerce Lexington – Minority Business Development	Tyrone Tyra	ttyra@commercelexington.com	859-226-1625
Tri-State Minority Supplier Diversity Council	Susan Marston	smarston@tsmsdc.com	502-365-9762
Small Business Development Council	Shawn Rogers UK SBDC	shawn.rogers@uky.edu	859-257-7666
Community Ventures Corporation	Phyllis Alcorn	palcorn@cvky.org	859-231-0054
KY Transportation Cabinet (KYTC)	Melvin Bynes	Melvin.bynes2@ky.gov	502-564-3601
KYTC Pre-Qualification	Shella Eagle	Shella.Eagle@ky.gov	502-782-4815
Ohio River Valley Women's Business Council (WBENC)	Sheila Mixon	smixon@orvwbc.org	513-487-6537
Kentucky MWBE Certification Program	Yvette Smith, Kentucky Finance Cabinet	Yvette.Smith@ky.gov	502-564-8099
National Women Business Owner's Council (NWBOC)	Janet Harris-Lange	janet@nwboc.org	800-675-5066
Small Business Administration	Robert Coffey	robertcoffey@sba.gov	502-582-5971
LaVoz de Kentucky	Andres Cruz	lavozdeky@yahoo.com	859-621-2106
The Key News Journal	Patrice Muhammad	production@keynewsjournal.com	859-685-8488

LFUCG MWDBE PARTICIPATION FORM
Bid/RFP/Quote Reference # 97-2020

The MWDBE and/or veteran subcontractors listed have agreed to participate on this Bid/RFP/Quote. If any substitution is made or the total value of the work is changed prior to or after the job is in progress, it is understood that those substitutions must be submitted to Central Purchasing for approval immediately. **Failure to submit a completed form may cause rejection of the bid.**

MWDBE Company, Name, Address, Phone, Email	MBE WBE or DBE	Work to be Performed	Total Dollar Value of the Work	% Value of Total Contract
1. TEM 3560 Bashford Ave. Louisville, Ky 40218 (502) 454-0101 tclark@temgroupinc.com	MBE	Electrical	$ 392,800	25
2.				
3.				
4.				

The undersigned company representative submits the above list of MWDBE firms to be used in accomplishing the work contained in this Bid/RFP/Quote. Any misrepresentation may result in the termination of the contract and/or be subject to applicable Federal and State laws concerning false statements and false claims.

Smith Contractors, Inc.
Company

Kerry Smith
Company Representative

10/22/20
Date

President
Title

LFUCG MWDBE SUBSTITUTION FORM

Bid/RFP/Quote Reference #_____

The substituted MWDBE and/or veteran subcontractors listed below have agreed to participate on this Bid/RFP/Quote. These substitutions were made prior to or after the job was in progress. These substitutions were made for reasons stated below and are now being submitted to Central Purchasing for approval. By the authorized signature of a representative of our company, we understand that this information will be entered into our file for this project.

SUBSTITUTED MWDBE Company Name, Address, Phone, Email	MWDBE Formally Contracted/ Name, Address, Phone, Email	Work to Be Performed	Reason for the Substitution	Total Dollar Value of the Work	% Value of Total Contract
1.					
2.					
3.					
4.					

The undersigned acknowledges that any misrepresentation may result in termination of the contract and/or be subject to applicable Federal and State laws concerning false statements and false claims.

_____ _____

Company Company Representative

_____ _____

Date Title

MWDBE QUOTE SUMMARY FORM
Bid/RFP/Quote Reference # 97-2020

The undersigned acknowledges that the minority and/or veteran subcontractors listed on this form did submit a quote to participate on this project. Failure to submit this form may cause rejection of the bid.

Company Name	Contact Person
Smith Contractors, Inc.	Kerry Smith
Address/Phone/Email	**Bid Package / Bid Date**
P.O. Box 480, Lawrenceburg, KY 40342 ks@sci82.com	97-2020 10/22/20

MWDBE Company Address	Contact Person	Contact Information (work phone, Email, cell)	Date Contacted	Services to be performed	Method of Communicatio (email, phone meeting, ad, event etc)	Total dollars $$ Do Not Leave Blank (Attach Documentation)	MBE * AA HA AS NA Female	Veteran
TEM	Tom Clark	502-454-0101		Electrical	phone/email	$ 392,800	MBE	

(MBE designation / AA=African American / HA= Hispanic American/AS = Asian American/Pacific Islander/ NA= Native American)

The undersigned acknowledges that all information is accurate. Any misrepresentation may result in termination of the contract and/or be subject to applicable Federal and State laws concerning false statements and claims.

Smith Contractors, Inc.
Company

10/22/20
Date

Company Representative
Kerry Smith
President
Title

LFUCG SUBCONTRACTOR MONTHLY PAYMENT REPORT

The LFUCG has a 10% goal plan adopted by city council to increase the participation of minority and women owned businesses in the procurement process. The LFUCG also has a 3% goal plan adopted by cited council to increase the participation of veteran owned businesses in the procurement process. In order to measure that goal LFUCG will track spending with MWDBE and Veteran contractors on a monthly basis. By the signature below of an authorized company representative, you certify that the information is correct, and that each of the representations set forth below is true. Any misrepresentation may result in termination of the contract and/or prosecution under applicable Federal and State laws concerning false statements and false claims. Please submit this form monthly to the Division of Central Purchasing/ 200 East Main Street / Room 338 / Lexington, KY 40507.

Bid/RFP/Quote #_____

Total Contract Amount Awarded to Prime Contractor for this Project_____

Project Name/ Contract #	Work Period/ From: To:
Company Name:	Address:
Federal Tax ID:	Contact Person:

Subcontractor Vendor ID (name, address, phone, email	Description of Work	Total Subcontract Amount	% of Total Contract Awarded to Prime for this Project	Total Amount Paid for this Period	Purchase Order number for subcontractor work (please attach PO)	Scheduled Project Start Date	Scheduled Project End Date

By the signature below of an authorized company representative, you certify that the information is correct, and that each of the representations set forth below is true. Any misrepresentations may result in the termination of the contract and/or prosecution under applicable Federal and State laws concerning false statements and false claims.

_____ _____

Company Company Representative

_____ _____

Date Title

LFUCG STATEMENT OF GOOD FAITH EFFORTS
Bid/RFP/Quote #__97-2020

By the signature below of an authorized company representative, we certify that we have utilized the following Good Faith Efforts to obtain the maximum participation by MWDBE and Veteran-Owned business enterprises on the project and can supply the appropriate documentation.

_____ Advertised opportunities to participate in the contract in at least two (2) publications of general circulation media; trade and professional association publications; small and minority business or trade publications; and publications or trades targeting minority, women and disadvantaged businesses not less than fifteen (15) days prior to the deadline for submission of bids to allow MWDBE firms and Veteran-Owned businesses to participate.

_____ Included documentation of advertising in the above publications with the bidders good faith efforts package

_____ Attended LFUCG Central Purchasing Economic Inclusion Outreach event

_____ Attended pre-bid meetings that were scheduled by LFUCG to inform MWDBEs and/or Veteran-Owned Businesses of subcontracting opportunities

_____ Sponsored Economic Inclusion event to provide networking opportunities for prime contractors and MWDBE firms and Veteran-Owned businesses

_____ Requested a list of MWDBE and/or Veteran subcontractors or suppliers from LFUCG and showed evidence of contacting the companies on the list(s).

_____ Contacted organizations that work with MWDBE companies for assistance in finding certified MWBDE firms and Veteran-Owned businesses to work on this project. Those contacted and their responses should be a part of the bidder's good faith efforts documentation.

_____Sent written notices, by certified mail, email or facsimile, to qualified, certified MWDBEs soliciting their participation in the contract not less than seven (7) days prior to the deadline for submission of bids to allow them to participate effectively.

_____ Followed up initial solicitations by contacting MWDBEs and Veteran-Owned businesses to determine their level of interest.

_____ Provided the interested MWBDE firm and/or Veteran-Owned business with adequate and timely information about the plans, specifications, and requirements of the contract.

_____ Selected portions of the work to be performed by MWDBE firms and/or Veteran-Owned businesses in order to increase the likelihood of meeting the contract goals. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate MWDBE and Veteran

participation, even when the prime contractor may otherwise perform these work items with its own workforce

_____ Negotiated in good faith with interested MWDBE firms and Veteran-Owned businesses not rejecting them as unqualified without sound reasons based on a thorough investigation of their capabilities. Any rejection should be so noted in writing with a description as to why an agreement could not be reached.

_____ Included documentation of quotations received from interested MWDBE firms and Veteran-Owned businesses which were not used due to uncompetitive pricing or were rejected as unacceptable and/or copies of responses from firms indicating that they would not be submitting a bid.

_____ Bidder has to submit sound reasons why the quotations were considered unacceptable. The fact that the bidder has the ability and/or desire to perform the contract work with its own forces will not be considered a sound reason for rejecting a MWDBE and/or Veteran-Owned business's quote. Nothing in this provision shall be construed to require the bidder to accept unreasonable quotes in order to satisfy MWDBE and Veteran goals.

_____ Made an effort to offer assistance to or refer interested MWDBE firms and Veteran-Owned businesses to obtain the necessary equipment, supplies, materials, insurance and/or bonding to satisfy the work requirements of the bid proposal

_____Made efforts to expand the search for MWBE firms and Veteran-Owned businesses beyond the usual geographic boundaries.

_____ Other--any other evidence that the bidder submits which may show that the bidder has made reasonable good faith efforts to include MWDBE **and Veteran participation.**

NOTE: Failure to submit any of the documentation requested in this section may be cause for rejection of bid. Bidders may include any other documentation deemed relevant to this requirement which is subject to approval by the MBE Liaison. Documentation of Good Faith Efforts must be submitted with the Bid, if the participation Goal is not met.

The undersigned acknowledges that all information is accurate. Any misrepresentations may result in termination of the contract and/or be subject to applicable Federal and State laws concerning false statements and claims.

Smith Contractors, Inc.	[signature]
Company	**Company Representative**
10/22/20	President
Date	**Title**

8. AUTHENTICATION OF BID AND STATEMENT OF NON-COLLUSION AND CONFLICT OF INTEREST

I hereby swear (or affirm) under the penalty for false swearing:

1. That I am the Bidder (if the Bidder is an individual), a partner of the Bidder (if the Bidder is a partnership), or an officer or employee of the bidding corporation having authority to sign on its behalf (if the Bidder is a corporation);

2. That the attached bid has been arrived at by the Bidder independently, and has been submitted without collusion with, and without any agreement, understanding or planned common course of action, with any other contractor, vendor of materials, supplies, equipment or services described in the Invitation to Bid, designed to limit independent bidding or competition;

3. That the contents of the bid or bids have not been communicated by the Bidder or its employees or agents to any person not an employee or agent of the Bidder or its surety on any bond furnished, with the bid or bids, and will not be communicated to any such person, prior to the official opening of the bid or bids;

4. That the Bidder is legally entitled to enter into the contracts with the Lexington-Fayette Urban County Government, and is not in violation of any prohibited conflict of interest;

5. (Applicable to corporation only) That as a foreign corporation, we are registered with the Secretary of State, Commonwealth of Kentucky, and authorized to do business in the State _x_ or, that as a domestic corporation, we are in good standing with the Secretary of State, Commonwealth of Kentucky _____. Check the statement applicable.

6. This offer is for 60 calendar days from the date this bid is opened. In submitting the above, it is expressly agreed that, upon proper acceptance by the Lexington-Fayette Urban County Government of any or all items bid above, a contract shall thereby be created with respect to the items accepted.

7. That I have fully informed myself regarding the accuracy of the statements made in this statement.

8. That I certify that Subcontractors have not and will not be awarded to any firm(s) that have been debarred from noncompliance with the Federal Labor Standards, Title VI of the Civil Rights Act of 1964 As Amended, Executive Order 11246 As Amended or any other Federal Law.

9. **STATEMENT OF EXPERIENCE**

NAME OF INDIVIDUAL: _____

POSITION/TITLE: _____

STATEMENT OF EXPERIENCE: _____

_____

_____

_____

NAME OF INDIVIDUAL: _____

POSITION/TITLE: _____

STATEMENT OF EXPERIENCE: _____

_____

_____

_____

NAME OF INDIVIDUAL: _____

POSITION/TITLE: _____

STATEMENT OF EXPERIENCE: _____

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_____

NAME OF INDIVIDUAL: _____

POSITION/TITLE: _____

STATEMENT OF EXPERIENCE: _____

_____

_____

NAME OF INDIVIDUAL: _____

POSITION/TITLE: _____

STATEMENT OF EXPERIENCE: _____

_____

_____

NAME OF INDIVIDUAL: _____

POSITION/TITLE: _____

STATEMENT OF EXPERIENCE: _____

_____

_____

* Include all officers, office management's, Affirmative Action officials, and field management personnel. (Attach separate sheets if necessary.)

10. EQUAL OPPORTUNITY AGREEMENT

Standard Title VI Assurance

The Lexington Fayette-Urban County Government, (hereinafter referred to as the "Recipient") hereby agrees that as a condition to receiving any Federal financial assistance from the U.S. Department of Transportation, it will comply with Title VI of the Civil Rights Act of 1964, 78Stat.252, 42 U.S.C. 2000d-4 (hereinafter referred to as the "Act"), and all requirements imposed by or pursuant to Title 49, Code of Federal Regulations, U.S. Department of Transportation, Subtitle A, Office of the Secretary, (49 CFR, Part 21) Nondiscrimination in Federally Assisted Program of the Department of Transportation – Effectuation of Title VI of the Civil Rights Act of 1964 (hereinafter referred to as the "Regulations") and other pertinent directives, no person in the United States shall, on the grounds of race, color, national origin, sex, age (over 40), religion, sexual orientation, gender identity, veteran status, or disability be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Recipient receives Federal financial assistance from the U.S. Department of Transportation, including the Federal Highway Administration, and hereby gives assurance that will promptly take any necessary measures to effectuate this agreement. This assurance is required by subsection 21.7(a) (1) of the Regulations.

The Law

* Title VII of the Civil Rights Act of 1964 (amended 1972) states that it is unlawful for an employer to discriminate in employment because of race, color, religion, sex, age (40-70 years) or national origin.
* Executive Order No. 11246 on Nondiscrimination under Federal contract prohibits employment discrimination by contractor and subcontractor doing business with the Federal Government or recipients of Federal funds. This order was later amended by Executive Order No. 11375 to prohibit discrimination on the basis of sex.
* Section 503 of the Rehabilitation Act of 1973 States:

  The Contractor will not discriminate against any employee or applicant for employment because of physical or mental handicap.
* Section 2012 of the Vietnam Era Veterans Readjustment Act of 1973 requires Affirmative Action on behalf of disabled veterans and veterans of the Vietnam Era by contractors having Federal Contracts.
* Section 206 (A) of Executive Order 12086, Consolidation of Contract Compliance Functions for Equal Employment Opportunity, states:

  The Secretary of Labor may investigate the employment practices of any Government contractor or sub-contractor to determine whether or not the contractual provisions specified in Section 202 of this order have been violated.

The Lexington-Fayette Urban County Government practices Equal Opportunity in recruiting, hiring and promoting. It is the Government's intent to affirmatively provide employment opportunities for those individuals who have previously not been allowed to enter into the mainstream of society. Because of its importance to the local Government, this policy carries the full endorsement of the Mayor, Commissioners, Directors, and all supervisory personnel. In following this commitment to Equal Employment Opportunity and because the Government is

the benefactor of the Federal funds, it is both against the Urban County Government policy and illegal for the Government to let contracts to companies which knowingly or unknowingly practice discrimination in their employment practices. Violation of the above mentioned ordinances may cause a contract to be canceled and the contractor may be declared ineligible for future consideration.

Please sign this statement in the appropriate space acknowledging that you have read and understand the provisions contained herein. Return this document as part of your application packet.

Bidders

I/We agree to comply with the Civil Rights Laws listed above that govern employment rights of minorities, women, Vietnam veterans, handicapped, and aged persons.

Signature

Smith Contractors, Inc.
Name of Business

The Entity (regardless of whether construction contractor, non-construction contractor or supplier) agrees to provide equal opportunity in employment for all qualified persons, to prohibit discrimination in employment because of race, color, creed, national origin, sex or age, and to promote equal employment through a positive, continuing program from itself and each of its sub-contracting agents. This program of equal employment opportunity shall apply to every aspect of its employment policies and practices.

The Kentucky equal Employment Opportunity Act of 1978 (KRS 45.560-45.640) requires that any count, city, town, school district, water district, hospital district, or other political subdivision of the state shall include in directly or indirectly publicly funded contracts for supplies, materials, services, or equipment hereinafter entered into the following provisions:

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

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, age or national origin;

(2) The contractor will state in all solicitations or advertisements for employees placed by or on behalf of the contractors that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, age or national origin;

(3) The contract will post notices in conspicuous places, available to employees and applicants for employment, setting forth the provisions of the non-discrimination clauses required by this section; and

(4) The contractor will send a notice to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding advising the labor union or workers' representative of the contractor's commitments under the nondiscrimination clauses.

The Act further provides:

KRS 45.610. Hiring minorities – Information required

(1) For the length of the contract, each contractor shall hire minorities from other sources within the drawing area, should the union with which he has collective bargaining agreements be unwilling to supply sufficient minorities to satisfy the agreed upon goals and timetable.

(2) Each contractor shall, for the length of the contract, furnish such information as required by KRS 45.560 to KRS 45.640 and by such rules, regulations and orders issued pursuant thereto and will permit access to all books and records pertaining to his employment practices and work sites by the contracting agency and the department for purposes of investigation to ascertain compliance with KRS 45.560 to 45.640 and such rules, regulations and orders issued pursuant thereto.

KRS 45.620. Action against contractor – Hiring of minority contractor or subcontractor

(1) If any contractor is found by the department to have engaged in an unlawful practice under this chapter during the course of performing under a contract or subcontract covered under KRS 45.560 to 45.640, the department shall so certify to the contracting agency and such certification shall be binding upon the contracting agency unless it is reversed in the course of judicial review.

(2) If the contractor is found to have committed an unlawful practice under KRS 45.560 to 45.640, the contracting agency may cancel or terminate the contract, conditioned upon a program for future compliance approved by the contracting agency and the department. The contracting agency may declare such a contractor ineligible to bid on further contracts with that agency until such time as the contractor complies in full with the requirements of KRS 45.560 – 45.640.

(3) The equal employment provisions of KRS 45.560 to 45.640 may be met in part by a contractor by subcontracting to a minority contractor or subcontractor. For the provisions of KRS 45.560 to 45.640, a minority contractor or subcontractor shall mean a business that is owned and controlled by one or more persons disadvantaged by racial or ethnic circumstances.

KRS 45.630 Termination of existing employee not required, when

Any provision of KRS 45.560 to 45.640 notwithstanding, no contractor shall be required to terminate an existing employee upon proof that that employee was employed prior to the date of the contract.

KRS 45.640 Minimum skills

Nothing in KRS 45.560 to 45.640 shall require a contractor to hire anyone who fails to demonstrate the minimum skills required to perform a particular job.

It is recommended that all of the provisions quoted above to be included as special conditions in each contract. In the case of a contract exceeding $250,000, the contractor is required to furnish evidence that his work-force in Kentucky is representative of the available work-force in the area from which he draws employees, or to supply an Affirmative Action plan which will achieve such representation during the life of the contract.

11. EQUAL EMPLOYMENT OPPORTUNITY AFFIRMATIVE ACTION POLICY

It is the policy of Smith Contractors, Inc.

to assure that all applicants for employment and all employees are treated on a fair and equitable basis without regard to their race, religion, sex, color, handicap, natural origin or age.

Such action shall include employment, promotion, demotion, recruitment or recruitment advertising, layoff or termination, rates of pay and other forms of compensation, and selection for training, whether apprenticeship and/or on-the-job-training.

Furthermore, this company agrees to make special recruitment efforts to hire the protected class whenever feasible. This company also agrees to adhere to all applicable federal, state, and local laws relating to Equal Employment Opportunity for all individuals.

12.

Workforce Analysis Form

Name of Organization: Smith Contractors Inc.

Categories	Total	White (Not Hispanic or Latino)		Hispanic or Latino		Black or African-American (Not Hispanic or Latino		Native Hawaiian and Other Pacific Islander (Not Hispanic or Latino		Asian (Not Hispanic or Latino		American Indian or Alaskan Native (not Hispanic or Latino		Two or more races (Not Hispanic or Latino		Total	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Administrators	2	2														2	
Professionals																	
Superintendents	7	7														7	
Supervisors																	
Foremen																	
Technicians																	
~~Protective Service~~ Operators	11	11														11	
~~Para-Professionals~~ Laborers	29	19		9		1										29	
Office/Clerical	6	2	3				1									2	4
Skilled Craft Carpenters	9	7		2												9	
Service/Maintenance	8	7		1												8	
Total:	72	55	3	12		1	1									68	4

Prepared by: Sandra Steffy - Treasurer
(Name and Title)

Date: 10 / 22 / 2020

Revised 2015-Dec-15

13. EVIDENCE OF INSURABILITY

LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT CONSTRUCTION PROJECT
(Use separate form for each Agency or Brokerage agreeing to provide coverage)

Names Insured: Smith Contractors, Inc. Employee ID: _____

Address: P.O. Box 480, Lawrenceburg, KY 40342 Phone: _____

Project to be insured: West Hickman BPR Improvements

In lieu of obtaining certificates of insurance at this time, the undersigned agrees to provide the above Named Insured with the minimum coverage listed below. These are outlined in the Insurance and Risk Management of Part V (Special Conditions), including all requirements, and conditions:

Section Items	Coverage	Minimum Limits and Policy Requirements	Limits Provided To Insured	Name of Insurer	A.M. Best's Code	Rating
SC-3, Section 2, Part 4.1—see provisions	CGL	$1,000,000 per occ. And $2,000,000 aggregate	$ same as required	Amerisure	004071	A
SC-3, Section 2, Part 4.1—see provisions	AUTO	$2,000,000/per occ.	$ same as required	Amerisure	004071	A
SC-3, Section 2, Part 4.1—see provisions	WC	Statutory w/endorsement as noted	$ 4,000,000	KY AGC SIF	05002	A

Section 2 includes required provisions, statements regarding insurance requirements, and the undersigned agrees to abide by all provisions for the coverage's checked above unless stated otherwise when submitting.

AJ Gallagher Risk Management Services, Inc.
Agency or Brokerage

1601 Alliant Avenue
Street Address

Louisville KY 40299
City State Zip

502-415-7000
Telephone Number

Drew Windhorst
Name of Authorized Representative

Area Assistant Vice President
Title

Andrew D. Windhorst Jr.
Authorized Signature

10/15/2020
Date

NOTE: Authorized signatures may be the agent's if agent has placed insurance through an agency agreement with the insurer. If insurance is brokered, authorized signature must be that of authorized representative of insurer.

IMPORTANT: Contract may not be awarded if a completed and signed copy of this form for all coverage's listed above is not provided with the bid.

14. DEBARRED FIRMS

PROJECT NAME: West Hickman BPR Improvements

BID NUMBER: 97-2020

LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT
LEXINGTON, KY

All prime Contractors shall certify that Subcontractors have not and will not be awarded to any firms that has been debarred for noncompliance with the Federal Labor Standards, Title VI of the Civil Rights Act of 1964 As Amended, Executive Order 11246 As Amended or any other Federal Law.

All bidders shall complete the attached certification in duplicate and submit both copies to the Owner with the bid proposal. The Owner (grantee) shall transmit one copy to the Lexington-Fayette Urban County Government, Division of Community Development, within fourteen (14) days after bid opening.

The undersigned hereby certifies that the firm of Smith Contractors, Inc. has not and will not award a subcontract, in connection with any contract award 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 Federal Law.

Smith Contractors, Inc.
Name of Firm Submitting Bid

Signature of Authorized Official
Kerry Smith

President
Title

10/22/20
Date

15. DEBARMENT CERTIFICATION

All contractors/subcontractors shall complete the following certification and submit it with the bid proposal.

The contractor/subcontractor certifies in accordance with Executive Order 12549 (Debarment and Suspension 2/18/86) that to the best of its knowledge and belief, that it and its principals:

1) Are not presently debarred, suspended, proposed for debarment, declared negligible, or voluntarily excluded from covered transactions or contract by any Federal department or agency for noncompliance with the Federal Labor Standards, Title VI of the Civil Rights Act of 1964 as amended, Executive Order 11246 as amended or any other Federal law;

    a) Have not within a three year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

    b) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(a) of this certification; and

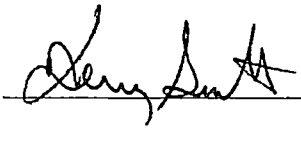
    c) Have not within a three year period preceding this bid has one or more public (Federal, State or local) transactions or contracts terminated for cause or default.

2) Where the contractor is unable to certify to any of the statements in this certification, such prospective contractors shall attach an explanation to this certification form.

Firm Name: Smith Contractors, Inc.

Project: West Hickman BPR Improvements

Printed Name and Title of Authorized Representative: Kerry Smith, President

Signature: 

Date: 10/22/20

END OF SECTION

SMITH CONTRACTORS, INC. EQUIPMENT LISTING

SCHEDULE C

EQUIPMENT DESCRIPTION
OFF ROAD DUMP TRUCKS
2004 Cat 740 6x6 Articulated Dump Truck
2005 Cat 740 6x6 Articulated Dump Truck
2009 Morooka MST 2200VD Crawler Carrier/Dumper (off road)
2010 Morooka MST 2200VD Crawler Carrier
2012 Canycom S25A Rotating Back Dump
2004 Caterpillar 740 6x6 Articulated Dump Truck
2013 Morooka MST 2200VD Crawler Dumper
BACKHOES
590 Case SL Loader/Backhoe
Case 590 SL Loader/Backhoe
Case 590 SL Loader/Backhoe
Case 590SM Loader/Backhoe - 2003
Case 580 L Backhoe
Case 580 M Loader Backhoe w/24" Bucket
EQUIPMENT DESCRIPTION
BUCKETS/ATTACHMENTS
Cat 375 H 60" Sev Bucket
Cat 375 42" Sev Bucket
42" Bucket for 330 Excavator
36" Cepco Bucket (312 Excavator)
Caterpillar 320 B 42" Bucket
Caterpillar 320C 24" Bucket
312 CL 24" Bucket
RCW-15344-36" Bucket
36" 312C Bucket
Caterpillar 312C 30" Bucket

SMITH CONTRACTORS, INC. EQUIPMENT LISTING

SCHEDULE C

EQUIPMENT DESCRIPTION
Caterpillar Bucket Model #420E 1.25
Caterpillar 320, 42" Excavator Bucket
Caterpillar 18" Mini Excavator Bucket
SKID STEER LOADERS
Caterpillar 299C XPS Compact Track Loader - 2011
Cat 815 Compactor
Cat 279C Skid Loader
Cat 2990 Track Loader (Skid Steer)
Cat 279D High Flow XPS Skid Loader
CRAWLER LOADERS
Cat 963 Track Loader
963D Caterpillar Track Loader
Cat 963C Crawler Loader - 2005
RUBBER TIRE LOADERS
IT 18B Cat Loader
Cat 926M Wheel Loader - 2015
CRANES
Terex RT175 Crane
Link Belt LS138H 75 Ton Crawler Crane
1990 Link Belt LS-138 H Crane
Terex 75 Ton Truck Crane
2009 Link Belt 218 HSL 110 Ton Crawler Crane
2007 Terex RT555-1 55 Ton 4x4x4 Rough Terrain Crane
1999 Link Belt 138H Crane
2014 Kobelco CK1100G 110 Ton Crane

SMITH CONTRACTORS, INC. EQUIPMENT LISTING

SCHEDULE C

EQUIPMENT DESCRIPTION
CRAWLER TRACTOR
2000 Case 650H Crawler Dozer
2002 Cat D8R Series II Crawler Tractor
2003 Caterpillar D6R XL Series II Crawler Tractor
EXCAVATORS
Caterpillar 312CL Excavator
Caterpillar 324 DL Long Reach Excavator
Caterpillar 385BL Excavator w/bucket
Caterpillar 336EL Hydraulic Excavator
Caterpillar 320DL Excavator
2010 Caterpillar 320DL Hydraulic Excavator
2009 Caterpillar Medium Hydraulic Excavator Model 321 DLCR
Caterpillar 304CR Hydraulic Excavator
2016 Link-Belt 350X4EX Excavator
2014 Caterpillar 314E LCR Hydraulic Excavator
2010 Yanmar VI035-5B Mini Excavator
2013 Caterpillar Model 321D LCR Excavator
2014 Yanmar Mini Excavator
2017 Caterpillar 336F Hydraulic Excavator
2019 Link-Belt 80X3EX Excavator
FORK LIFTS
Cat TH103 Telescopic Forklift with 42' Boom
Cat TH103 Telescopic Forklift
Cat TH 460B Forklift Telehandler
Cat TH103 Telescopic Forklift
Cat TL1055 Telehandler Forklift
Genie GTH1256 Telescopic Forklift
Skytrak 10054 Telescopic Forklift

SMITH CONTRACTORS, INC. EQUIPMENT LISTING

SCHEDULE C

EQUIPMENT DESCRIPTION
FORKS
Con-Tech Forks w/Rod
CTI Forks
CTI 6000# Drive-In Forks w/Bar
CONVEYOR
Felco Bedding Conveyor
HOE RAMS
Rammer E68 Hydraulic Hammer
Caterpillar H130
Allied 730 Hydraulic Ram
Rammer S83 Hydraulic Hammer
2014 Hydraulic HMR 10000 lb Hammer
2014 Allied AR110C Hydraulic Hammer w/ MTG Bracket
Allied AR 130B Hydraulic Hammer, 5000 lb
2015 Allied AR 165 Hydraulic Hammer, 10000 lb
2017 Allied Rammer 4099 Hydraulic Hammer, 10000 lb
HYDRAULIC UNITS
Godwin Heidra 150 Hydraulic Pump & 150 MR 6" Pump End
Hydraulic Hammer, 4000 lb Stanley
Hydraulic Hammer, 500 lb Foster
Hydraulic Power Unit
ROLLERS
2005 Ingersoll Rand SD45DTF Vibratory Smooth Drum Roller
Ingersoll Rand SD70D Vibratory Roller

SMITH CONTRACTORS, INC. EQUIPMENT LISTING

SCHEDULE C

EQUIPMENT DESCRIPTION
WELDER
2004 Lincoln Classic 300D Portable Welder
Multiquip Weler Gen Light Plant
Bobcat 250
Bobcat 225
Lincoln 200
2004 Miller Big 40 Skid Mounted Welder
1996 Miller Bobcat 225G Portable Welder
1996 Miller Bobcat 225G Welder
PUMPS
Godwin CD 150MBS 6 in. Skid Mounted Water Pump
Godwin Sub-Prime GSP10 Submersible Pump
Godwin Sub-Prime GSP10 Submersible Pump
Godwin 10 in. Hydraulic Submersible Pump
Toyo DP75B Submersible Pump
DRILLS
Jaegen Rock Drill
Model 155 Drill
Model 155 Drill
Rock Drill
1" Rock Drill
Sullair Rock Drill
Furukawa Hydraulic Drill
OTHER
Bradco Skid Steer Broom Attachment
24" Compaction Wheel for a Cat 320
Cat Quick Disconnet
Bobcat Landscape Rake, 6B
Finn B40 Straw Blower

SMITH CONTRACTORS, INC. EQUIPMENT LISTING

SCHEDULE C

EQUIPMENT DESCRIPTION
John Deere 7220 Tractor
John Deere 726 Loader
Kubota 26 HP 60" Commercial Mower
MX Upright Scissor Lift
Ice 216 Vibro Pile Hammer
72" Bobcat Seeder
Grove Scissor Lift
Tamp Vibrator Plate
Genie 19' Scissor Lift
15 ft Woods Batwing Bushhog
2010 Tye Drill - Model #124-557X
Broce RJ350 Self Propelled Broom
4" Aluminum Low Profile Channel Impact Trash Strainer
Cat BA18 Manual Angle Broom for Skid Steer
2010 Broce KR350 Broom/Sweeper
Compactor Plate Toro FP3000
Cat Fussion 926M Boom Pole (TAG)
Telescopic Spreader Beams

SMITH CONTRACTORS, INC.

FIVE YEAR PROJECT HISTORY

Schedule B

Project Name & Location	Owner	Design Engineer	Date Complete	Contract Amount	References
Dover Water Treatment Plant	North Stewart Utility District	James C. Hailey	July, 2013	$ 3,855,750.00	Neal Westerman 615-883-4933
Dover, TN					7518 Hyy 70S, Nashville, TN 37221
Raw Water Intake	North Stewart Utility District	James C. Hailey	July, 2013	$ 2,046,000.00	Neal Westerman 615-883-4933
Dover, TN					7518 Hyy 70S, Nashville, TN 37221
Lexington Expansion Area 2AA - Force Main	Lexington Fayette Urban Govt.	GRW Engineers	Aug., 2013	$ 1,084,002.41	Joe Henry 859-223-3999
Lexington, KY					801 Corporate Dr., Lexington, KY 40503
Red River WWTP	Red River WW Authority	Bell Engineering	March, 2014	$ 9,266,870.95	Ron Rogers 859-278-5412
Stanton, KY					2480 Fortune Dr., Ste 301, Lexington, KY 40509
Lexington Expansion Area 2AA - Pump Station	Lexington Fayette Urban Govt.	GRW Engineers	June, 2014	$ 4,861,000.00	Joe Henry 859-223-3999
Lexington, KY					801 Corporate Dr., Lexington, KY 40503
Owensboro Cargo Dock	Owensboro Riverport Authority	W.R. Coles	Oct., 2014	$ 6,517,000.00	Ron Coles 615-712-9755
Owensboro, KY					P.O. Box 159266, Nashville, TN 37215
Monticello WWTP	City of Monticello	Bell Engineering	Dec., 2014	$ 7,054,447.19	Ron Rogers 859-278-5412
Monticello, KY					2480 Fortune Dr., Ste 301, Lexington, KY 40509
Carr Creek WTP Expansion	Knott Co. Water & Sewer	R.M. Johnson	Aug., 2014	$ 2,254,000.00	Jared Salmons 606-785-5926
Vicco, KY		Engineering			P.O. Box 444, Hindman, KY 41822

10-21-20

SMITH CONTRACTORS, INC.

FIVE YEAR PROJECT HISTORY

Schedule B

Project Name & Location	Owner	Design Engineer	Date Complete	Contract Amount	References
Jonesborough WWTP	Town of Jonesborough	GRW Engineers	Oct., 2014	$ 1,987,205.11	Robert Threadgill, P.E. 615-366-1600
Jonesborough, TN					404 BNA Drive, Ste 201, Nashville, TN 37217
Town Branch Vactor Truck	Lexington Fayette Urban Gov't.	Lexington Fayette Urban	Nov., 2014	$ 391,998.00	Chase Azevedo 859-258-3425
Lexington, KY		Govt.			125 Industrial Avenue, Lexington, KY 40511
Monticello WTP	City of Monticello	Bell Engineering	May, 2015	$ 10,910,695.00	David Schrader 859-278-5412
Monticello, KY					2480 Fortune Dr., Ste 301, Lexington, KY 40509
Owensboro Riverfront Pavilion	City of Owensboro	City of Owensboro	July, 2015	$ 1,713,651.00	Bailey Bennett 270-687-8641
Owensboro, KY					P.O. Box 10003, Owensboro, KY 42302
Bon Air Lift Station	Frankfort Sewer Plant Board	Kenvirons, Inc.	Oct., 2015	$ 1,430,729.82	Phil Meador 502-695-4357
Frankfort, KY					452 Versailles Road, Frankfort, KY 40601
Two Creeks Sanitary Sewer Collection Sys	Frankfort Sewer Plant Board	Jacbos Engineering Group	Oct., 2015	$ 3,335,943.54	Dinesh Palaniswamy 513-595-7429
Frankfort, KY					1880 Waycross Road, Cincinnati, OH 45240
New Water Treatment Plant	City of Greensburg	Bell Engineers	May, 2016	$ 6,271,809.00	Mike Wilmoth 859-278-5412
Greensburg, KY					2480 Fortune Drive, Lexington, KY 40509
Lebanon WTP	City of Lebanon	Water Management Services	June 2015	$ 7,761,742.80	Joe Hinkle 615-366-6088
Lebanon, TN					2 International Plaza, Nashville, TN 37217

SMITH CONTRACTORS, INC.

FIVE YEAR PROJECT HISTORY

Schedule B

Project Name & Location	Owner	Design Engineer	Date Complete	Contract Amount	References
Water Street Storm Sewer	City of Richmond	Integrated Engineering	Sept., 2016	$ 5,952,546.83	Steve Garland 859-368-0145
Richmond, KY					166 Prosperous Place, Lexington, KY 40509
Ross's Landing Riverfront Improveemnts	City of Chattanooga	HDR Engineering, Inc.	April, 2016	$ 6,278,943.06	Dan Garza 361-696-3300
Chattanooga, TN					1201 Market Street, Ste C, Chattanooga, TN 37402
Hite Creek WQTC	Metropolitan Sewer District	Metropolitan Sewer District	Aug., 2016	$ 9,116,001.37	Steven Leong 502-540-6637
Louisville, KY					700 West Liberty Street, Louisville, KY 40203
Moccasin Bend WWTP Effluent Disinfection	City of Chattanooga	Barge Waggoner Sumner & Cannon	May 2016	$ 8,043,733.86	David Bible 423-756-3025
Chattanooga, TN					1110 Market St, Ste 200, Chattanooga, TN 37402
Hartsville WWTP Improvements	Hartsville/Trousdale Water & Sewer	Barge Waggoner Sumner & Cannon	May 2017	$ 6,767,130.76	Luke Burris 615-254-1500
Hartsville, TN					211 Commerce St., Ste 600, Nashville, TN 37201
West Frankfort Pump Station	City of Frankfort	GRW Engineers	Oct., 2017	$ 2,787,851.70	John Martin 859-223-3999
Frankfort, KY					801 Corporate Dr., Lexington, KY 40503
Beaver Creek WWTP Improvements	Hallsdale Powell Utility District	CTI Engineers	Dec., 2017	$ 7,813,057.00	David Jones 865-246-2750
Knoxville, TN					112 Durwood Rd., St A, Knoxville, TN 37922
Sludge Dewatering Conveyance	Shelbyville Municipal Water &	HDR Engineering, Inc.	May, 2017	$ 4,035,952.57	Jerry McClary 859-629-4800
Shelbyville, KY	Sewer Commission				2517 Sir Barton Way, Lexington, KY 40509

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SMITH CONTRACTORS, INC.

FIVE YEAR PROJECT HISTORY

Schedule B

Project Name & Location	Owner	Design Engineer	Date Complete	Contract Amount	References
Portlamd CSO Basin Project	Metropolitan Sewer District	Metropolitan Sewer District	Nov., 2017	$ 4,722,996.59	Jacob Mathis 502-741-1236
Louisville, KY					700 West Liberty Street. Louisville, KY 40203
Harrodsburg WWTP Expansion	City of Harrodsburg	GRW Engineers	Oct., 2018	$ 17,582,953.82	Bob Smallwood 859-223-3999
Harrodsburg, KY					801 Corporate Drive, Lexington, KY 40503
Fleming-Neon WTP	City of Fleming-Neon	Nesbitt Engineering	March, 2019	$ 2,641,588.24	Ora Main 859-685-4514
Fleming-Neon, KY					227 North Upper Street, Lexington, KY 40507
LWC I-64 Transmission Main	Louisville Water Company	Louisville Water Company	May, 2019	$ 12,680,000.00	Eric Walls 502-569-3600
Shelby County, KY					550 South Third Street, Louisville, KY 40202
Ten Mile PS & Sewer Lines	West Knox Utility District	GRW Engineers	Nov., 2019	$ 5,158,189.01	Louis Robbins, P.E. 615-366-1600
Knoxville, TN					404 BNA Drive, Ste 201, Nashville, TN 37217
Trenton WWTP Improvements	Trenton Light & Water	J.R. Wauford & Co.	Nov., 2019	$ 8,894,265.64	Robert Qualman, P.E. 615-883-3243
Trenton, TN					PO Box 140350, Nashville, TN 37214
Town Creek WWTP Improvements	City of Bardstown	HDR Engineering	Feb., 2020	$ 1,378,376.00	Richard Smith, P.E. 859-629-4844
Bardstown, KY					2517 Sir Barton Way, Lexington, KY 40509
Irvine Water Main & Storage Tank	Irvine Municipal Utilities	GRW Enginners	Sept., 2019	$ 1,647,721.00	David Osborne, P.E. 502-489-8484
Irvine, KY					9710 Bunsen Parkway, Louisville, KY 40299
Contr 2 HSPS Addition & WTP Improvements	Logan Todd Regional	McGhee Engineering	Oct., 2019	$ 2,474,842.00	Chris Wilcutt, P.E. 270-483-9985
Guthrie, KY	Water Commission				202 Ewing Street, Guthrie, KY 42234

SMITH CONTRACTORS, INC.

FIVE YEAR PROJECT HISTORY

Schedule B

Project Name & Location	Owner	Design Engineer	Date Complete	Contract Amount	References
West Hickman 7 Wet Weather Storage Tank Facilityt	Lexington Fayette Urban Co Gov't	HDR Engineering	Nov., 2019	$ 10,168,870.01	Benton Hanson, P.E. 859-629-4800
Lexington, KY					2517 Sir Barton Way, Lexington, KY 40509

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Smith Contractors, Inc.

Current Projects
Schedule A

Project Name & Location	Owner	Engineer	Contract Amount	Percent Complete	Scheduled Completion	Reference Including Address & Phone #
Cadiz Water Treatment Plant	City of Cadiz	Water Management	$ 8,723,708.00	87%	730 days	Steven Jones, P.E. 615-366-6088
Cadiz, Kentucky						2 International Plaza, Nashville, TN 37217
New WTP Improvements	City of Leitchfield	Cann-Tech, Inc.	$ 11,694,116.28	36%	760 days	Matt Baker, P.E. 502-859-0907
Leitchfield, Kentucky						1100 Glensboro Road, Lawrenceburg, KY 40342
WWTP Improvements	Humboldt Municipal Utilities	J.R. Wauford	$ 25,591,000.00	48%	790 days	Robert Qualman, P.E. 615-883-3243
Humboldt, Tennessee						2835 Lebanon Road, Nashville, TN 37214
New Water Treatment Plant	City of Lancaster	Kentucky Engineering Group	$ 9,579,544.00	37%	760 days	Ryan Carr, P.E. 859-251-4127
Lancaster, Kentucky						P.O. Box 1034, Versailles, KY 40383
Sharon Village PS & FM	Lexington Fayette Urban	Strand Associates	$ 3,188,500.00	43%	365 days	Mike Davis, P.E. 859-225-8500
Lexington, Kentucky	Co. Gov't.					651 Perimeter Drive, Lexington, KY 40517
Augusta WWTP	City of Augusta	HMB Engineers	$ 5,593,000.00	15%	365 days	Ray Bascom, P.E. 502-695-9800
Augusta, Kentucky						3 HMB Circle/US 460, Frankfort, KY 40601
Hammond Wood WWTP	HWEA	J.R. Wauford	$ 45,517,700.00	4%	1080 days	Stephen Lee, P.E. 615-883-3243
Hopkinsville, Kentucky						PO Box 140350, Nashville, TN 37214

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Smith Contractors, Inc.

KEY PERSONNEL

Schedule C

Employee Name	Position	Date Employed with SCI	Date Started in Construction	Prior Positions and Years Held in Construction
Kerry Smith	President/Owner	January, 1982	1970	Superintendent/Project Manager
Joe Smith	Vice-President	June, 1999	1998	Superintendent/Project Manager
Vandra Guffey	Treasurer	December, 1989	1982	Accounting Controller
Codee Guffey	Project Manager	May, 2011	May, 2011	Project Manager
Jerry Powell	Superintendent/ Project Manager	May, 1992	1972	Resume provided upon request
Dennis Muse	Superintendent	April, 2004	1984	Resume provided upon request
Jason Steinmetz	Superintendent/ Project Manager	December, 2001	2000	Resume provided upon request
Mike Craft	Superintendent	June, 2004	1994	Resume provided upon request
Chris James	Superintendent	August, 2001	2001	Resume provided upon request
Ryan Cox	Superintendent	January, 2007	2007	Resume provided upon request
Jamie Pennington	Superintendent	June, 1993	1993	Resume provided upon request

Smith Contractors, Inc.

KEY PERSONNEL

Schedule C

[redacted]

Current DBE Subcontractor Participation

Subcontractor Name	Project (Specific Type	DBE	% of Work
Lykins Reinforcing	Hammond Wood WWTP, Hopkinsville, KY	WBE	1%
The Fence Co.	Hammond Wood WWTP, Hopkinsville, KY	WBE	1%

Smith Contractors, Inc.

KEY PERSONNEL

Schedule C

Employee Name	Position	Date Started with SCI	Date Started in Construction	Prior Positions and Experience in Construction
Kerry Smith	President/Owner	January, 1982	1970	Superintendent/Project Manager
Joe Smith	Vice-President	June, 1999	1998	Superintendent/Project Manager
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Mike Craft	Superintendent	June, 2004	1994	Resume provided upon request
Chris James	Superintendent	August, 2001	2001	Resume provided upon request
Ryan Cox	Superintendent	January, 2007	2007	Resume provided upon request
Jamie Pennington	Superintendent	June, 1993	1993	Resume provided upon request

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Smith Contractors, Inc.

KEY PERSONNEL

Schedule C

[redacted]

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END OF SECTION

PART IV

GENERAL CONDITIONS

1. DEFINITIONS

Wherever used in these General Conditions or the other Contract Documents, the following terms have the meanings indicated which are applicable to both the singular and plural thereof.

1.1 Addenda
Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bid Documents or the Contract Documents.

1.2 Agreement
The written agreement between OWNER and CONTRACTOR covering the Work to be performed; other Contract Documents are attached to the Agreement and made a part thereof as provided therein.

1.3 Application for Payment
The form accepted by ENGINEER which is to be used by CONTRACTOR in requesting progress or final payments and which is to include such supporting documentation as is required by the Contract Documents.

1.4 Bid
The offer or proposal of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

1.5 Bidder
An individual, partnership, or corporation, who submit a Bid for a prime contract with the OWNER, for the Work described in the proposed Contract Documents.

1.6 Bonds
Bid, performance and payment bonds and other instruments of security.

1.7 Calendar Day
A calendar day of twenty-four hours measured from midnight to the next midnight shall constitute a day.

1.8 Change Order
A document recommended by ENGINEER, which is signed by CONTRACTOR and OWNER and authorizes an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the Contract Time, issued on or after the Effective Date of the Agreement.

1.9 Contract Documents

The Advertisement for Bidders, Information for Bidders, Agreement, Addenda (which pertain to the Contract Documents), CONTRACTOR'S Bid (including documentation accompanying the Bid and any post-bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Agreement, the Bonds, these General Conditions, the Special Conditions, the Specifications and the Drawings as the same are more specifically identified in the Agreement, together with all amendments, modifications and supplements.

1.10 Contract Unit Price

The monies payable by OWNER to CONTRACTOR under the Contract Documents as stated in the Agreement. Unit Prices are to be firm for the term of this Contract.

1.11 Contract Time

The number of consecutive calendar days between the date of issuance of the Notice to Proceed and the contract completion date.

1.12 CONTRACTOR

The person, firm or corporation with whom OWNER has entered into the Agreement.

1.13 Defective

An adjective which when modifying the word Work refers to Work that is unsatisfactory, faulty or deficient, or does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to ENGINEER'S recommendation of final payment (unless responsibility for the protection thereof has been assumed by OWNER).

1.14 Drawings

The drawings which show the character and scope of the Work to be performed and which have been prepared or approved by ENGINEER and are referred to in the Contract Documents.

1.15 Effective Date of the Agreement

The date indicated in the Agreement on which it becomes effective.

1.16 ENGINEER

The Lexington-Fayette Urban County Government Division of Water Quality or its authorized representative.

1.17 Field Order

A documented order issued by ENGINEER which orders minor changes in the Work, but which does not involve a change in the Contract Price or the Contract Time.

1.18 Giving Notice

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

1.19 Laws and Regulations

Laws, rules, regulations, ordinances, codes and/or orders.

1.20 Notice of Award

The written notice by OWNER to the apparent successful bidder stating that upon compliance by the apparent successful bidder with the conditions enumerated therein, within the time specified, OWNER will sign and deliver the Agreement.

1.21 Notice to Proceed

A written notice given by OWNER to CONTRACTOR fixing the date on which the Contract Time will commence to run and on which CONTRACTOR shall start to perform CONTRACTOR'S obligations under the Contract Documents.

1.22 OWNER

The Lexington-Fayette Urban County Government.

1.23 Partial Utilization

Placing a portion of the Work in service for the purpose for which it is intended (or related purpose) before reaching Completion for all the Work.

1.24 Project

The total construction of which the Work to be provided under the Contract Documents may be the whole, or a part as indicated elsewhere in the Contract Documents.

1.25 Inspector

The authorized representative of the ENGINEER who is assigned to the site or any part thereof.

1.26 Shop Drawings

All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for CONTRACTOR to illustrate some portion of the Work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a Supplier and submitted by CONTRACTOR to illustrate material or equipment for some portion of the Work.

1.27 Specifications

Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards and

workmanship as applied to the Work and certain administrative details applicable thereto.

1.28 Standard Specifications
The "Standard Specifications for Road and Bridge Construction", Transportation Cabinet, Department of Highways, Commonwealth of Kentucky, current edition. MUTCD shall refer to the "Manual of Uniform Traffic Control Devices.

1.29 Subcontractor
An individual, firm or corporation having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the site.

1.30 Special Conditions
The part of the Contract Documents which amends or supplements these General Conditions.

1.31 Supplier
A manufacturer, fabricator, supplier, distributor, materialman or vendor.

1.32 Underground Facilities
All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.

1.33 Unit Price Work
Not applicable

1.34 Work
The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work is the result of performing services, furnishing labor and furnishing and incorporating materials and equipment into the construction, all as required by the Contract Documents.

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

2. PRELIMINARY MATTERS

2.1 Delivery of Bonds

When the CONTRACTOR delivers the executed Agreements to OWNER, CONTRACTOR shall also deliver to OWNER, such Bonds, Insurance Certificate, and Power of Attorney as CONTRACTOR may be required to furnish.

2.2 Copies of Documents

Owner shall furnish to CONTRACTOR up to three copies (unless otherwise specified in the Special Conditions) of the Contract Documents as are reasonably necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction.

2.3 Commencement of Contract Time; Notice to Proceed

The Contract Time will commence to run on the day specified in the Notice to Proceed.

2.4 Starting the Project

CONTRACTOR shall start to perform the Work on the date when the Contract Time commences to run, but no Work shall be done at the site prior to the date on which the Contract Time commences to run.

2.5 Before Starting Construction

Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. CONTRACTOR shall promptly report in writing to ENGINEER any conflict, error or discrepancy which CONTRACTOR may discover and shall obtain a written interpretation or clarification from ENGINEER before proceeding with any Work affected thereby; however, CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any conflict, error or discrepancy in the Contract Documents, unless CONTRACTOR had actual knowledge thereof or should reasonably have known thereof.

2.6 Submittal of Schedules

Within ten days after the effective date of the Agreement (unless otherwise specified) CONTRACTOR shall submit to ENGINEER for review:

2.6.1 an estimated progress schedule indicating the starting and completion dates of the various stages of the Work;

2.6.2 a preliminary schedule of Shop Drawing submissions; and

2.6.3 a preliminary schedule of values for all of the Work which will include quantities and prices of items aggregating the Contract Price and will subdivide the Work into component parts in sufficient detail to serve as the

basis for progress payments during construction. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work which will be confirmed in writing by CONTRACTOR at the time of submission.

2.7 Preconstruction Conference

Before CONTRACTOR starts the Work at the proposed site, a conference attended by CONTRACTOR, ENGINEER, EEO-Affirmative Action Officer, and other appropriate parties will be held to discuss the following issues: (1) The scheduling of the Work to be completed; (2) The procedures for handling shop drawings and other submittals; (3) The processing of applications for payment; (4) The establishment of an understanding among the involved parties in regard to the proposed project; and (5) The establishment of procedures for effectively implementing the LFUCG's 10% minimum DBE goals.

2.8 Finalizing Schedules

At least ten days before submission of the first Application for Payment a conference attended by CONTRACTOR, ENGINEER and others as appropriate will be held to finalize the schedules submitted in accordance with paragraph 2.6. The finalized progress schedule will be acceptable to ENGINEER as providing orderly progression of the Work to completion within the Contract Time, but such acceptance will neither impose on ENGINEER responsibility for the progress or scheduling of the Work nor relieve CONTRACTOR from full responsibility thereof. The finalized schedule of Shop Drawing submissions will be acceptable to ENGINEER as providing a workable arrangement for processing the submissions. The finalized schedule of values will be acceptable to ENGINEER as to form and substance.

3. CONTRACT DOCUMENTS: INTENT, CONFLICTS, AMENDING AND REUSE

3.1 General

The Contract Documents comprise the entire agreement between OWNER and CONTRACTOR concerning the Work. The Contract Documents are complementary; what is called for by one is as binding as if called for by all. The Contract Documents will be construed in accordance with the law of the place of the Project.

3.2 Intent

It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any Work, materials or equipment that may reasonably be inferred from the Contract Documents as being required to produce the intended result will be supplied whether or not specifically called for. When words which have a well-known technical or trade meaning are used to describe Work, materials or equipment such words shall be interpreted in accordance with that meaning. Reference to standard specifications, manuals or codes of any

technical society, organization or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code or laws or regulations in effect at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated. 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 paragraph 8.12.3 or 8.12.4. Clarifications and interpretations of the Contract Documents shall be issued by ENGINEER as provided in paragraph 8.4.

3.3 Conflicts

If, during the performance of the Work, CONTRACTOR finds a conflict, error or discrepancy in the Contract Documents, CONTRACTOR shall so report to ENGINEER in writing at once and before proceeding with the Work affected thereby shall obtain a written interpretation or clarification from ENGINEER; however, CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any conflict, error or discrepancy in the Contract Documents unless CONTRACTOR had actual knowledge thereof or should reasonably have known thereof.

In resolving such conflicts, errors and discrepancies, the documents shall be given precedence in the following order:

1. Agreement
2. Field and Change Orders
3. Addenda
4. Special Conditions
5. Instruction to Bidders
6. General Conditions
7. Specifications and Drawings

Figure dimension on drawings shall govern over scale dimensions and detailed Drawings shall govern over general Drawings.

3.4 Amending and Supplementing Contract Documents

The Contract Documents may be amended to provide for additions, deletions and revisions in the Work or to modify the terms and conditions thereof by means of a Change Order or a Field Order. Contract Price and Contract Time may only be changed by a Change Order.

3.5 Reuse of Documents

Neither CONTRACTOR nor any Subcontractor or Supplier or other person or organization performing or furnishing any of the Work under a direct or indirect contract with OWNER shall have or acquire any title to or ownership rights in any of the Drawings, Specifications or other documents (or copies of any thereof) prepared by or bearing the seal of ENGINEER; and they shall not reuse any of them on extensions of the Project or any other project without written consent of OWNER and ENGINEER and specific written verification or adaptation by ENGINEER.

4. AVAILABILITY OF LANDS; PHYSICAL CONDITIONS, REFERENCE POINTS

4.1 Availability of Lands

OWNER shall furnish, as indicated in the Contract Documents, the lands upon which the Work is to be performed, rights-of-way and easements for access thereto, and such other lands which are designated for the use of CONTRACTOR. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by OWNER, unless otherwise provided in the Contract Documents. If CONTRACTOR believes that any delay in OWNER'S furnishing these lands, rights-of-way or easements entitles CONTRACTOR to an extension of the Contract Time, CONTRACTOR may make a claim therefor as provided in Article 11. ENGINEER shall determine if the claim is legitimate or not. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.2 Physical Conditions

4.2.1 Explorations and Reports

Reference is made to the Special Conditions for identification of those reports of explorations and tests of subsurface conditions at the site that have been utilized by ENGINEER in preparation of the Contract Documents. CONTRACTOR may rely upon the accuracy of the technical data contained in such reports, but not upon non-technical data, interpretations or opinions contained therein or for the completeness thereof for CONTRACTOR'S purposes. Except as indicated in the immediately preceding sentence and in paragraph 4.2.6, CONTRACTOR shall have full responsibility with respect to subsurface conditions at the site.

4.2.2 Existing Structures

Reference is made to the Special Conditions for identification of those drawings of physical conditions in or relating to existing surface and subsurface structures (except Underground Facilities referred to in paragraph 4.3 which are at or contiguous to the site that have been utilized by ENGINEER in preparation of the Contract Documents. CONTRACTOR may rely upon the accuracy of the technical data contained in such drawings, but not for the completeness thereof for CONTRACTOR'S purposes. Except as indicated in the immediately preceding sentence and in paragraph

4.2.6, CONTRACTOR shall have full responsibility with respect to physical conditions in or relating to such structures.

4.2.3 Report of Differing Conditions
If CONTRACTOR believes that:

4.2.3.1 any technical data on which CONTRACTOR is entitled to rely as provided in paragraphs 4.2.1 and 4.2.2 is inaccurate, or

4.2.3.2 any physical conditions uncovered or revealed at the site differ materially from that indicated, reflected or referred to in the Contract Documents,

CONTRACTOR shall, promptly after becoming aware thereof and before performing and WORK in connection therewith (except in an emergency) notify OWNER and ENGINEER in writing about the inaccuracy or difference.

4.2.4 ENGINEER'S Review
Engineer will promptly review the pertinent conditions, determine the necessity of obtaining additional explorations or tests with respect thereto and advise CONTRACTOR of ENGINEER'S findings and conclusions.

4.2.5 Possible Document Change
If ENGINEER concludes that there is a material error in the Contract Documents or that because of newly discovered conditions a change I the Contract Documents is required, a Change Order will be issued as provided in Article 10 to reflect and document the consequences of the inaccuracy or difference.

4.2.6 Possible Price and Time Adjustments
In each such case, an increase or decrease in the Contract Price or an extension or shortening of the Contract Time, or any combination thereof, will be allowable to the extent that they are attributable to any such inaccuracy or difference.

4.3 Physical Conditions-Underground Facilities

4.3.1 Shown or Indicated
The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site is based on information and data furnished to OWNER or ENGINEER by the owners of such underground facilities or by others. Unless it is otherwise expressly provided in the Special Conditions:

4.3.1.1 OWNER and ENGINEER shall not be responsible for the accuracy or completeness of any such information or data; and,

4.2.1.2 CONTRACTOR shall have full responsibility for reviewing and checking all such information and data; for locating all underground facilities shown or indicated in the Contract Documents; for coordination of the Work with the owners of such underground facilities during construction; and for the safety and protection thereof and repairing any damage thereto resulting from the Work, the cost of all of which will be considered as having been included in the Contract Price.

4.3.2 Not Shown or Indicated

If an underground facility is uncovered or revealed at or contiguous to the site which was not shown or indicated in the Contract Documents and which CONTRACTOR could not reasonably have been expected to be aware of, CONTRACTOR shall, promptly after becoming aware thereof and before performing any Work affected thereby (except in an emergency), identify the owner of such Underground Facility and give written notice thereof to that owner and to OWNER and ENGINEER. ENGINEER will promptly review the underground facility to determine the extent to which the Contract Documents should be modified to reflect and document the consequences of the existence of the Underground Facility, and the Contract Documents will be amended or supplemented to the extent necessary. During such time, CONTRACTOR shall be responsible for the safety and protection of such underground facility. CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, to the extent that they are attributable to the existence of any underground facility that was not shown or indicated in the Contract Documents and which CONTRACTOR could not reasonably have been expected to be aware of.

4.4 Reference Points

OWNER shall provide engineering surveys to establish reference points for construction which in ENGINEER'S judgment are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for laying out the Work (unless otherwise specified), shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of OWNER. CONTRACTOR shall report to ENGINEER whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points by a Registered Land Surveyor.

5. CONTRACTOR'S RESPONSIBILITIES

5.1 Supervision

CONTRACTOR shall supervise and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. CONTRACTOR shall assure that all CONTRACTOR personnel (including subcontractors, etc.) conduct themselves in a courteous and respectful manner toward the ENGINEER and the general public. Failure to comply with this

condition of the Contract will result in immediate suspension of the Work. Following a review by the Commissioner of Public Works, the Contract may be terminated (see GC section 14). CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences and procedures of construction, but CONTRACTOR shall not be responsible for the negligence of others in the design or selection of a specific means, method, technique, sequence or procedure of construction which is indicated in and required by the Contract Documents. CONTRACTOR shall be responsible to see that the finished Work complies accurately with the Contract Documents.

5.2 Superintendence

CONTRACTOR shall keep on the Work at all times during its progress a competent resident superintendent, who shall not be replaced without written notice to OWNER and ENGINEER except under extraordinary circumstances. The superintendent will be CONTRACTOR'S representative at the site and shall have authority to act on behalf of CONTRACTOR. All communications given to the superintendent shall be as binding as if given to CONTRACTOR.

5.3 Labor

CONTRACTOR shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. CONTRACTOR shall at all times maintain good discipline and order at the site. Except in connection with the safety or protection of persons or the Work or property at the site or adjacent thereto, and except as otherwise indicated in the Contract Documents, all Work at the site shall be performed during regular working hours, and CONTRACTOR will not permit overtime work or the performance of Work on Saturday, Sunday or any legal holiday without OWNER'S written consent given after prior written notice to ENGINEER.

5.4 Start-Up and Completion of Work

Unless otherwise specified, CONTRACTOR shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up and completion of the Work.

5.5 Materials and Equipment

All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. If required by ENGINEER, CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable supplier except as otherwise provided in the Contract Documents; but no provision of any such instructions will 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 paragraph 8.12.3 or 8.12.4.

5.5.1 Not Clearly Specified or Indicated

In all instances where materials specified are obtainable in different sizes, weights, trade grades, qualities or finishes, etc., whose weights, trade grades, qualities or finishes, etc., are not clearly specified or indicated on the Drawings, the CONTRACTOR shall notify the ENGINEER of all such instances at least five (5) days in advance of receiving the proposals. The Engineer will then determine which size, weight, trade grade, quality, finish, etc., is required.

5.5.2 Coordination of Work

The CONTRACTOR shall see that for his own Work and for the work of each subcontractor, proper templates and patterns necessary for the coordination of the various parts of the Work are prepared. The CONTRACTOR shall furnish or require the Subcontractor to furnish such duplicates as will enable the Subcontractors to fit together and execute fully their respective portions of the Work.

5.6 Adjusting Progress Schedule

CONTRACTOR shall submit to ENGINEER for acceptance (to the extent indicated in paragraph 2.8) adjustments in the progress schedule to reflect the impact thereon of new developments; these will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the Contract Documents applicable thereto.

5.7 Substitutes or "Or-Equal" Items

5.7.1 General

Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular supplier, the naming of the item is intended to establish the type, function, and quality required. Unless the name is followed by words indicating that no substitution is permitted, materials or equipment of other Suppliers may be accepted by OWNER/ENGINEER if sufficient information is submitted by CONTRACTOR to allow OWNER/ENGINEER to determine that the material or equipment proposed is equivalent or equal to that named. The procedure for review by OWNER/ENGINEER will include the following. Requests for review of substitute items of material and equipment will not be accepted by OWNER/ENGINEER from anyone, other than CONTRACTOR. If CONTRACTOR wishes to furnish or use a substitute item of material or equipment, CONTRACTOR shall make written application to OWNER/ENGINEER for acceptance thereof, certifying that the proposed

substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified. The application will state that the evaluation and acceptance of the proposed substitute will not prejudice CONTRACTOR'S achievement of completion on time, whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) to adapt the design to the proposed substitute and whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute from that specified will be identified in the application and available maintenance, repair and replacement service will be indicated. The application will also contain an itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other contractors affected by the resulting change, all of which shall be considered by OWNER/ENGINEER in evaluating the proposed substitute. OWNER/ENGINEER may require CONTRACTOR to furnish at CONTRACTOR'S expense additional data about the proposed substitute.

5.7.2 Substitutes

If a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract Documents, CONTRACTOR may furnish or utilize a substitute means, method, sequence, technique or procedure of construction acceptable to OWNER/ENGINEER, if CONTRACTOR submits sufficient information to allow OWNER/ENGINEER to determine that the substitute proposed is equivalent to that indicated or required by the Contract Documents. The procedure for review by OWNER/ENGINEER will be similar to that provided in paragraph 5.7.1 as applied by OWNER/ENGINEER.

5.7.3 OWNER/ENGINEER'S Approval

OWNER/ENGINEER will be allowed a reasonable time within which to evaluate each proposed substitute. OWNER/ENGINEER will be the sole judge of acceptability, and no substitute will be ordered, installed or utilized without OWNER/ENGINEER'S prior written acceptance which will be evidenced by either a Change Order or an approved Shop Drawing. OWNER may require CONTRACTOR to furnish at CONTRACTOR'S expense a special performance guarantee or other surety with respect to any substitute. OWNER/ENGINEER will record time required by OWNER/ENGINEER and OWNER/ENGINEER'S consultants in evaluating substitutions proposed by CONTRACTOR and in making changes in the Contract Documents occasioned thereby. Whether or not OWNER/ENGINEER accepts a proposed substitute, CONTRACTOR shall reimburse OWNER for the charges of OWNER/ENGINEER and

OWNER/ENGINEER'S consultants for evaluating each proposed substitute.

5.8 Subcontractors, Suppliers, and Others

5.8.1 Acceptable to ENGINEER

CONTRACTOR shall not employ any Subcontractor, Supplier or other person or organization (including those acceptable to OWNER and ENGINEER as indicated in paragraph 5.8.2), whether initially or as a substitute, against whom OWNER or ENGINEER may have reasonable objection. CONTRACTOR shall not be required to employ any Subcontractor, Supplier or other person or organization to furnish or perform any of the Work against whom CONTRACTOR has reasonable objection.

5.8.2 Objection After Due Investigation

If the Contract Documents require the identity of certain Subcontractors, Suppliers or other persons or organizations (including those who are to furnish the principal items of materials and equipment) to be submitted to OWNER in advance of the specified date prior to the Effective Date of the Agreement for acceptance by OWNER and ENGINEER and if CONTRACTOR has submitted a list thereof, OWNER'S or ENGINEER'S acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the bidding documents or the Contract Documents) of any such Subcontractor, Supplier or other person or organization so identified may be revoked on the basis of reasonable objection after due investigation, in which case CONTRACTOR shall submit an acceptable substitute. No acceptance by OWNER or ENGINEER of any such Subcontractor, Supplier or other person or organization shall constitute a waiver of any right of OWNER or ENGINEER to reject defective Work.

5.8.3 Contractor Responsible for Acts of Subcontractors

The CONTRACTOR shall perform on the site, and with its own organization, work equivalent to at least fifty (50) percent of the total amount of Work to be performed under the Contract. This percentage may be reduced by a supplemental agreement to this Contract if, during performing the Work, the CONTRACTOR requests a reduction and the Urban County Engineer determines that the reduction would be to the advantage of the Urban County Government.

The CONTRACTOR shall, at the time he submits his proposal for the Contract, notify the OWNER in writing of the names of Subcontractors proposed for the Work. He shall not employ any Subcontractor without the prior written approval of the OWNER.

CONTRACTOR shall be fully responsible to OWNER and ENGINEER for all acts and omissions of the Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR just as CONTRACTOR is responsible for CONTRACTOR'S own acts and omissions. Nothing in the Contract Documents shall create any contractual relationship between OWNER or ENGINEER and any such Subcontractor, Supplier or other person or organization, nor shall it create any obligation on the part of OWNER or ENGINEER to pay or to see to the payment of any moneys due any such Subcontractor, Supplier or other person or organization except as may otherwise be required by Laws and Regulations.

5.8.4 Division of Specifications

The divisions and sections of the Specifications and the identifications of any Drawings shall not control CONTRACTOR in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

5.8.5 Agreement Between Contractor and Subcontractors

All Work performed for CONTRACTOR by a Subcontractor will be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor which specifically binds the Subcontractor to the applicable terms and conditions of the Contract Documents for the benefit of OWNER and ENGINEER.

5.8.6 Statements and Comments by CONTRACTOR

Neither the CONTRACTOR, his employees, nor his subcontractors shall at any time make any statement or comment as to the project scope, nature, intention, design, or construction method to any third party or parties without the explicit written consent of the OWNER.

Any third party requesting such information shall be referred to the OWNER or his representative.

Should there be any change from the original intent of the project as a result of any statement or comment by the contractor, his employees or subcontractors, contractor shall be held liable for any change in the scope, nature, design, or construction method and shall bear the full cost for the previously mentioned changes.

5.9 Patent Fees and Royalties

CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others.

5.10 Permits

Unless otherwise provided in the Special conditions, CONTRACTOR shall obtain and pay for all construction permits and licenses. OWNER shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work, which are applicable at the time of opening of Bids, or if there are no Bids on the Effective Date of the Agreement. CONTRACTOR shall pay all charges of utility owners for connections to the Work, and OWNER shall pay all charges of such utility owners for capital costs related thereto such as plant investment fees.

5.11 Laws and Regulations

5.11.1 CONTRACTOR to Comply

CONTRACTOR shall give all notices and comply with all Laws and Regulations applicable to furnishing and performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither OWNER nor ENGINEER shall be responsible for monitoring CONTRACTOR'S compliance with any Laws and Regulations.

5.11.2 Specifications and Drawings at Variance

If CONTRACTOR observes that the Specifications or Drawings are at variance with any Laws or Regulations, CONTRACTOR shall give ENGINEER prompt written notice thereof, and any necessary changes will be authorized by one of the methods indicated in paragraph 3.4. If CONTRACTOR performs any Work knowing or having reason to know that it is contrary to such Laws, or Regulations, and without such notice to ENGINEER, CONTRACTOR shall bear all costs arising therefrom; however, it shall not be CONTRACTOR'S primary responsibility to make certain that the Specifications and Drawings are in accordance with such Laws and Regulations.

5.12 Taxes

CONTRACTOR shall pay all sales, consumer, use and other similar taxes required to be paid by CONTRACTOR in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work. Any party, firm or individual submitting a proposal pursuant to invitation must have paid all taxes owed to the Lexington-Fayette Urban County Government at the time the proposal is submitted, and must maintain a "current" status in regard to those taxes throughout the Contract. If applicable, business must be licensed in Fayette County.

5.13 Use of Premises

5.13.1 Project Site

CONTRACTOR shall confine construction equipment, the storage of materials and equipment and the operations of workers to the staging areas or work site areas identified in and permitted by the Contract Documents and other land and areas permitted by Laws and Regulations, rights-of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any land or areas contiguous thereto, resulting from the performance of the Work. Should any claim be made against OWNER or ENGINEER by any such owner or occupant because of the performance of the Work, CONTRACTOR shall promptly attempt to settle with such other party by agreement or otherwise resolve the claim by arbitration or at law. CONTRACTOR shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold OWNER and ENGINEER harmless from and against all claims, damages, losses and expenses (including, but not limited to, fees of engineers, architects, attorneys and other professionals and court and arbitration costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any such other party against OWNER or ENGINEER to the extent based on a claim arising out of CONTRACTOR'S performance of the Work.

5.13.2 Clean UP

During the progress of the Work, CONTRACTOR shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work, CONTRACTOR shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery, and surplus materials, and shall leave the site clean and ready for occupancy by OWNER. CONTRACTOR shall restore to original condition all property not designated for alteration by the Contract Documents.

5.13.1 Loading of Structures

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

5.14 Record Drawings

CONTRACTOR shall maintain in a safe place at the site one record copy of all Drawings, Specifications, Addenda, Change Orders, Field Orders and written interpretations and clarifications (issued pursuant to paragraph 9.4) in good order

and annotated to show all changes made during construction. These record documents together with all approved samples and a counterpart of all approved Shop Drawings will be available to ENGINEER for reference. Upon completion of the Work, these record documents, samples and Shop Drawings will be delivered to ENGINEER for OWNER.

5.15 Shop Drawings and Samples

5.15.1 Shop Drawing Submittals

After checking and verifying all field measurements and after complying with applicable procedures specified, CONTRACTOR shall submit to ENGINEER for review and approval in accordance with the accepted schedule of Shop Drawing submissions (see paragraph 2.8), or for other appropriate action if so indicated in the Special Conditions, five copies (unless otherwise specified) of all Shop Drawings, which will bear a stamp or specific written indication that CONTRACTOR has satisfied CONTRACTOR'S responsibilities under the Contract Documents with respect to the review of the submission. All submissions will be identified as ENGINEER may require. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to enable ENGINEER to review the information as required.

5.15.2 Sample Submittals

CONTRACTOR shall also submit to ENGINEER for review and approval with such promptness as to cause no delay in Work, all samples required by the Contract Documents. All samples will have been checked by and accompanied by a specific written indication that CONTRACTOR has satisfied CONTRACTOR'S responsibilities under the Contract Documents with respect to the review of the submission and will be identified clearly as to material, Supplier, pertinent data such as catalog numbers and the use for which intended.

5.15.3 Review by CONTRACTOR

Before submission of each Shop Drawing or sample CONTRACTOR shall have determined and verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each Shop Drawing or sample with other Shop Drawings and samples and with the requirements of the Work and the Contract Documents.

5.15.4 Notice of Variation

At the time of each submission, CONTRACTOR shall give ENGINEER specific written notice of each variation that the Shop Drawings or samples may have from the requirements of the Contract Documents, and, in

addition, shall cause a specific notation to be made on each Shop Drawing submitted to ENGINEER for review and approval of each such variation.

5.15.5 ENGINEER'S Approval

ENGINEER will review and approve with reasonable promptness Shop Drawings and samples, but ENGINEER'S review and approval will be only for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents and shall not extend to means, methods, techniques, sequences or procedures of construction (except where a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. CONTRACTOR shall make corrections required by ENGINEER, and shall return the required number of corrected copies of Shop Drawings and submit, as required, new samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals.

5.15.6 Responsibility for Errors and Omissions

ENGINEER'S review and approval of Shop Drawings or samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has in writing called ENGINEER'S attention to each such variation at the time of submission as required by paragraph 5.15.4 and ENGINEER has given written approval of each such variation by a specific written notation thereof incorporated in or accompanying the Shop Drawing or sample approval; nor will any approval by ENGINEER relieve CONTRACTOR from responsibility for errors or omissions in the Shop Drawings or from responsibility for having complied with the provisions of paragraph 5.15.3.

5.15.7 Cost of Related Work

Where a Shop or sample is required by the Specifications, any related Work performed prior to ENGINEER'S review and approval of the pertinent submission will be the sole expense and responsibility of CONTRACTOR.

5.16 Continuing the Work

CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with OWNER. No Work shall be delayed or postponed pending resolutions of any disputes or disagreements, except as permitted by paragraph 14.5 or as CONTRACTOR and OWNER may otherwise agree in writing.

5.17 Erosion and Sediment Control

5.17.1 General Environmental Requirements

The CONTRACTOR and Subcontractors performing work on projects on behalf of the OWNER shall comply with all applicable federal, state, and local environmental regulations and all requirements and conditions set forth in "special" permits including but not limited to Corp of Engineers 404 permits, 401 Water Quality Certifications, Stream Crossing and Floodplain Encroachment Permits.

Any fines or penalties resulting from the failure to comply with the terms of the federal, state or local permits or perform necessary corrective action are solely the obligation of the CONTRACTOR.

5.17.2 Stormwater Pollution Prevention

A. The CONTRACTOR shall exercise due care to prevent or minimize any damage to any stream or wetland from pollution by debris, sediment or other material. The operation of equipment and/or materials in a jurisdictional wetland is expressly prohibited. Water that has been used for washing or processing, or that contains oils, sediments or other pollutants shall not be discharged from the job site. Such waters shall be collected and properly disposed of by the CONTRACTOR in accordance with applicable local, state and federal law.

B. The CONTRACTOR is solely responsible for securing all required state and local permits associated with stormwater discharges from the project including, but not necessarily limited to the KY Notice of Intent to Disturb (NOI) for Coverage of Storm Water Discharges Associated with Construction Activities under the KPDES Storm Water General Permit KYR100000 and the LFUCG, Land Disturbance Permit. Permit application preparation and all required documentation are the responsibility of the CONTRACTOR. The CONTRACTOR is solely responsible for maintaining compliance with the stormwater pollution prevention plan or erosion and sediment control plan and ensuring the following:

a. That the Stormwater Pollution Prevention Plan (SWPPP) or erosion control plan is current and available for review on site;
b. That any and all stormwater inspection reports required by the permit are conducted by qualified personnel and are available for review onsite; and
c. That all best management practices (BMPs) are adequately maintained and effective at controlling erosion and preventing sediment from leaving the site.

C. The CONTRACTOR shall provide the necessary equipment and personnel to perform any and all emergency measures that may be required to contain any spillage or leakage and to remove materials, soils

or liquids that become contaminated. The collected spill material shall be properly disposed at the CONTRACTOR's expense.

D. Upon completion of the work and with the concurrence of the OWNER, the CONTRACTOR must file a Notice of Termination (NOT) of Coverage Under the KPDES General Permit for Storm Water Discharges Associated with Construction Activity with the appropriate local and state authorities.

E. Any fines or penalties resulting from the failure to comply with the terms of the state or local stormwater permits or perform necessary corrective action are solely the obligation of the CONTRACTOR.

6. OTHER WORK

6.1 Related Work at Site

OWNER may perform other work related to the Project at the site by OWNER'S own forces, have other work performed by utility owners or let other direct contracts therefor which shall contain General Conditions similar to these. If the fact that such other work is to be performed was not noted in the Contract Documents, written notice thereof will be given to CONTRACTOR prior to starting any such other work; and, if such performance will involve additional expense to CONTRACTOR or requires additional time, a Change Order to the Contract will be negotiated.

6.2 Other Contractors or Utility Owners

CONTRACTOR shall afford each utility owner and other contractor who is a party to such a direct contract (or OWNER, if OWNER is performing the additional work with OWNER'S employees) proper and safe access to the site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such work, and shall properly connect and coordinate the Work with theirs. CONTRACTOR shall do all cutting, fitting and patching of the Work that may be required to make its several parts come together properly and integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of ENGINEER and the others whose work will be affected. The duties and responsibilities of CONTRACTOR under this paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of CONTRACTOR in said direct contracts between OWNER and such utility owners and other contractors.

6.3 Delays Caused by Others

If any part of CONTRACTOR'S Work depends for proper execution or results upon the work of any such other contractor or utility owner (or OWNER), CONTRACTOR shall inspect and promptly report to ENGINEER in writing any delays, defects or deficiencies in such work that render it unavailable or unsuitable for such proper execution and results. CONTRACTOR'S failure so to report will constitute an acceptance of the other work as fit and proper for integration with

CONTRACTOR'S Work except for latent or non-apparent defects and deficiencies in the other work.

6.4 Coordination

If OWNER contracts with others for the performance of other work on the Project at the site, the person or organization who will have authority and responsibility for coordination of the activities among the various prime contractors will be identified in the Special Conditions, and the specific matters to be covered by such authority and responsibility will be itemized, and the extent of such authority and responsibilities will be provided, in the Special Conditions.

7. OWNER'S RESPONSIBILITIES

7.1 Communications

OWNER shall issue all communications to CONTRACTOR through ENGINEER.

7.2 Data and Payments

OWNER shall furnish the data required of OWNER under the Contract Documents promptly after they are due.

7.3 Lands, Easements, and Surveys

OWNER'S duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.1 and 4.4. Paragraph 4.2 refers to OWNER'S identifying and making available to CONTRACTOR copies of reports of explorations and tests of subsurface conditions at the site and in existing structures which have been utilized by ENGINEER in preparing the Drawings and Specifications.

7.4 Change Orders

OWNER is obligated to execute Change Orders as indicated in paragraph 9.4.

7.5 Inspections, Tests and Approvals

OWNER'S responsibility in respect to certain inspections, tests and approvals is set forth in paragraph 13.3.

7.6 Stop or Suspend Work

In connection with OWNER'S right to stop Work or suspend Work, see paragraph 12.4 and 14.1 Paragraph 14.2 deals with OWNER'S rights to terminate services of CONTRACTOR under certain circumstances.

8. ENGINEER'S STATUS DURING CONSTRUCTION

8.1 OWNER'S Representative

ENGINEER will be OWNER'S representative during the construction period. The duties and responsibilities and the limitations of authority of ENGINEER as OWNER'S representative during construction are set forth in the Contract Documents and shall not be extended without written consent of OWNER and ENGINEER.

8.2 Visits to Site

ENGINEER will make visits to the site at intervals appropriate to the various stages of construction to observe the progress and quality of the executed Work and to determine, in general, if the Work is proceeding in accordance with the Contract Documents. ENGINEER will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. ENGINEER'S efforts will be directed toward providing for OWNER a greater degree of confidence that the completed Work will conform to the Contract Documents. On the basis of such visits and on-site observations, ENGINEER will keep OWNER informed of the progress of the Work and will endeavor to guard OWNER against defects and deficiencies in the Work.

8.3 Project Representation

ENGINEER will provide an Inspector to assist ENGINEER in observing the performance of the Work. If OWNER designates another agent to represent OWNER at the site who is not ENGINEER'S agent or employee, the duties, responsibilities and limitations of authority of such other person will be as provided in the Special Conditions.

8.4 Clarifications and Interpretations

ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents (in the form of Drawings or otherwise) as ENGINEER may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents.

8.5 Authorized Variations in Work

ENGINEER may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Time and are consistent with the overall intent of the Contract Documents. These may be accomplished by a Field Order.

8.6 Rejecting Defective Work

ENGINEER will have authority to disapprove or reject Work which ENGINEER believes to be defective, and will also have authority to require special inspection or testing of the Work as provided in paragraph 12.3, whether or not the Work is fabricated, installed or completed.

8.7 Shop Drawings

In connection with ENGINEER'S responsibility for Shop Drawings and samples, see paragraphs 5.15.1 through 5.16 inclusive.

8.8 Change Orders

In connection with ENGINEER'S responsibilities as to Change Orders, see Articles 10, 11 and 12.

8.9 Payments

In connection with ENGINEER'S responsibilities with respect to Applications for Payment, etc., see Article 13.

8.10 Determinations for Unit Prices

ENGINEER will determine the actual quantities and classifications of Unit Price Work performed by CONTRACTOR.

ENGINEER will review with CONTRACTOR ENGINEER'S preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise).

8.11 Decision on Disputes

ENGINEER will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. Claims, disputes and other matters relating to the acceptability of the Work or the interpretation of the requirements of the Contract Documents pertaining to the performance and furnishing of the Work and claims under Articles 10 and 11 in respect of changes in the Contract Price or Contract Time will be referred initially to ENGINEER in writing with a request for a formal decision in accordance with this paragraph, which ENGINEER will render in writing within a reasonable time. Written notice of each such claim, dispute and other matter will be delivered to ENGINEER promptly (but in no event later than thirty days) after the occurrence of the event giving rise thereto, and written supporting data will be submitted to ENGINEER within sixty days after such occurrence unless ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim.

8.12 Limitations on Engineer's Responsibilities

8.12.1 CONTRACTOR, Supplier, or Surety

Neither ENGINEERS authority to act under this Article 8 or elsewhere in the Contract Documents nor any decision made by ENGINEER in good faith either to exercise or not exercise such authority shall give rise to any duty or

responsibility of ENGINEER to CONTRACTOR, any Subcontractor, any Supplier, or any other person or organization performing any of the Work, or to any surety for any of them.

8.12.2 To Evaluate the Work

Whenever in the Contract Documents the terms "as ordered", "as directed", "as required", "as allowed", "as approved" or terms of like effect or import are used, or the adjectives "reasonable", "suitable", "acceptable", "proper", or "satisfactory" or adjectives or like "effect" or "import" are used to describe a requirement, direction, review or judgment of ENGINEER as to the Work, it is intended that such requirement, direction, review or judgment will be solely to evaluate the Work for compliance with the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign ENGINEER 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 paragraph 8.12.3 or 8.12.4.

8.12.3 CONTRACTOR'S Means, Methods, Etc.

ENGINEER will not be responsible for CONTRACTOR'S means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, and ENGINEER will not be responsible for CONTRACTOR'S failure to perform or furnish the Work in accordance with the Contract Documents.

8.12.4 Acts of Omissions of CONTRACTOR

ENGINEER will not be responsible for the acts or omissions of CONTRACTOR or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the Work.

9. CHANGES IN THE WORK

9.1 OWNER May Order Change

Without invalidating the Agreement and without notice to any surety, OWNER may, at any time or from time to time, order additions, deletions or revisions in the Work; these will be authorized by a Change Order. Upon receipt of such notice, CONTRACTOR shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

9.2 Claims

Claims for an increase or decrease in the Contract Price or an extension or shortening or the Contract Time that should be allowed as a result of a Change Order will be settled as provided for in Article 10 or Article 11.

9.3 Work Not in Contract Documents

CONTRACTOR shall not be entitled to an increase in the Contract Price or an extension of the Contract Time with respect to any Work performed that is not required by the Contract Documents as amended, modified and supplemented as provided in paragraph 3.4, except in the case of an emergency and except in the case of uncovering Work as provided in paragraph 12.3.4.

9.4 Change Orders

OWNER and CONTRACTOR shall execute appropriate Change Orders covering:

9.4.1 changes in the Work which are ordered by OWNER pursuant to paragraph 9.1, are required because of acceptance of defective Work under paragraph 12.7 or corrective defective Work under paragraph 12.8, or are agreed to by the parties;

9.4.2 changes in the Contract Price or Contract Time which are agreed to by the parties; and

9.4.3 changes in the Contract Price or Contract Time which embody the substance of any written decision rendered by ENGINEER pursuant to paragraph 8.11; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and REGULATIONS, but during any such appeal, CONTRACTOR shall carry on the Work and adhere to the progress schedule as provided in paragraph 5.16.

9.5 Notice of Change

If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Time) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be CONTRACTOR'S responsibility, and the amount of each applicable Bond will be adjusted accordingly.

10. CHANGE OF CONTRACT PRICE

10.1 Total Compensation

The Contract Price constitutes the total compensation (subject to authorized adjustments) payable to CONTRACTOR for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by CONTRACTOR shall be at his expense without change in the Contract Price.

10.2 Claim for Increase or Decrease in Price

The Contract Price may only be changed by a Change Order. Any claim for an increase or decrease in the Contract Price shall be based on written notice delivered by the CONTRACTOR to the ENGINEER promptly (but in no event later than

thirty days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the amount of the claim with supporting data shall be delivered within sixty days after such occurrence (unless ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by CONTRACTOR'S written statement that the amount claimed covers all known amounts (direct, indirect, and consequential) to which the CONTRACTOR is entitled as a result of the occurrence of said event.

10.3 Value of Work

The value of any Work covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the following ways:

10.3.1 Unit Prices

Where the Work involved is covered by unit prices contained in the Contract Documents, by application of unit prices to the quantities of the items involved (subject to the provisions of paragraphs 10.9.1. through 10.9.3, inclusive).

10.3.2 Lump Sum

By mutual acceptance of a lump sum (which may include an allowance for overhead and profit not necessarily in accordance with paragraph 10.6.2.1).

10.3.3 Cost Plus Fee

On the basis of the Cost of the Work (determined as provided in paragraphs 10.4 and 10.5) plus a CONTRACTOR'S fee for overhead and profit (determined as provided in paragraphs 10.6 and 10.7).

10.4 Cost of the Work

The term Cost of the Work means the sum of all costs necessarily incurred and paid by CONTRACTOR in the proper performance of the Work. Except as otherwise may be agreed to in writing by OWNER, such costs shall be in amounts no higher than those prevailing in the locality of the Project; shall include only the following items; and shall not include any of the costs itemized in paragraph 10.5:

10.4.1 Payroll Costs

Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the Work under schedules of job classifications agreed upon by OWNER and CONTRACTOR. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits which shall include social security contributions, unemployment, excise and payroll taxes, workers' or workmen's compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. Such employees shall

include superintendents and foremen at the site. The expenses of performing Work after regular working hours, on Saturday, Sunday or legal holidays, shall be included in the above to the extent authorized by OWNER.

10.4.2 Materials and Equipment Costs

Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to CONTRACTOR unless OWNER deposits funds with CONTRACTOR with which to make payments, in which case the cash discounts shall accrue to OWNER. All trade discounts, rebates and refunds and all returns from sale of surplus materials and equipment shall accrue to OWNER, and CONTRACTOR shall make provisions so that they may be obtained.

10.4.3 Subcontractor Costs

Payments made by CONTRACTOR to the Subcontractors for Work performed by Subcontractors. If required by OWNER, CONTRACTOR shall obtain competitive bids from Subcontractors acceptable to CONTRACTOR and shall deliver such bids to OWNER who will then determine, with the advice of ENGINEER, which bids will be accepted. If a subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work Plus a Fee, the Subcontractor's Cost of the Work shall be determined in the same manner as CONTRACTOR'S Cost of the Work. All subcontracts shall be subject to the other provisions of the Contract Documents insofar as applicable.

10.4.4 Special Consultant Costs

Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys and accountants) employed for services specifically related to the Work.

10.4.5 Supplemental Costs

10.4.5.1 The proportion of necessary transportation, travel and subsistence expenses of CONTRACTOR'S employees incurred in discharge of duties connected with the Work.

10.4.5.2 Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office and temporary facilities at the site and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost less

market value of such items used but not consumed which remain the property of CONTRACTOR.

10.4.5.3 Rentals of all construction equipment and machinery and the parts thereof whether rented from CONTRACTOR or others in accordance with rental agreements approved by OWNER with the advice of ENGINEER, and the costs of transportation, loading, unloading, installation, dismantling and removal shall be in accordance with terms of said rental agreements. The rental of any such equipment, machinery or parts shall cease when the use thereof is no longer necessary for the Work.

10.4.5.4 Sales, consumer, use or similar taxes related to the Work, and for which CONTRACTOR is liable, imposed by Laws and Regulations.

10.4.5.5 Deposits lost for causes other than negligence of CONTRACTOR, any Subcontractor or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

10.4.5.6 Losses and damages (and related expenses), not compensated by insurance or otherwise, to the Work or otherwise sustained by CONTRACTOR in connection with the performance and furnishing of the Work (except losses and damages within the deductible amounts of property insurance established by OWNER), provided they have resulted from causes other than the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of OWNER. No such losses, damages and expenses shall be included in the Cost of the Work for the purpose of determining CONTRACTOR'S fee. If, however, any such loss or damage requires reconstruction and CONTRACTOR is placed in charge thereof, CONTRACTOR shall be paid a fee proportionate to that stated in paragraph 10.6.2 for services.

10.4.5.7 The cost of utilities, fuel and sanitary facilities at the site.

10.4.5.8 Minor expenses such as telegrams, long distance telephone calls, telephone service at the site,

expressage and similar petty cash items in connection with the Work.

10.4.5.9 Cost of premiums for additional Bonds and insurance required because of changes in the Work and premiums for property insurance coverage within the limits of the deductible amounts established by OWNER.

10.5 Not to Be Included in Cost of the Work

The term Cost of the Work shall not include any of the following:

10.5.1 Costs of Officers and Executives

Payroll costs and other compensation of CONTRACTOR'S officers, executives, principals (of partnership and sole proprietorships), general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks and other personnel employed by CONTRACTOR whether at the site or in CONTRACTOR'S principal or a branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in paragraph 10.4.1 or specifically covered by paragraph 10.4.4 - all of which are to be considered administrative costs covered by the CONTRACTOR'S fee.

10.5.2 Principal Office

Expenses of CONTRACTOR'S principal and branch offices other than CONTRACTOR'S office at the site.

10.5.3 Capital Expense

Any part of CONTRACTOR'S capital expenses, including interest on CONTRACTOR'S capital employed for the Work and charges against CONTRACTOR for delinquent payments.

10.5.4 Bonds and Insurance

Cost of premiums for all Bonds and for all insurance whether or not CONTRACTOR is required by the Contract Documents to purchase and maintain the same (except for the cost of premiums covered by subparagraph 10.4.5.9 above).

10.5.5 Costs Due to Negligence

Costs due to the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied and making good any damage to property.

10.5.6 Other Costs

Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraph 10.4.

10.6 Contractor's Fee

The CONTRACTOR'S Fee allowed to CONTRACTOR for overhead and profit shall be determined as follows:

10.6.1 a mutually acceptable fixed fee; or if none can be agreed upon,

10.6.2 a fee based on the following percentages of the various portions of the Cost of the Work:

10.6.2.1 for costs incurred under paragraphs 10.4.1 and 10.4.2, the CONTRACTOR'S fee shall be fifteen percent;

10.6.2.2 for costs incurred under paragraph 10.4.3, the CONTRACTOR'S fee shall be five percent; and if a subcontract is on the basis of Cost of the Work Plus a fee, the maximum allowable to CONTRACTOR on account of overhead and profit of all Subcontractors shall be fifteen percent;

10.6.2.3 no fee shall be payable on the basis of costs itemized under paragraphs 10.4.4, 10.4.5 and 10.5;

10.6.2.4 the amount of credit to be allowed by CONTRACTOR to OWNER for any such change which results in a net decrease in cost will be the amount of the actual net decrease plus a deduction in CONTRACTOR'S Fee by an amount equal to ten percent of the net decrease; and

10.6.2.5 when both additions and credits are involved in any one change, the adjustment in CONTRACTOR'S fee shall be computed on the basis of the net change in accordance with paragraphs 10.6.2.1 through 10.6.2.4, inclusive.

10.7 Itemized Cost Breakdown

Whenever the cost of any Work is to be determined pursuant to paragraph 10.4 or 10.5, CONTRACTOR will submit in form acceptable to ENGINEER an itemized cost breakdown together with supporting data.

10.8 Cash Allowances

It is understood that CONTRACTOR has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be done by such Subcontractors or Suppliers and for such sums within the limit of the allowances as may be acceptable to ENGINEER, CONTRACTOR agrees that:

10.8.1 Materials and Equipment

The allowances include the cost to CONTRACTOR (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the site, and all applicable taxes; and

10.8.2 Other Costs

CONTRACTOR'S costs for unloading and handling on the site, labor, installation costs, overhead, profit and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances. No demand for additional payment on account of any thereof will be valid.

10.8.3 Change Order

Prior to final payment, an appropriate Change Order will be issued as recommended by ENGINEER to reflect actual amounts due CONTRACTOR on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

10.9 Unit Price Work

10.9.1 General

Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the established unit prices for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by CONTRACTOR will be made by ENGINEER in accordance with Paragraph 8.10.

10.9.2 Overhead and Profit

Each unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR'S overhead and profit for each separately identified item.

10.9.3 Claim for Increase in Unit Price

Where the quantity of any item of Unit Price Work performed by CONTRACTOR differs materially and significantly from the estimated quantity of such item indicated in the Agreement and there is no corresponding adjustment with respect to any other item of Work and if CONTRACTOR believes that CONTRACTOR has incurred additional expense as a result thereof, CONTRACTOR may make a claim for an increase in the Contract Price in accordance with Article 10.

11. CHANGE OF CONTRACT TIME

11.1 Change Order

The Contract Time may only be changed by a Change Order. Any claim for an extension or shortening of the Contract Time shall be based on written notice delivered to ENGINEER promptly (but in no event later than thirty days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the extent of the claim with supporting data shall be delivered within sixty days after such occurrence (unless ENGINEER allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by the claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant has reason to believe it is entitled as a result of the occurrence of said event. All claims for adjustment in the Contract Time shall be determined by ENGINEER in accordance with paragraph 8.11. No claim for an adjustment in the Contract Time will be valid if not submitted in accordance with the requirements of this paragraph 11.1.

11.2 Justification for Time Extensions

The Contract Time will be extended in an amount equal to time lost due to delays beyond the control of CONTRACTOR if a claim is made therefore as provided in paragraph 11.1. Such delays shall include, but not be limited to, acts or neglect by OWNER or others performing additional work as contemplated by Article 6, or to fires, floods, labor disputes, epidemics, abnormal weather conditions or acts of God.

11.3 Time Limits

All time limits stated in the Contract Documents are of the essence of the Agreement. The provisions of this Article 11 shall not exclude recovery for damages (including but not limited to fees and charges of engineers, architects, attorneys and other professionals and court costs) for delay by either party.

12. WARRANTY AND GUARANTEE; TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

12.1 Warranty and Guarantee

CONTRACTOR warrants and guarantees to OWNER and ENGINEER that all Work will be in accordance with the Contract Documents and will not be defective. All defective Work, whether or not in place, may be rejected, corrected or accepted as provided in this Article 12.

12.2 Access to Work

ENGINEER and ENGINEER'S representatives, other representatives of OWNER, testing agencies and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspecting and testing. CONTRACTOR shall provide proper and safe conditions for such access.

12.3 Tests and Inspections

12.3.1 Timely Notice

CONTRACTOR shall give ENGINEER timely notice of readiness of the Work for all required inspections, tests or approvals.

12.3.2 Requirements and Responsibilities

The ENGINEER may require such inspection and testing during the course of the Work as he/she deems necessary to ascertain and assure the integrity and acceptable quality of the materials incorporated and the work performed. Inspection presence may be either full-time or intermittent, and neither the presence nor absence at any time of the ENGINEER or the INSPECTOR shall relieve the CONTRACTOR of sole responsibility for the acceptability and integrity of the Work or any part thereof.

The costs of sampling, testing, and inspection on-site to ascertain acceptability of the Work and materials will be borne by the OWNER except as otherwise provided. The OWNER will select a testing laboratory to perform such sampling and testing. Sampling and/or testing required by the CONTRACTOR or necessitated by failure of Work or materials to meet the above acceptability test shall be at the expense of the CONTRACTOR.

Inspection services may be performed by the employees of the OWNER or by others selected or designated by the OWNER or the ENGINEER.

Sampling and/or testing required for manufacturing quality and/or process control, for certification that raw mineral materials or manufactured products are the quality specified in the contract, or to assure the acceptability for incorporation into the Work shall be borne by the CONTRACTOR or the material supplier.

Cost for inspection, sampling, testing, and approvals required by the laws or regulations of any public body having competent jurisdiction shall be borne by the CONTRACTOR or the material supplier.

Sampling and testing will be in accord with pertinent codes and regulations and with appropriate standards of the American Society of Testing Materials or other specified standards.

12.3.3 On-Site Construction Test and Other Testing

All inspections, tests or approvals other than those required by Laws or Regulations of any public body having jurisdiction shall be performed by organizations acceptable to OWNER and CONTRACTOR (or by ENGINEER if so specified).

12.3.4 Covered Work

If any Work (including the work of others) that is to be inspected, tested or approved is covered without written concurrence of ENGINEER, it must, if requested by ENGINEER, be uncovered for observation. Such uncovering shall be at CONTRACTOR'S expense unless CONTRACTOR has given ENGINEER timely notice of CONTRACTOR'S intention to cover the same and ENGINEER has not acted with reasonable promptness in response to such notice.

12.3.5 CONTRACTOR'S Obligation

Neither observations by ENGINEER nor inspections, tests or approvals by others shall relieve CONTRACTOR from CONTRACTOR'S obligations to perform the Work in accordance with the Contract Documents.

12.4 OWNER May Stop the Work

If the Work is defective, or CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, OWNER may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of OWNER to stop the Work shall not give rise to any duty on the part of OWNER to exercise this right for the benefit of CONTRACTOR or any other party.

12.5 Correction or Removal of Defective Work

If required by ENGINEER, CONTRACTOR shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by ENGINEER, remove it from the site and replace it with non-defective Work. CONTRACTOR shall bear all direct, indirect and consequential costs of such correction or removal (including but not limited to fees and charges of engineers, architects, attorneys and other professionals) made necessary thereby.

12.6 One Year Correction Period

If within one year after the date of Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER'S written instructions, either correct such defective Work, or, if it has been rejected by OWNER, remove it from the site and replace it with non-defective Work. If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or the rejected Work removed and replaced, and all direct, indirect and consequential costs of such removal and replacement (including but not limited to fees and charges of engineers, architects, attorneys and

other professionals) will be paid by CONTRACTOR. In special circumstances where a particular item of equipment is placed in continuous service before Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications or by Change Order.

12.7 Acceptance of Defective Work

If, instead of requiring correction or removal and replacement of defective Work, OWNER prefers to accept it, OWNER may do so. CONTRACTOR shall bear all direct, indirect and consequential costs attributable to OWNER'S evaluation of and determination to accept such defective Work (such costs to be approved by ENGINEER as to reasonableness and to include but not be limited to fees and charges of engineers, architects, attorneys and other professionals).

12.8 OWNER May Correct Defective Work

If CONTRACTOR fails within a reasonable time after written notice of ENGINEER to proceed to correct and to correct defective Work or to remove and replace rejected Work as required by ENGINEER in accordance with paragraph 12.5, or if CONTRACTOR fails to perform the Work in accordance with the Contract Documents, or if CONTRACTOR fails to comply with any other provision of the Contract Documents, OWNER may, after seven days' written notice to CONTRACTOR, correct and remedy any such deficiency. In exercising the rights and remedies under this paragraph OWNER shall proceed expeditiously. To the extent necessary to complete corrective and remedial action, OWNER may exclude CONTRACTOR from all or part of the site, take possession of all or part of the Work, and suspend CONTRACTOR'S services related thereto, take possession of CONTRACTOR'S tools, appliances, construction equipment and machinery at the site and incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow OWNER, OWNER'S representatives, agents and employees such access to the site as may be necessary to enable OWNER to exercise the rights and remedies under this paragraph. All direct, indirect and consequential costs of OWNER in exercising such rights and remedies will be charged against CONTRACTOR in an amount approved as to reasonableness by ENGINEER, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and OWNER shall be entitled to an appropriate decrease in the Contract Price. Such direct, indirect and consequential costs will include but not be limited to fees and charges of engineers, architects, attorneys and other professionals, all court costs and all costs of repair and replacement of work of others destroyed or damaged by correction, removal or replacement of CONTRACTOR'S defective Work. CONTRACTOR shall not be allowed an extension of the Contract Time because of any delay in performance of the Work attributable to the exercise by OWNER of OWNER'S rights and remedies hereunder.

13. PAYMENTS TO CONTRACTOR AND COMPLETION

13.1 Schedule of Values

The schedule of values established as provided in paragraph 2.8 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to ENGINEER. Progress payments on account of Unit Price Work will be based on the number of units completed.

13.2 Application for Progress Payment

At least ten days before each progress payment is scheduled (but not more often than once a month), CONTRACTOR shall submit to ENGINEER for review an Application for Payment filled out and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice or other documentation warranting that OWNER has received the materials and equipment free and clear of all liens, charges, security interests and encumbrances (which are hereinafter in these General Conditions referred to as "Liens") and evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect OWNER'S interest therein, all of which will be satisfactory to OWNER. OWNER shall, within thirty (30) calendar days of presentation to him of an approved Application for Payment, pay CONTRACTOR the amount approved by ENGINEER. Monthly progress payments shall be ninety (90) percent of the sum obtained by applying the respective bid unit prices to the approved estimated quantities of work completed by the Contractor during the preceding month. The remaining ten (10) percent will be held by the Owner, as retainage. At such time as the Engineer deems appropriate - based on the quality of work performed, progress of cleanup, and other pertinent factors - the rate of retainage, or the total amount retained, may be reduced; although, any reduction in retainage, below the ten (10) percent level, is made solely at the Engineer's discretion. All remaining retainage held will be included in the final payment to the Contractor.

13.3 CONTRACTOR'S Warranty of Title

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

13.4 Review of Applications for Progress Payment

13.4.1 Submission of Application for Payment

ENGINEER will, after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to OWNER, or return the Application to CONTRACTOR indicating in writing ENGINEER'S reasons for refusing to recommend payment. In the latter case, CONTRACTOR may make the necessary corrections and resubmit the Application.

13.4.2 ENGINEER'S Recommendation

ENGINEER may refuse to recommend the whole or any part of any payment, if, in ENGINEER'S opinion, it would be incorrect to make such representations to OWNER. ENGINEER may also refuse to recommend any such payment, or, because of subsequently discovered evidence or the results of subsequent inspections or tests, nullify any such payment previously recommended, to such extent as may be necessary in ENGINEER'S opinion to protect OWNER from loss because:

13.4.2.1 the Work is defective, or completed Work has been damaged requiring correction or replacement;

13.4.2.2 the Contract Price has been reduced by Written Amendment or Change Order;

13.4.2.3 OWNER has been required to correct defective Work or complete Work in accordance with paragraph 12.8; or

13.4.2.4 of ENGINEER'S actual knowledge of the occurrence of any of the events enumerated in paragraphs 14.2.1 through 14.2.9 inclusive.

13.5 Partial Utilization

OWNER at any time may request CONTRACTOR in writing to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and has been completed. If CONTRACTOR agrees, CONTRACTOR will certify to OWNER that said part of the Work is complete and request that a Certificate of Completion be issued for that part of the Work.

13.6 Final Inspection

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

13.7 Final Application for Payment

After CONTRACTOR has completed all such corrections to the satisfaction of ENGINEER and delivered all maintenance and operating instructions, schedules, guarantees, Bonds, certificates of inspection, marked-up record documents (as provided in paragraph 5.14) and other documents - all as required by the Contract Documents, and after ENGINEER has indicated that the Work is acceptable (subject to the provisions of paragraph 13.10), CONTRACTOR may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied by all documentation called for in the Contract Documents, together with complete and legally effective releases or waivers (satisfactory to OWNER) of all Liens arising out of or filed in connection with the Work. In lieu thereof and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full; an affidavit of CONTRACTOR that the releases and receipts include all labor, services, material and equipment for which a Lien could be filed, and that all payrolls, material and equipment bills, and other indebtedness connected with the Work for which OWNER or OWNER'S property might in any way be responsible, have been paid or otherwise satisfied; and consent of the surety, if any, to final payment. If any Subcontractor or Supplier fails to furnish a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to OWNER to indemnify OWNER against any Lien.

13.8 Final Payment and Acceptance

13.8.1 ENGINEER'S Approval

If, on the basis of ENGINEER'S observation of the Work during construction and final inspection, and ENGINEER'S review of the final Application for Payment and accompanying documentation - all as required by the Contract Documents, ENGINEER is satisfied that the Work has been completed and CONTRACTOR'S other obligations under the Contract Documents have been fulfilled, ENGINEER will, after receipt of the final Application for Payment, indicate in writing ENGINEER'S recommendation of payment and present the Application to OWNER for payment. Thereupon ENGINEER will give written notice to OWNER and CONTRACTOR that the Work is acceptable, subject to the provisions of paragraph 13.10. Otherwise, ENGINEER will return the Application to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application.

13.8.2 Delay in Completion of Work

If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed, OWNER shall, upon receipt of CONTRACTOR'S final Application for Payment and recommendation of ENGINEER, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by OWNER for Work not fully completed or corrected is

less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph 10 of Part II, Information for Bidders, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to ENGINEER with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

13.9 CONTRACTOR'S Continuing Obligation

CONTRACTOR'S obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. Neither recommendation of any progress or final payment by ENGINEER, nor the issuance of a certificate of Completion, nor any payment by OWNER to CONTRACTOR under the Contract Documents, nor any use or occupancy of the Work or any part thereof by OWNER, nor any act of acceptance by OWNER nor any failure to do so, nor any review and approval of a Shop Drawing or sample submission, nor any correction of defective Work by OWNER will constitute an acceptance of Work not in accordance with the Contract Documents or a release of CONTRACTOR'S obligation to perform the Work in accordance with the Contract Documents (except as provided in paragraph 13.10).

13.10 Waiver of Claims

The making and acceptance of final payment will constitute:

13.10.1 a waiver of all claims by OWNER against CONTRACTOR, except claims arising from unsettled Liens, from defective Work appearing after final inspection or from failure to comply with the Contract Documents or the terms of any special guarantees specified therein; however, it will not constitute a waiver by OWNER of any rights in respect of CONTRACTOR'S continuing obligations under the Contract Documents; and

13.10.2 a waiver of all claims by CONTRACTOR against OWNER other than those previously made in writing and still unsettled.

14. SUSPENSION OF WORK AND TERMINATION

14.1 OWNER May Suspend Work

OWNER may, at any time and without cause, suspend the Work or any portion thereof for a period of not more than ninety days by notice in writing to CONTRACTOR and ENGINEER which will fix the date on which Work will be resumed. CONTRACTOR shall resume the Work on the date so fixed. CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension if CONTRACTOR makes an approved claim therefor as provided in Articles 10 and 11.

14.2 OWNER May Terminate

The OWNER may terminate the Work upon the occurrence of any one or more of the following events:

14.2.1 if CONTRACTOR commences a voluntary case under any chapter of the Bankruptcy Code (Title 11, United States Code), as now or hereafter in effect, or if CONTRACTOR takes any equivalent or similar action by filing a petition or otherwise under any other federal or state law in effect at such time relating to the bankruptcy or insolvency;

14.2.2 if a petition is filed against CONTRACTOR under any chapter of the Bankruptcy Code as now or hereafter in effect at the time of filing, or if a petition is filed seeking any such equivalent or similar relief against CONTRACTOR under any other federal or state law in effect at the time relating to bankruptcy or insolvency;

14.2.3 if CONTRACTOR makes a general assignment for the benefit of creditors;

14.2.4 if a trustee, receiver, custodian or agent of CONTRACTOR is appointed under applicable law or under contract, whose appointment or authority to take charge of property of CONTRACTOR is for the purpose of enforcing a Lien against such property or for the purpose of general administration of such property for the benefit of CONTRACTOR'S creditors;

14.2.5 if CONTRACTOR admits in writing an inability to pay its debts generally as they become due;

14.2.6 if CONTRACTOR persistently fails to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under paragraph 2.8 as revised from time to time);

14.2.7 if CONTRACTOR disregards Laws or Regulations of any public body having jurisdiction;

14.2.8 if CONTRACTOR disregards the authority of ENGINEER, or

14.2.9 if CONTRACTOR otherwise violates in any substantial way any provisions of the Contract Documents;

OWNER may, after giving CONTRACTOR (and the surety) seven days' written notice and to the extent permitted by Laws and Regulations, terminate the services of CONTRACTOR, exclude CONTRACTOR from

the site and take possession of the Work and of all CONTRACTOR'S tools, appliances, construction equipment and machinery at the site and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are stored elsewhere, and finish the Work as OWNER may deem expedient. In such case CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the direct, indirect and consequential costs of completing the Work (including but not limited to fees and charges of engineers, architects, attorneys and other professionals and court and arbitration costs) such excess will be paid to CONTRACTOR. If such costs exceed such unpaid balance, CONTRACTOR shall pay the difference to OWNER. Such costs incurred by OWNER will be approved as to reasonableness by ENGINEER and incorporated in a Change Order, but when exercising any rights or remedies under this paragraph OWNER shall not be required to obtain the lowest price for the Work performed.

14.2.10 If safety violations are observed and brought to the Contractors attention and Contractor fails to take immediate corrective measures any repeat of similar safety violations, Owner will order an immediate termination of contract. Note: it is the Contractor's responsibility to know proper safety measures as they pertain to construction and OSHA.

14.2.11 This contract may be canceled by either party thirty (30) days after delivery by canceling party of written notice of intent to cancel to the other contracting party.

14.2.12 This contract may be canceled by the Lexington-Fayette Urban County Government if it is determined that the Bidder has failed to perform under the terms of this agreement, such cancellation to be effective upon receipt of written notice of cancellation by the Bidder.

14.3 CONTRACTOR'S Services Terminated

Where CONTRACTOR'S services have been so terminated by OWNER, the termination will not affect any rights or remedies of OWNER against CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR from liability.

14.4 Payment After Termination

Upon seven days' written notice to CONTRACTOR, OWNER may, without cause and without prejudice to any other right or remedy, elect to abandon the Work and terminate the Agreement. In such case, CONTRACTOR shall be paid for all Work executed and any expense sustained plus reasonable termination expenses, which will include, but not be limited to, direct, indirect and consequential costs (including,

but not limited to, fees and charges of engineers, architects, attorneys and other professionals and court and arbitration costs).

14.5 CONTRACTOR May Stop Work or Terminate

If, through no act or fault of CONTRACTOR, the Work is suspended for a period of more than ninety days by OWNER or under an order of court or other public authority, or ENGINEER fails to act on any Application for Payment within sixty days after it is submitted, or OWNER fails for sixty days to pay CONTRACTOR any sum finally determined to be due, then CONTRACTOR may, upon seven days' written notice to OWNER and ENGINEER, terminate the Agreement and recover from OWNER payment for all Work executed and any expense sustained plus reasonable termination expenses. In addition and in lieu of terminating the Agreement, if ENGINEER has failed to act on an Application for Payment or OWNER has failed to make any payment as aforesaid, CONTRACTOR may upon seven days' written notice to OWNER and ENGINEER stop the Work until payment of all amounts then due. The provisions of this paragraph shall not relieve CONTRACTOR of the obligations under paragraph 5.16 to carry on the Work in accordance with the progress schedule and without delay during disputes and disagreements with OWNER.

15. MISCELLANEOUS

15.1 Claims for Injury or Damage

Should OWNER or CONTRACTOR suffer injury or damage to person or property because of any error, omission or act of the other party or of any of the other party's employees or agents or others for whose acts the other party is legally liable, claim will be made in writing to the other party within a reasonable time of the first observance of such injury or damage. The provisions of this paragraph 15.1 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or repose.

15.2 Non-Discrimination in Employment

The CONTRACTOR shall comply with the following requirements prohibiting discrimination:

15.2.1 That no person (as defined in KRS 344.010) shall bid on Lexington-Fayette Urban County Government construction projects, or bid to furnish materials or supplies to the Lexington-Fayette Urban County Government, if, within six months prior to the time of opening of bids, said person shall have been found, by declamatory judgment action in Fayette Circuit Court, to be presently engaging in an unlawful practice, as hereinafter defined. Such declamatory judgment action may be brought by an aggrieved individual or upon an allegation that an effort at conciliation pursuant to KRS 344.200 has been attempted and failed, by the Lexington-Fayette County Human Rights Commission.

15.2.2 That it is an unlawful practice for an employer:

15.2.2.1 to fail or refuse to hire, or to discharge any individual or otherwise to discriminate against an individual, with respect to his compensation, terms, conditions, or privileges of employment, because of such individual's race, color, religion, sex, age, or national origin; or

15.2.2.2 to limit, segregate or classify his employees in any way which would deprive or tend to deprive an individual of employment opportunities or otherwise adversely affect his status as an employee because of such individual's sex, race, color, religion, age, or national origin.

15.2.3 That it is an unlawful practice for an employer, labor organization, or joint-labor management committee controlling apprenticeship or other training or retraining, including on-the-job training programs to discriminate against an individual because of his race, color, religion, sex, age, or national origin in admission to, or employment in, any program established to provide apprenticeship or other training.

15.2.4 That a copy of this Ordinance shall be furnished all suppliers and made a part of all bid specifications.

15.2.5 This Ordinance shall take effect after it is signed, published and recorded, as required by law.

15.3 Temporary Street Closing or Blockage

The CONTRACTOR will notify the ENGINEER at least 72 hours prior to making any temporary street closing or blockage. This will permit orderly notification to all concerned public agencies. Specific details and restrictions on street closure or blockage are contained in the Special Conditions.

15.4 Percentage of Work Performed by prime CONTRACTOR

The CONTRACTOR shall perform on site, and with its own organization, Work equivalent to at least fifty (50%) percent of the total amount of Work to be performed under the Contract. This percentage may be reduced by a supplemental agreement to this Contract if, during performing the Work, the CONTRACTOR requests a reduction and the ENGINEER determines that the reduction would be to the advantage of the OWNER.

15.5 Clean-up

Cleanup shall progress, to the greatest degree practicable, throughout the course of the Work. The Work will not be considered as completed, and final payment will not be made, until the right-of-way and all ground occupied or affected by the Contractor in connection with the Work has been cleared of all rubbish, equipment,

excess materials, temporary structures, and weeds. Rubbish and all waste materials of whatever nature shall be disposed of, off of the project site, in an acceptable manner. All property, both public and private, which has been damaged in the prosecution of the Work, shall be restored in an acceptable manner. All areas shall be draining, and all drainage ways shall be left unobstructed, and in such a condition that drift will not collect or scour be induced.

15.6 General

The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto, and, in particular but without limitation, the warranties, guarantees and obligations imposed upon CONTRACTOR by paragraphs 12.1, 12.3.5, 13.3, and 15.2 and all of the rights and remedies available to OWNER and ENGINEER thereunder, are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply. All representations, warranties and guarantees made in the Contract Documents will survive final payment and termination or completion of the Agreement.

15.7 Debris Disposal

For all LFUCG projects any trash, construction demolition debris, yard waste, dirt or debris of any kind that is removed from the project site must be disposed of in accordance with local, state, and federal regulations. The disposal site or facility must be approved in advance by the LFUCG and disposal documentation is required. The Contractor will be responsible for payment of any fines associated with improper disposal of material removed from the project site.

END OF SECTION

PART V
SPECIAL CONDITIONS
INDEX

1. BLASTING

Blasting shall only be allowed with the specific written permission from the OWNER and the CONTRACTOR will be fully responsible and will be required to provide additional insurance.

Blasting is only allowed by a licensed blaster in compliance with the State of Kentucky Laws, KRS Section 351.310 – 351.340 and applicable rules and regulations issued by the Department of Mines and Minerals.

CONTRACTOR shall notify each property owner and public utility company having structures or facilities in proximity to the site of the work of the intent to use explosives. Give such notice sufficiently in advance to enable those being notified to take the necessary steps to protect their property from injury. CONTRACTOR will be liable for any and all damages and claims made as a result of his blasting operations.

CONTRACTOR shall preserve the original bearing value of rock located under proposed structure foundations from damage be blasting, by concussion from the blasting or by excessive breakage. The CONTRACTOR shall bear any increase in structure costs caused by blasting damage to rock under proposed foundations.

2. **RISK MANAGEMENT PROVISIONS**
INSURANCE AND INDEMNIFICATION

INDEMNIFICATION AND HOLD HARMLESS PROVISION

(1) It is understood and agreed by the parties that Contractor hereby assumes the entire responsibility and liability for any and all damages to persons or property caused by or resulting from or arising out of any act or omission on the part of Contractor or its employees, agents, servants, owners, principals, licensees, assigns or subcontractors of any tier (hereinafter "CONTRACTOR") under or in connection with this agreement and/or the provision of goods or services and the performance or failure to perform any work required thereby.

(2) CONTRACTOR shall indemnify, save, hold harmless and defend the Lexington-Fayette Urban County Government and its elected and appointed officials, employees, agents, volunteers, and successors in interest (hereinafter "LFUCG") from and against all liability, damages, and losses, including but not limited to, demands, claims, obligations, causes of action, judgments, penalties, fines, liens, costs, expenses, interest, defense costs and reasonable attorney's fees that are in any way incidental to or connected with, or that arise or are alleged to have arisen, directly or indirectly, from or by CONTRACTOR's performance or breach of the agreement and/or the provision of goods or services provided that: (a) it is attributable to personal injury, bodily injury, sickness, or death, or to injury to or destruction of property (including the loss of use resulting therefrom), or to or from the negligent acts, errors or omissions or willful misconduct of the CONTRACTOR; and (b) not caused solely by the active negligence or willful misconduct of LFUCG.

(3) In the event LFUCG is alleged to be liable based upon the above, CONTRACTOR shall defend such allegations and shall bear all costs, fees and expenses of such defense, including but not limited to, all reasonable attorneys' fees and expenses, court costs, and expert witness fees and expenses, using attorneys approved in writing by LFUCG, which approval shall not be unreasonably withheld.

(4) These provisions shall in no way be limited by any financial responsibility or insurance requirements, and shall survive the termination of this agreement.

(5) The work and services performed hereunder involve a CONSENT DECREE as further explained in Part 1-Advertisement for Bids, provision 13. These provisions are incorporated herein by reference as if expressly stated.

(6) LFUCG is a political subdivision of the Commonwealth of Kentucky. CONTRACTOR acknowledges and agrees that LFUCG is unable to provide indemnity or otherwise save, hold harmless, or defend the CONTRACTOR in any manner.

FINANCIAL RESPONSIBILITY

BIDDER/CONTRACTOR understands and agrees that it shall, prior to final acceptance of its bid and the commencement of any work, demonstrate the ability to assure compliance with the above Indemnity provisions and these other risk management provisions.

INSURANCE REQUIREMENTS

YOUR ATTENTION IS DIRECTED TO THE INSURANCE REQUIREMENTS BELOW, AAND YOU MAY NEED TO CONFER WITH YOUR INSURANCE AGENTS, BROKERS, OR CARRIERS TO DETERMINE IN ADVANCE OF SUBMISSION OF A RESPONSE THE AVAILABILITY OF THE INSURANCE COVERAGES AND ENDORSEMENTS REQUIRED HEREIN. IF YOU FAIL TO COMPLY WITH THE INSURANCE REQUIREMENTS BELOW, YOU MAY BE DISQUALIFIED FROM AWARD OF THE CONTRACT.

Required Insurance Coverage

BIDDER/CONTRACTOR shall procure and maintain for the duration of this contract the following or equivalent insurance policies at no less than the limits shown below and cause its subcontractors to maintain similar insurance with limits acceptable to LFUCG in order to protect LFUCG against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by CONTRACTOR. The cost of such insurance shall be included in any bid:

Coverage	**Limits**
General Liability aggregate (Insurance Services Office Form CG 00 01)	$1 million per occurrence, $2 million or $2 million combined single limit
Commercial Automobile Liability occurrence (Insurance Services Office Form CA 0001)	combined single, $1 million per
Worker's Compensation	Statutory
Employer's Liability	$500,000.00

The policies above shall contain the following conditions:

a. All Certificates of Insurance forms used by the insurance carrier shall be properly filed and approved by the Department of Insurance for the Commonwealth of Kentucky (DOI). LFUCG shall be named as an additional insured in the General Liability Policy and Commercial Automobile Liability Policy using the Kentucky DOI approved forms.

b. The General Liability Policy shall be primary to any insurance or self-insurance retained by LFUCG.

c. The General Liability Policy shall include a Products and Completed Operations endorsement or Premises and Operations Liability endorsement unless it is deemed not to apply by LFUCG.

d. The General Liability Policy shall include a Pollution liability and/or Environmental Casualty endorsement unless it is deemed not to apply by LFUCG.

e. LFUCG shall be provided at least 30 days advance written notice via certified mail,

return receipt requested, in the event any of the required policies are canceled or non-renewed.

f. Said coverage shall be written by insurers acceptable to LFUCG and shall be in a form acceptable to LFUCG. Insurance placed with insurers with a rating classification of no less than Excellent (A or A-) and a financial size category of no less than VIII, as defined by the most current Best's Key Rating Guide shall be deemed automatically acceptable.

g. Owner requests that the Bidder obtain an Umbrella Liability endorsement to the CGL policy for a limit of liability of $_____ and that this CGL policy endorsement be renewed for one (1) year after completion of this project.

Renewals

After insurance has been approved by LFUCG, evidence of renewal of an expiring policy must be submitted to LFUCG and may be submitted on a manually signed renewal endorsement form. If the policy or carrier has changed, however, new evidence of coverage must be submitted in accordance with these Insurance Requirements.

Deductibles and Self-Insured Programs

IF YOU INTEND TO SUBMIT A SELF-INSURANCE PLAN IT MUST BE FORWARDED TO LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT, DIVISION OF RISK MANAGEMENT, 200 EAST MAIN STREET, LEXINGTON, KENTUCKY 40507 NO LATER THAN A MINIMUM OF FIVE (5) WORKING DAYS PRIOR TO THE RESPONSE DATE. Self-insurance programs, deductibles, and self-insured retentions in insurance policies are subject to separate approval by Lexington-Fayette Urban County Government's Division of Risk Management, upon review of evidence of BIDDER/CONTRACTOR's financial capacity to respond to claims. Any such programs or retentions must provide LFUCG with at least the same protection from liability and defense of suits as would be afforded by first-dollar insurance coverage. If BIDDER/CONTRACTOR satisfies any portion of the insurance requirements through deductibles, self-insurance programs, or self-insured retentions, BIDDER/CONTRACTOR agrees to provide Lexington-Fayette Urban County Government, Division of Risk Management, the following data prior to the final acceptance of bid and the commencement of any work:

a. Latest audited financial statement, including auditor's notes.

b. Any records of any self-insured trust fund plan or policy and related accounting statements.

c. Actuarial funding reports or retained losses.

d. Risk Management Manual or a description of the self-insurance and risk management program.

e. A claim loss run summary for the previous five (5) years.

f. Self-Insured Associations will be considered.

Safety and Loss Control

CONTRACTOR shall comply with all applicable federal, state, and local safety standards related to the performance of its works or services under this Agreement and take necessary action to protect the life, health and safety and property of all of its personnel on the job site, the public, and LFUCG.

Verification of Coverage

BIDDER/CONTRACTOR agrees to furnish LFUCG with all applicable Certificates of Insurance signed by a person authorized by the insurer to bind coverage on its behalf prior to final award, and if requested, shall provide LFUCG copies of all insurance policies, including all endorsements.

Right to Review, Audit and Inspect

CONTRACTOR understands and agrees that LFUCG may review, audit and inspect any and all of its records and operations to insure compliance with these Insurance Requirements.

DEFAULT

BIDDER/CONTRACTOR understands and agrees that the failure to comply with any of these insurance, safety, or loss control provisions shall constitute default and that LFUCG may elect at its option any single remedy or penalty or any combination of remedies and penalties, as available, including but not limited to purchasing insurance and charging BIDDER/CONTRACTOR for any such insurance premiums purchased, or suspending or terminating the work.

3. **WAGE SCALES** – No Wage Rates

END OF SECTION

PART VI

CONTRACT AGREEMENT

INDEX

PART VI

CONTRACT AGREEMENT

THIS AGREEMENT, made on the _____ day of _____, 20____, by and between **Lexington-Fayette Urban County Government**, acting herein called "OWNER" and **Smith Contractors, Inc.**, doing business as *(an individual) (a partnership) (a corporation) located in the City of Lawrenceburg, County of Anderson, and State of Kentucky, hereinafter called "CONTRACTOR."

WITNESSETH: That the CONTRACTOR and the OWNER in consideration of One Million Five Hundred Twenty Six Thousand Dollars and Zero Cents ($1,526,000.00) quoted in the proposal by the CONTRACTOR, dated October 22, 2020, hereby agree to commence and complete the construction described as follows:

1. SCOPE OF WORK

The CONTRACTOR shall furnish all the materials, supplies, machinery, equipment, tools, superintendence, labor, insurance, and other accessories and services necessary to complete the said project in accordance with the conditions and prices stated in the Proposal, the General Conditions, and the Special Conditions of the Contract, the Specifications and Contract Documents therefore as prepared by Tetra Tech for the **WEST HICKMAN BPR IMPROVEMENTS**

2. TIME OF COMPLETION AND LIQUIDATED DAMAGES

The time period estimated and authorized by the OWNER for the proper execution of the Work by the Contract, in full, is hereby fixed as **TIME OF COMPLETION (180)** calendar days. The time shall begin ten (10) days after the CONTRACTOR is given the Notice to Proceed with the Work. **TIME IS OF THE ESSENCE IN THE PERFORMANCE OF THIS AGREEMENT AND CONTRACTOR SHALL BE LIABLE AND RESPONSIBLE FOR DAMAGES SUFFERED BY OWNER AS A RESULT OF THE DELAY CAUSED BY CONTRACTOR.**

Should the contractor fail or refuse to complete the work within the time specified in his Proposal and/or Contract (or extension of time granted by the owner), the Contractor shall pay liquidated damages in an amount of **$1,000.00 per day.** The amount of liquidated damages shall in no event be considered as a penalty, nor other than an amount agreed upon by the Contractor and the Owner for damages, loses, additional engineering, additional resident representation and other cost that will be sustained by the owner, if the Contractor fails to complete the work within the specified time. Liquidated damages will be applied on a rate per day for each and every calendar day (Sundays and holidays included) beyond the Contract expiration date stipulated in the Contract Documents, considering all time extension granted. **These Liquidated Damages are in addition to any other damages/fees/penalties that are incurred as a result of Consent Decree requirements.**

3. ISSUANCE OF WORK ORDERS

Notice to begin Work will be given in whole or for part of the Work as determined by the OWNER pending the availability of funds. The order of construction will be as determined by the Engineer after consultation with the CONTRACTOR and the OWNER.

4. THE CONTRACT SUM

The OWNER agrees to pay the CONTRACTOR in current funds for the performance of the Contract, as quoted in the proposal, subject to any additions and deductions, as provided therein.

5. PROGRESS PAYMENTS

The OWNER shall make payments on account of the Contract, as provided in accordance with the General Conditions, as estimated by the Engineer, less the aggregate of previous payments.

6. ACCEPTANCE AND FINAL PAYMENT

Final payment shall be due within ninety (90) days after completion of the Work, provided the Work be then fully completed and the Contract fully accepted.

Before issuance of final certificate, the CONTRACTOR shall submit evidence satisfactory to the Engineer that all payrolls, material bills, and other indebtedness connected with the Work has been paid.

If, after the Work has been substantially completed, full completion thereof is materially delayed through no fault of the CONTRACTOR, and the ENGINEER so certifies, the OWNER shall upon certificate of the ENGINEER, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

7. THE CONTRACT DOCUMENTS

The Advertisement for Bids, Information for Bidders, the General Conditions, Performance and Payment Bonds, Contract Agreement, Special Conditions, Technical Specifications, any and all Addenda, and Proposal, and Plan Drawings form the Contract, and they are fully a part of the Contract as if hereto attached or herein repeated.

8. EXTRA WORK

The OWNER, without invalidating the Contract, may order extra work or make changes by altering, adding to or deducting from the Work, the Contract Sum being adjusted accordingly. All such Work shall be executed and paid for in accordance with the General Conditions, which is a part of this Contract.

9. CONSENT DECREE REQUIREMENTS

9.1 OWNER, the United States Environmental Protection Agency, and the Commonwealth of Kentucky have entered into a Consent Decree in a case styled *United States, et al. v. Lexington-Fayette Urban County Government*, United States District Court for the Eastern District of Kentucky, Case No. 5:06-CV-00386 ("CONSENT DECREE"), that requires OWNER to complete numerous projects related to its sanitary sewer system and stormwater management program within specific periods of time.

9.2 TIME IS OF THE ESSENCE IN THE PERFORMANCE OF THIS AGREEMENT. CONTRACTOR is aware that the OWNER is subject to penalties for non-compliance with the CONSENT DECREE deadlines. The CONTRACTOR shall be specifically liable and responsible for payment of any and all penalties, fines, or fees assessed against or incurred by the OWNER as a result of any delay in, or non-performance of, any of the CONTRACTOR's obligations or responsibilities under this Contract, or for any other damages suffered by OWNER as a result of such delay or non-performance. This shall specifically include, but shall not be limited to, any penalty, fine, fee, or assessment against the OWNER by the U.S. Department of Justice, U.S. Environmental Protection Agency, and/or the Kentucky Energy and Environment Cabinet related to the Consent Decree.

9.3 The provisions of this Section and the various rates of compensation for CONTRACTOR's services provided for elsewhere in this Agreement have been agreed to in anticipation of the orderly and continuous progress of the PROJECT through completion.

9.4 If delays result by reason of acts of the OWNER or approving agencies, which are beyond the control of the CONTRACTOR, an extension of time for such delay will be considered. If delays occur, the CONTRACTOR shall immediately notify the OWNER, and within five (5) business days from the date of the delay apply in writing to the OWNER for an extension of time for such reasonable period as may be mutually agreed upon between the parties, and if approved, the PROJECT schedule shall be revised to reflect the extension. Such extension of time to the completion date shall in no way be construed to operate as a waiver on the part of the OWNER of any of its rights in the Agreement. Section 9.6 of this Agreement (Disputes) shall apply in the event the parties cannot agree upon an extension of time.

In the event that the overall delay resulting from the above-described causes is sufficient to prevent complete performance of the Agreement within six (6) months of the time specified herein, the fees to be paid to CONTRACTOR shall be subject to adjustment as agreed upon by the parties. Section 9.6 of this Agreement shall apply in the event the parties cannot agree upon an adjustment of fee.

9.5 If delays result solely by reason of acts of the CONTRACTOR, the CONTRACTOR shall be held liable for any financial penalties incurred by the OWNER as a result of the delay, including but not limited to those assessed pursuant to the CONSENT

DECREE as provided in Section 9.2, above. Section 9.6 of this Agreement (Disputes), shall apply in the event the parties cannot mutually agree upon the cause(s) associated with delays in completing project deliverables. The CONTRACTOR must immediately notify the OWNER in the event of such delay, and provide the OWNER a written action plan within five (5) business days on how it will attempt to resolve the delay.

9.6 DISPUTES

Except as otherwise provided in this Agreement, any dispute hereunder may be resolved by agreement of the OWNER's Agent (Charles H. Martin, P.E., Director of Water Quality) and the CONTRACTOR. In the absence of such an agreement, the dispute shall be submitted to the OWNER's Commissioner, Department of Environmental Quality, whose decision shall be final and conclusive unless determined by a court of competent jurisdiction to have been fraudulent, capricious, arbitrary, or so grossly erroneous as necessarily to imply bad faith. Pending a final decision of a dispute hereunder, the CONTRACTOR shall proceed diligently with the performance of the Agreement in accordance with the directions of the OWNER.

10. THE FOLLOWING IS AN ENUMERATION OF THE SPECIFICATIONS AND DRAWINGS (CONTRACT DOCUMENTS):

SPECIFICATIONS

SECTION NO.	TITLE	PAGES
I	Advertisement for Bids	AB 1 thru 5
II	Information for Bidders	IB 1 thru 9
III	Form of Proposal	P 1 thru 36
IV	General Conditions	GC 1 thru 50
V	Special Conditions	SC 1 thru 6
VI	Contract Agreement	CA 1 thru 6
VII	Performance and Payment Bonds	PB 1 thru 7
VIII	Addenda	AD 1 thru 2
	Technical Specifications	DIV 1 thru APP A

IN WITNESSETH WHEREOF, the parties hereto have executed this Contract as of the date and year above written.

(Seal)

Lexington-Fayette Urban County Government.
Lexington, Kentucky
(Owner)

ATTEST:

Deputy Mackenzie Sommers
Clerk of the Urban County Council

BY: Linda Gorton
MAYOR

Muriel Nelson
(Witness)

Mayor Linda Gorton
(Title)

(Seal)

Smith Contractors, Inc.
(Contractor)

Lon Smith
(Secretary)*

BY:

President
(Title)

Linda Duffey
(Witness)

PO Box 480
Lawrenceburg, Ky 40342
(Address and Zip Code)

IMPORTANT: *Strike out any non-applicable terms.

Secretary of the Owner should attest. If the CONTRACTOR is corporation, Secretary should attest. Give proper title of each person-executing Contract.

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 11/17/2020

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER Arthur J. Gallagher Risk Management Services, Inc 1601 Alliant Avenue Louisville KY 40299	CONTACT NAME: PHONE (A/C, No, Ext): 502-415-7041 FAX (A/C, No): 502-415-7001 E-MAIL ADDRESS: Beth_Jost@ajg.com	
	INSURER(S) AFFORDING COVERAGE	NAIC #
	INSURER A : Amerisure Mutual Insurance Company	23396
INSURED Smith Contractors, Inc. PO Box 480 Lawrenceburg KY 40342	INSURER B : Kentucky AGC Self Insurors Fund	
	INSURER C : Hanover American Insurance Company	36064
	INSURER D :	
	INSURER E :	
	INSURER F :	

COVERAGES **CERTIFICATE NUMBER:** 1036492294 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY	Y		CPP20260881901	1/1/2020	1/1/2021	EACH OCCURRENCE	$ 1,000,000
	CLAIMS-MADE [X] OCCUR						DAMAGE TO RENTED PREMISES (Ea occurrence)	$ 100,000
							MED EXP (Any one person)	$ 5,000
							PERSONAL & ADV INJURY	$ 1,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$ 2,000,000
	POLICY [X] PRO-JECT [ ] LOC						PRODUCTS - COMP/OP AGG	$ 2,000,000
	OTHER:							$
A	AUTOMOBILE LIABILITY			CA20260871702	1/1/2020	1/1/2021	COMBINED SINGLE LIMIT (Ea accident)	$ 1,000,000
	X ANY AUTO						BODILY INJURY (Per person)	$
	OWNED AUTOS ONLY / SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	HIRED AUTOS ONLY / NON-OWNED AUTOS ONLY						PROPERTY DAMAGE (Per accident)	$
								$
A	X UMBRELLA LIAB [X] OCCUR			CU20260891502	1/1/2020	1/1/2021	EACH OCCURRENCE	$ 10,000,000
	EXCESS LIAB CLAIMS-MADE						AGGREGATE	$ 10,000,000
	DED [X] RETENTION $ 0							$
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y/N [N]	N/A		7132	1/1/2020	1/1/2021	X PER STATUTE [ ] OTH-ER	
	ANYPROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH)						E.L. EACH ACCIDENT	$ 4,000,000
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$ 4,000,000
							E.L. DISEASE - POLICY LIMIT	$ 4,000,000
C	Blanket Builders Risk			IHW A855434	6/1/2020	6/1/2021	BR Limit	21,500,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

RE: West Hickman BPR Improvements

Lexington Fayette Urban County Government is Additional Insured regarding the General Liability on a Primary and Non-Contributory basis. A 30 day written notice applies except for nonpayment of premium.

CERTIFICATE HOLDER

Lexington Fayette Urban County Government
200 East Main Street
Lexington KY 40507
USA

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

CONTRACTOR'S BLANKET ADDITIONAL INSURED ENDORSEMENT – FORM A

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

Policy Number CPP202608817	**Agency Number** 0635755	**Policy Effective Date** 01/01/2020
Policy Expiration Date 01/01/2021	**Date**	**Account Number** 20016076
Named Insured SMITH CONTRACTORS INC	**Agency** GARRETT-STOTZ COMPANY	**Issuing Company** AMERISURE MUTUAL INSURANCE COMPANY

1. a. **SECTION II - WHO IS AN INSURED** is amended to add as an additional insured any person or organization:

   (1) Whom you are required to add as an additional insured on this policy under a written contract or written agreement relating to your business; or

   (2) Who is named as an additional insured under this policy on a certificate of insurance.

   b. The written contract, written agreement, or certificate of insurance must:

   (1) Require additional insured status for a time period during the term of this policy; and

   (2) Be executed prior to the "bodily injury", "property damage", or "personal and advertising injury" leading to a claim under this policy.

   c. If, however:

   (1) "Your work" began under a letter of intent or work order; and

   (2) The letter of intent or work order led to a written contract or written agreement within 30 days of beginning such work; and

   (3) Your customer's customary contracts require persons or organizations to be named as additional insureds;

   we will provide additional insured status as specified in this endorsement.

2. The insurance provided under this endorsement is limited as follows:

   a. That person or organization is an additional insured only with respect to liability caused, in whole or in part, by:

   (1) Premises you:

   (a) Own;

   (b) Rent;

   (c) Lease; or

   (d) Occupy;

   (2) Ongoing operations performed by you or on your behalf. Ongoing operations does not apply to "bodily injury" or "property damage" occurring after:

(a) All work to be performed by you or on your behalf for the additional insured(s) at the site of the covered operations is complete, including related materials, parts or equipment (other than service, maintenance or repairs); or

(b) That portion of "your work" out of which the injury or damage arises is put to its intended use by any person or organization other than another contractor working for a principal as a part of the same project.

(3) Completed operations coverage, but only if:

(a) The written contract, written agreement, or certificate of insurance requires completed operations coverage or "your work" coverage; and

(b) This coverage part provides coverage for "bodily injury" or "property damage" included within the "products-completed operations hazard".

However, the insurance afforded to such additional insured only applies to the extent permitted by law.

b. If the written contract, written agreement, or certificate of insurance:

(1) Requires "arising out of" language; or

(2) Requires you to provide additional insured coverage to that person or organization by the use of either or both of the following:

(a) Additional Insured – Owners, Lessees or Contractors – Scheduled Person Or Organization endorsement CG 20 10 10 01; or

(b) Additional Insured – Owners, Lessees or Contractors – Completed Operations endorsement CG 20 37 10 01;

then the phrase "caused, in whole or in part, by" in paragraph **2.a.** above is replaced by "arising out of".

c. If the written contract, written agreement, or certificate of insurance requires you to provide additional insured coverage to that person or organization by the use of:

(1) Additional Insured – Owners, Lessees or Contractors – Scheduled Person Or Organization endorsement CG 20 10 07 04 or CG 20 10 04 13; or

(2) Additional Insured – Owners, Lessees or Contractors – Completed Operations endorsement CG 20 37 07 04 or CG 20 37 04 13; or

(3) Both those endorsements with either of those edition dates; or

(4) Either or both of the following:

(a) Additional Insured – Owners, Lessees or Contractors – Scheduled Person Or Organization endorsement CG 20 10 without an edition date specified; or

(b) Additional Insured – Owners, Lessees or Contractors – Completed Operations endorsement CG 20 37 without an edition date specified;

then paragraph **2.a.** above applies.

d. Premises, as respects paragraph **2.a.(1)** above, include common or public areas about such premises if so required in the written contract or written agreement.

e. Additional insured status provided under paragraphs **2.a.(1)(b)** or **2.a.(1)(c)** above does not extend beyond the end of a premises lease or rental agreement.

f. The limits of insurance that apply to the additional insured are the least of those specified in the:

(1) Written contract;

(2) Written agreement;

(3) Certificate of insurance; or

(4) Declarations of this policy.

The limits of insurance are inclusive of and not in addition to the limits of insurance shown in the Declarations.

g. The insurance provided to the additional insured does not apply to "bodily injury", "property damage", or "personal and advertising injury" arising out of an architect's, engineer's, or surveyor's rendering of, or failure to render, any professional services, including but not limited to:

(1) The preparing, approving, or failing to prepare or approve:

(a) Maps;

(b) Drawings;

(c) Opinions;

(d) Reports;

(e) Surveys;

(f) Change orders;

(g) Design specifications; and

(2) Supervisory, inspection, or engineering services.

h. **SECTION IV – COMMERCIAL GENERAL LIABILITY CONDITIONS**, paragraph **4. Other Insurance** is deleted and replaced with the following:

4. Other Insurance.

Coverage provided by this endorsement is excess over any other valid and collectible insurance available to the additional insured whether:

a. Primary;

b. Excess;

c. Contingent; or

d. On any other basis;

but if the written contract, written agreement, or certificate of insurance requires primary and non-contributory coverage, this insurance will be primary and non-contributory relative to other insurance available to the additional insured which covers that person or organization as a Named Insured, and we will not share with that other insurance.

i. If the written contract, written agreement, or certificate of insurance as outlined above requires additional insured status by use of CG 20 10 11 85, then the coverage provided under this CG 70 48 endorsement does not apply except for paragraph **2.h. Other Insurance.** Additional insured status is limited to that provided by CG 20 10 11 85 shown below and paragraph **2.h. Other Insurance** shown above.

ADDITIONAL INSURED - OWNERS, LESSEES OR CONTRACTORS (FORM B)

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART.

SCHEDULE

Name of Person or Organization: Blanket Where Required by Written Contract, Agreement, or Certificate of Insurance that the terms of CG 20 10 11 85 apply

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

WHO IS AN INSURED (Section II) is amended to include as an insured the person or organization shown in the Schedule, but only with respect to liability arising out of "your work" for that insured by or for you.

CG 20 10 11 85 Copyright, Insurance Services Office, Inc., 1984

j. The insurance provided by this endorsement does not apply to any premises or work for which the person or organization is specifically listed as an additional insured on another endorsement attached to this policy.

PART VII

PERFORMANCE AND PAYMENT BONDS

1. PERFORMANCE BOND

2. PAYMENT BOND

PART VII

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that

Smith Contractors, Inc.
(Name of CONTRACTOR)

1241 Bypass North, Lawrenceburg, KY 40342
(Address of CONTRACTOR)

a Corporation, hereinafter
(Corporation, Partnership, or Individual)

called Principal, and Liberty Mutual Insurance Company
(Name of Surety)

175 Berkeley Street, Boston, MA 02116
(Address of Surety)

hereinafter called Surety, are held and firmly bound unto

LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT
200 East Main Street, Third Floor
Lexington, Kentucky 40507

hereinafter called "OWNER" in the penal sum of: One Million Five Hundred Twenty Six Thousand and 00/100---
Dollars, ($ 1,526,000), for the payment of whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, Principal by written agreement is entering into a Contract with OWNER for **West Hickman BPR Improvements** in accordance with drawings and specifications prepared by: **Tetra Tech** which Contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Principal shall promptly and faithfully perform said Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

The Surety hereby waives notice of any alteration or extension of time made by the OWNER.

Whenever, Principal shall be, and declared by OWNER to be in default under the Contract, the OWNER having performed OWNER'S obligations thereunder, the Surety may promptly remedy the default, or shall promptly:

(1) Complete the Contract in accordance with its terms and conditions or

(2) Obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and upon determination by Surety of the lowest responsible bidder, or if the OWNER elects, upon determination by the OWNER and Surety jointly of the lowest responsible bidder, arrange for a Contract between such bidder and OWNER, and make available as Work progresses (even though there may be a default or a succession of defaults under the Contract or Contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the Contract Price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of the Contract Price", as used in this paragraph shall mean the total amount payable by OWNER to Principal under the Contract and any amendments thereto, less the amount properly paid by OWNER to Principal.

Any suit under this bond must be instituted before the expiration of two (2) years from the date on which final payment under the Contract falls due.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the OWNER named herein or the heirs, executors, administrators or successors of OWNER.

IN WITNESS WHEREOF, this instrument is executed in 4 (number) counterparts, each one of which shall be deemed an original, this the _____ day of _____, 20____.

ATTEST:

Lou Smith
(Principal) Secretary

Smith Contractors, Inc.
Principal

BY: Kenny Smith (s)

1241 Bypass North
(Address)
Lawrenceburg, KY 40342

Sandra Tuffley
Witness as to Principal

P.O. Box 480
(Address)
Lawrenceburg, Ky 40342

Liberty Mutual Insurance Company
Surety

BY: Andrew G Windhorst
Attorney-in-Fact Andrew G. Windhorst, Jr.

1601 Alliant Avenue
(Address)
Louisville, KY 40299

ATTEST:

Elizabeth Dawson
(Surety) Secretary Elizabeth Dawson

(SEAL)

Diane L Phelps
Witness as to Surety Diane L. Phelps

1601 Alliant Avenue
(Address)
Louisville, KY 40299

TITLE: Attorney-in-Fact
Surety

BY: Andrew G. Windhorst, Jr.

TITLE: Attorney-in-Fact

NOTE: The number of executed counterparts of the bond shall coincide with the number of executed counterparts of the Contract.

PART VII

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENT: that

Smith Contractors, Inc.
(Name of Contractor)

1241 Bypass North, Lawrenceburg, KY 40342
(Address of Contractor)

a Corporation, hereinafter
(Corporation, Partnership or Individual)

called Principal, and Liberty Mutual Insurance Company
(Name of Surety)

175 Berkeley Street, Boston, MA 02116
(Address of Surety)

hereinafter called Surety, are held and firmly bound unto:

LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT
200 East Main Street, Third Floor
Lexington, Kentucky 40507

Obligee, hereinafter called OWNER, for the use and benefit of claimants as hereinafter defined, in the amount of One Million Five Hundred Twenty Six Thousand and 00/100--- Dollars ($ 1,526,000) the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, Principal by written agreement is entering into a Contract with OWNER for **West Hickman BPR Improvements** in accordance with drawings and specifications prepared by: **Tetra Tech** which Contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Principal shall promptly make payment to all claimants as hereinafter defined for all labor and material used or reasonably required for use in the performance of the Contract, then this obligation shall be void; otherwise it shall remain in full force and effect, subject, however, to the following conditions.

1. A claimant is defined as one having a direct contract with the Principal or with a Subcontractor of the Principal for labor, material, or both, used or reasonably required for use in the performance of the Contract, labor and material being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment directly applicable to the Contract.

2. The above named Principal and Surety hereby jointly and severally agree with the OWNER that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work or labor was done or performed, or materials were furnished by such claimant, may sue on this bond for the use of such claimant, prosecute the suit to final judgment for such sum or sums as may be justly due claimant, and have execution thereon. The OWNER shall not be liable for the payment of any costs or expenses of any such suit.

3. No suit or action shall be commenced hereunder by any claimant:

(a) Unless claimant, other than one having a direct contract with the Principal, shall have given written notice to any two of the following: The Principal, the OWNER, or the Surety above named, within ninety (90) days after such claimant did or performed the last of the Work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the Work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the Principal, OWNER, or Surety, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer.

(b) After the expiration of one (1) year following the date on which Principal ceased Work on said Contract, it being understood, however, that if any limitation embodied in this 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.

(c) Other than in a state court of competent jurisdiction in and for the county or other political subdivision of the state in which the project, or any part thereof, is situated, or in the United States District Court for the district in which the project, or any part thereof, is situated, and not elsewhere.

4. The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payment by Surety of mechanics' liens which may be filed of record against aid improvement, whether or not claim for the amount of such lien be presented under and against this bond.

IN WITNESS WHEREOF, this instrument is executed in 4 (number) counterparts, each one of which shall be deemed an original, this the _____ day of _____, 20____.

ATTEST:

(Principal) Secretary

Smith Contractors, Inc.
(Principal)

(SEAL)

BY: _____(s)
1241 Bypass North
(Address)
Lawrenceburg, KY 40342

(Witness to Principal)
P.O. Box 480
(Address)
Lawrenceburg, Ky 40342

Liberty Mutual Insurance Company
(Surety)

ATTEST:

BY: _____
(Attorney-in-Fact) Andrew G. Windhorst, Jr.

(Surety) Secretary Elizabeth Dawson

(SEAL)

Witness as to Surety Diane L. Phelps
1601 Alliant Avenue
(Address)
Louisville, KY 40299

1601 Alliant Avenue
(Address)
Louisville, KY 40299

NOTE: The number of executed counterparts of the bond shall coincide with the number of executed counterparts of the Contract.

END OF SECTION

This Power of Attorney limits the acts of those named herein, and they have no authority to bind the Company except in the manner and to the extent herein stated.

Liberty Mutual Insurance Company
The Ohio Casualty Insurance Company
West American Insurance Company

Certificate No: 8203893 - 969222

POWER OF ATTORNEY

KNOWN ALL PERSONS BY THESE PRESENTS: That The Ohio Casualty Insurance Company is a corporation duly organized under the laws of the State of New Hampshire, that Liberty Mutual Insurance Company is a corporation duly organized under the laws of the State of Massachusetts, and West American Insurance Company is a corporation duly organized under the laws of the State of Indiana (herein collectively called the "Companies"), pursuant to and by authority herein set forth, does hereby name, constitute and appoint, Andrea Cortes, Andrew G. Windhorst, Jr., Christopher E. von Allmen, Diane L. Phelps, Elizabeth Dawson, Ryan P. Mitchell, Thomas J. Mitchell, William A. Kantlehner, III, William A. Kantlehner, IV

all of the city of Louisville state of KY each individually if there be more than one named, its true and lawful attorney-in-fact to make, execute, seal, acknowledge and deliver, for and on its behalf as surety and as its act and deed, any and all undertakings, bonds, recognizances and other surety obligations, in pursuance of these presents and shall be as binding upon the Companies as if they have been duly signed by the president and attested by the secretary of the Companies in their own proper persons.

IN WITNESS WHEREOF, this Power of Attorney has been subscribed by an authorized officer or official of the Companies and the corporate seals of the Companies have been affixed thereto this 23rd day of June, 2020.

Liberty Mutual Insurance Company
The Ohio Casualty Insurance Company
West American Insurance Company

By: _____
David M. Carey, Assistant Secretary

State of PENNSYLVANIA
County of MONTGOMERY ss

On this 23rd day of June, 2020 before me personally appeared David M. Carey, who acknowledged himself to be the Assistant Secretary of Liberty Mutual Insurance Company, The Ohio Casualty Company, and West American Insurance Company, and that he, as such, being authorized so to do, execute the foregoing instrument for the purposes therein contained by signing on behalf of the corporations by himself as a duly authorized officer.

IN WITNESS WHEREOF, I have hereunto subscribed my name and affixed my notarial seal at King of Prussia, Pennsylvania, on the day and year first above written.

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Teresa Pastella, Notary Public
Upper Merion Twp., Montgomery County
My Commission Expires March 28, 2021
Member, Pennsylvania Association of Notaries

By: _____
Teresa Pastella, Notary Public

This Power of Attorney is made and executed pursuant to and by authority of the following By-laws and Authorizations of The Ohio Casualty Insurance Company, Liberty Mutual Insurance Company, and West American Insurance Company which resolutions are now in full force and effect reading as follows:

ARTICLE IV – OFFICERS: Section 12. Power of Attorney.
Any officer or other official of the Corporation authorized for that purpose in writing by the Chairman or the President, and subject to such limitation as the Chairman or the President may prescribe, shall appoint such attorneys-in-fact, as may be necessary to act in behalf of the Corporation to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations. Such attorneys-in-fact, subject to the limitations set forth in their respective powers of attorney, shall have full power to bind the Corporation by their signature and execution of any such instruments and to attach thereto the seal of the Corporation. When so executed, such instruments shall be as binding as if signed by the President and attested to by the Secretary. Any power or authority granted to any representative or attorney-in-fact under the provisions of this article may be revoked at any time by the Board, the Chairman, the President or by the officer or officers granting such power or authority.

ARTICLE XIII – Execution of Contracts: Section 5. Surety Bonds and Undertakings.
Any officer of the Company authorized for that purpose in writing by the chairman or the president, and subject to such limitations as the chairman or the president may prescribe, shall appoint such attorneys-in-fact, as may be necessary to act in behalf of the Company to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations. Such attorneys-in-fact subject to the limitations set forth in their respective powers of attorney, shall have full power to bind the Company by their signature and execution of any such instruments and to attach thereto the seal of the Company. When so executed such instruments shall be as binding as if signed by the president and attested by the secretary.

Certificate of Designation – The President of the Company, acting pursuant to the Bylaws of the Company, authorizes David M. Carey, Assistant Secretary to appoint such attorneys-in-fact as may be necessary to act on behalf of the Company to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations.

Authorization – By unanimous consent of the Company's Board of Directors, the Company consents that facsimile or mechanically reproduced signature of any assistant secretary of the Company, wherever appearing upon a certified copy of any power of attorney issued by the Company in connection with surety bonds, shall be valid and binding upon the Company with the same force and effect as though manually affixed.

I, Renee C. Llewellyn, the undersigned, Assistant Secretary, The Ohio Casualty Insurance Company, Liberty Mutual Insurance Company, and West American Insurance Company do hereby certify that the original power of attorney of which the foregoing is a full, true and correct copy of the Power of Attorney executed by said Companies, is in full force and effect and has not been revoked.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the seals of said Companies this _____ day of _____, 2020.

By: _____
Renee C. Llewellyn, Assistant Secretary

Not valid for mortgage, note, loan, letter of credit, currency rate, interest rate or residual value guarantees.

To confirm the validity of this Power of Attorney call 1-610-832-8240 between 9:00 am and 4:30 pm EST on any business day.

PART VIII

ADDENDA

All addenda issued during the bidding of the Project will be reproduced in the signed Contract Documents, on the pages following this heading sheet.

Addendum Number	Title	Date
1.	Addendum #1	October 5, 2020
2.	Addendum #2	October 15, 2020
3.		
4.		
5.		

MAYOR LINDA GORTON

LEXINGTON

TODD SLATIN
DIRECTOR
CENTRAL PURCHASING

ADDENDUM #1

Bid Number: #97-2020

Date: October 5, 2020

Subject: West Hickman BPR Improvements

Address inquiries to:
Brian Marcum
(859) 258-3320

TO ALL PROSPECTIVE SUBMITTERS:

Please be advised of the following clarifications to the above referenced bid:

See the attached sign in sheet and DBE notes from the site visit.

All questions must be received by the 4:00 PM October 8, 2020.

Plan holders can be registered at Lynn Imaging or in Ionwave.

All Bids must be submitted online in Ionwave, including all completed bid documents.

Todd Slatin, Director
Division of Central Purchasing

All other terms and conditions of the RFP and specifications are unchanged. This letter should be signed, attached to and become a part of your submittal.

COMPANY NAME: Smith Contractors, Inc.

ADDRESS: P.O. Box 480, Lawrenceburg, KY 40342

SIGNATURE OF BIDDER:

SIGN-IN SHEET

Site Visit-Meeting #Bid 97-202 West Hickman BPR Improvements

October 1, 2020 @ ~~10:00 AM~~ 11:00 AM

Representative	Company Name	DBE/MBE/WBE/ Veteran	Phone#	Email Address
Tiffany Rak	LFUCG	N/A	859-425-2406	tiffanyr@lexingtonky.gov
Jason Beck	HPT	N/A	513-340-5283	JBeck@hpthompson.com
DAN BREETZ	D+M	N	513-814-1166	dbreetz@dugan-meyers.com
Ted Wagner	D+M	N	502 7790483	twagner@dugan-meyers.com
Tom Clark	TEM GROUP, INC.	Y	502-451-0101	tclark@temgroupinc.com
Wei Zhang	ChemScan, INC	N	262-391-8306	wei@chemscan.com
Clay Gaffey	Smith Contractors	N	502-598-6449	cg2@sci82.com
Kerry Smith	SCI	N	502-839-9196	KS@sci82.com
~~Ben Williams~~	~~Judy Const~~	N	~~859 2346966~~	~~bwilliams@judyconstructionco.com~~
Jeff Courtney	Faust Electric	N/	959-6082936	faustpaul@ymail.com
RYAN GABBARD	HERRICK COMPANY, INC.	N	502-839-3484	RYANHCI@DCR.NET
Jeffrey Nickell	MAC	N/A	502-291-615	jeffreyn@macconstruction.com
STEVE BAUDENDISTEL	ACKERS ELECTRIC	N/A	859-509-6364	sbaudendistel@ackerselectric.com
Jim Worten	LFUCG-WestHickman		859-983-4861	Jworten@lexingtonky.gov
Herb Lemaster	Tetra Tech		859-223-8000	herb.lemaster@tetratech.com
Rick Bowman	DWQ			
			859-487-1411	rbowman@elec.infotech.gov

MAYOR LINDA GORTON

LEXINGTON

TODD SLATIN
DIRECTOR
CENTRAL PURCHASING

September 16, 2020

NOTICE TO CONTRACTORS

SUBJECT: MINORITY BUSINESS ENTERPRISE PROGRAM

The city of Lexington has a 10% minority and women participation goal and a 3% veteran participation goal that all contractors must make a Good Faith Effort to meet on projects. The LFUCG MWDBE participation forms must be completed and submitted with the bid response. Subcontractors utilized on contracts must be certified.

The awarded contractor for this project will be required to register in the new Diverse Business Management system, https://lexingtonky.diversitycompliance.com/ to report compliance audits.

For questions or to request a copy of the certified list of minority, women and veteran owned businesses, email Sherita Miller, MBE Liaison, smiller@lexingtonky.gov .

Thanks, Sherita

Sherita Miller

Minority Business Enterprise Liaison

Central Purchasing

859.258.3323 office
lexingtonky.gov

MAYOR LINDA GORTON

LEXINGTON

TODD SLATIN
DIRECTOR
CENTRAL PURCHASING

ADDENDUM #2

Bid Number: **#97-2020**

Date: October 15, 2020

Subject: West Hickman BPR Improvements

Address inquiries to:
Brian Marcum
brianm@lexingtonky.gov
(859) 258-3325

TO ALL PROSPECTIVE SUBMITTERS:

Please be advised of the following clarifications to the above referenced Bid:

	Questions	Answers
1	Please confirm the Owner will be responsible for draining and cleaning the existing basins to allow for the installation of the new mixers. If this work is to be performed by the Contractor, please identify the quantity of sludge\debris to be removed and the disposal location or establish a bid allowance amount for the work.	LFUCG will drain and clean the basins. The Contractor will be responsible for coordinating with the Plant Superintendent.
2	How long can the BPR influent and effluent channels be taken out of service to allow for the installation of the new sample pumps and associated piping?	These channels will be taken out of service by LFUCG for the necessary installations. The maximum amount of time that the channels can be out of service is one and a half days (1 ½ days). This work must be coordinated with the Plant Superintendent. Weather conditions can alter this time frame. If necessary, these channels may be taken out of service again after a one-week period. It is anticipated that the Contractor will have all necessary materials, accessories, and equipment on site and ready for the installation.

3	How many of the existing basins may be taken out of service at one time to allow for the installation of the new mixers?	Four (4) of the basins may be out of service at one time. Basin No. 1 and Basin No. 2 cannot be out of service at the same time. This is to be coordinated with the Plant Superintendent.
4	Please identify any costs\fees associated with Consent Decree fines in the event the construction exceeds the specified duration.	West Hickman BPR Improvements is a LFUCG Consent Decree project. Following is language from the Consent Decree with respect to stipulated penalties for failure to complete this project on schedule. For each day LFUCG fails to timely complete projects required in Section VII of the Consent Decree (compliance Requirements Relating to Sanitary Sewer System) in accordance with the schedule set forth in the Consent Decree or in an approved compliance program, LFUCG may be assessed stipulated penalties for each such project as follows: Period beyond Completion Date — Penalty per Violation per Day 1-30 days — $1,000.00 31-60 days — $1,500.00 61-120 days — $2,000.00 More than 120 days — $3,000.00 In addition, for the circumstances described below, LFUCG may be assessed stipulated penalties as specified below: (i) For any recurring SSO that occurs at a location identified on Appendix A for which a project has been identified to eliminate the Recurring SSO under a Capital Improvement Project of the Sanitary Sewer System and WWTP Remedial Measures Plan after the SSO elimination

		deadline specified for the location, $1,000 per SSO of less than 5,000 gallons, $2,000 per SSO of 5,000 gallons to 100,000 gallons, $5,000 per SSO of more than 100,000 gallons. **There are no Appendix A SSO's related to this project.** (ii) For wet weather Unpermitted Bypasses at the WWTPs, $3,000 per bypass occurring after the deadline established for eliminating such bypasses under the Sanitary Sewer System and WWTP Remedial Measures Plan. (iii) For any other violation of Section VII of this Decree, $500 per day per violation.
5	Can exterior exposed conduits be Rigid Aluminum Conduit? Chart in Specification Section 16130 Part 3.02.17 shows PVC Coated metal Conduit only.	Yes, rigid aluminum exterior will be acceptable.
6	Sheet D-19\Detail 1\Note 3, states "Heat trace and insulate all exposed chemical piping." Does this apply only to Chemical Feed Point #2? We find no indication of electrical service being included for Chemical Feed Point #1 or #2. Please clarify.	All exposed chemical piping is to be heat traced and insulated. At SP-7 use the same heat trace circuit power and extend conduit and wire to heat trace and disconnect for Chemical Feed Point No. 2. For Chemical Feed Point No. 1, provide a new 3/4" conduit and 3#12 wire to a new disconnect and heat trace system matching SP-7 system. Bring circuit from Panel NPA. Provide the same type heat trace and controller as used at SP-7. For both Chemical Feed Points, heat trace the pipe inside the vault and external to the vault. Insulate the pipe and heat trace both with closed cell 1/2" insulation inside the vault and external to the vault. Install the pipe chase for both chemical injection points at least 12" below the frost line of the area to the pipe tunnel. For the two injection points, provide temperature sensors as indicated for the SP-7 location. Provide conduit and wire to SCADA panels and terminate as directed by integrator.

7	Sheet D-1 references Sheet D-19\Detail 1 pertaining to Chemical Feed Point #2. Please provide a similar detail for Chemical Feed Point #1, as it is unclear how the piping will be installed once it exists the pipe tunnel.	Junction Box to be installed at Chemical Feed Point No. 1 and No. 2. Sheet D-19\Detail 1 applies to both with the exception that the Chemical Feed Point No. 1 Junction Box will be surface mounted on existing concrete pad and the carrier pipe will enter thru the bottom from the tunnel.
8	On Sheet D-2, Note 4, and on Sheet D-8, Note 7, include the statement to "Provide temperature switch on piping to alarm on SCADA if temperature drops below 40 degrees F." Temperature switches nor alarms appear to be included with the Intellimodus scope of supply. Chromalox E121's are indicated on Sheet E-2 (Key Note 5) and on Sheet E-8 (Key Note 1), but these appear to be thermostats, not the switches that provide the alarm signal. Sheet E-22 includes two temperature transmitters (TT-1001 and TT-1007) in the schedule, and these are also shown on Sheet E-501\Detail 6. Are these the temperature switches indicated on Sheet D-2 and Sheet D-8, and are these provided by Intellimodus? Please clarify this scope of work.	There is no temperature switch, it is to be a temperature sensor identified as TT-1001 and TT1007. The temperature will be displayed on SCADA and an alarm initiated if the temperature drops below 40 degrees F. The temperature sensors are not included in the Intellimodus scope. They are to be provided, installed and configured by this Contractor. Intellimodus will display the information and provide for alarms and alarm logic on SCADA under their current scope of work.

1. DRAWINGS

A. DRAWING D-1

Extend an additional leader and arrow from note "4x4 Chemical Containment Pull Box See Detail 1, Sheet D-19" to FEED POINT #1.

B. DRAWING D-19

Add note to Detail 1/D-19 as follows:

"Feed Point No. 2 shown. Junction Box for Feed Point No. 1 to be surface mounted on concrete slap with carrier pipe entering thru the bottom from the tunnel."

C. DRAWING E-8

Add the following note:

"9. At SP-7 use the same heat trace circuit power and extend conduit and wire to heat trace and disconnect for Chemical Feed Point No. 2. For Chemical Feed Point No. 1, provide a new 3/4" conduit and 3#12 wire to a new disconnect and heat trace system matching SP-7 system. Bring circuit from Panel NPA. Provide the same type of heat trace and controller as used at SP-7. For both Chemical Feed Points, heat trace the pipe inside the vault and external to the vault. Insulate the pipe and heat trace both with closed cell 1/2" insulation inside the vault and external to the vault. Install the pipe chase for both chemical injection points at least 12" below the frost line of the area to the pipe tunnel. For the two injection points, provide temperature sensors as indicated for the SP-7 location. Provide conduit and wire to SCADA panels and terminate as directed by integrator."

2. SPECIFICATIONS

A. SPECIFICATION SECTION 16130 – RACEWAYS

Replace Article 3.02(A)(17) with the following:

"17 Areas of use for each type of conduit:

Location	Schedule 40 PVC	Schedule 80 PVC	Aluminum	PCMC
Electrical Room – Exposed			X	X
Tunnels – Exposed			X	X
Exterior Exposed			X	X
Exterior Underground, Underslab, or In Slab			PVC Coated	
Exterior Underground Service Entrance (Primary and Sec.)		X	PVC Coated"	

MAYOR LINDA GORTON

LEXINGTON

TODD SLATIN
DIRECTOR
CENTRAL PURCHASING

Todd Slatin, Director
Division of Central Purchasing

All other terms and conditions of the Bid and specifications are unchanged.
This letter should be signed, attached to and become a part of your Bid.

COMPANY NAME: Smith Contractors, Inc.

ADDRESS: P.O. Box 480, Lawrenceburg, KY 40342

SIGNATURE OF BIDDER:

TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

DIVISION 01

GENERAL REQUIREMENTS

SECTION 01010 - SUMMARY OF WORK

PART 1 - GENERAL

1.01 REQUIREMENTS

A. The Work to be done under this Contract and in accordance with these Specifications consists of furnishing all equipment, supervision, labor, skill, material and all other items necessary for the construction of the West Hickman Biological Phosphorus Removal (BPR) Improvements Project.

B. The Contractor shall perform all work required for such construction in accordance with the Contract Documents and subject to the terms and conditions of the Contract, complete and ready for use.

C. The principal features of the Work to be performed under this Contract includes, but is not limited to:

1. The installation of new submersible mixers in the BPR Basins. This will include the removal of the existing mixers and accessories, the complete replacement and relocation of pump cable termination boxes, the extension of associated conduits, replacement of all wire, modification of existing starters with new overtemperature and leak detection relay, testing and configuration of existing BPR starters.

2. The installation of a new process analyzer system (Chemscan) including sample pumps and analyzers along with sample piping and modifications required to install the pumps and piping. Work also includes providing new pump control starters per plans and specifications, network connections, fiber and copper Ethernet, flow meters, temperature sensors, pipe heaters to prevent freezing and all associated programming, configuration, setup, testing, IP address assignments, trending reporting, for new and existing equipment, PLC's, Flex I/O, media converters, network switches, SCADA terminals, starters, controllers, media converters, patch cords, PLC panel breakers, and any and all items for a complete system.

3. The installation of new sodium aluminate feed pumps and piping and providing new pump control panels, re-connection of pumps and pump power to new control panels and complete support and testing. Work also includes , network connections, fiber and copper Ethernet, sensors, and all associated programming, configuration, setup, testing, IP address assignments, trending reporting, for new and existing equipment, PLC's, Flex I/O, media converters, network switches, starters, controllers, media converters, patch cords, and any and all items for a complete system.

4. Work includes the fabrication, installation, and testing of sample pump control station(s) and sample pump control panels, refer to E-sheets.

5. Work includes providing a new 480-volt, 3 phase, 100 amp panelboard for pump branch circuits and modifications to MCC-PG to add a new bucket and breaker to serve new panelboard.

6. Coordination of Intellimodus (systems integrator) network configuration, programming, testing, trouble shooting and full integration with Citect SCDA system.

D. The foregoing description(s) shall not be construed as a complete description of all work required.

1.02 CONTRACT DOCUMENTS

A. Work to be done is shown on the set of Drawings entitled: West Hickman BPR Improvements Project. The numbers and titles of all Drawings appear on the index sheet of the Drawings. All drawings so enumerated shall be considered an integral part of the Contract Documents as defined herein.

1.03 GENERAL ARRANGEMENT

A. Drawings indicate the extent and general arrangement of the work. If any departures from the Drawings are deemed necessary by the Contractor to accommodate the materials and equipment he proposes to furnish, details of such departures and reasons therefore shall be submitted as soon as practicable to the Engineer for approval. No such departures shall be made without the prior written approval of the Engineer. Approved changes shall be made without additional cost to the Owner for this work or related work under other Contracts of the Project.

1.04 CONSTRUCTION PERMITS, EASEMENTS AND ENCROACHMENTS

A. The Contractor shall obtain, keep current and pay all fees for any necessary construction permits from those authorities, agencies, or municipalities having jurisdiction over land areas, utilities, or structures which are located within the Contract limits and which will be occupied, encountered, used, or temporarily interrupted by the Contractor's operations unless otherwise stated. Record copies of all permits shall be furnished to the Engineer.

B. When construction permits are accompanied by regulations or requirements issued by a particular authority, agency or municipality, it shall be the Contractor's responsibility to familiarize himself and comply with such regulations or requirements as they apply to his operations on this Project.

1.05 ADDITIONAL ENGINEERING SERVICES

A. In the event that the Engineer is required to provide additional engineering services as a result of substitution of materials or equipment by the Contractor which are not "or equal", or changes by the Contractor in dimension, weight, power requirements, etc., of the equipment and accessories furnished, or if the Engineer is required to examine and evaluate any changes proposed by the Contractor for the convenience of the Contractor, then the Engineer's charges in connection with such additional services shall be charged to the Contractor by the Owner.

B. In the event that the Engineer is required to provide additional engineering services as a result of Contractor's errors, omissions, or failure to conform to the requirements of the Contract Documents, or if the Engineer is required to examine and evaluate any changes proposed by the Contractor solely for the convenience of the Contractor, then the Engineer's charges in connection with such additional services shall be charged to the Contractor by the Owner.

1.06 ADDITIONAL OWNER'S EXPENSES

A. In the event the Work of this Contract is not completed within the time set forth in the Contract or within the time to which such completion may have been extended in accordance with the Contract Documents, the additional engineering or inspection charges incurred by the Owner may be charged to the Contractor and deducted from the monies due him. Extra work or supplemental Contract work added to the original Contract, as well as extenuating circumstances beyond the control of the Contractor, will be given due consideration by the Owner before assessing engineering and inspection charges against the Contractor.

B. Unless otherwise specifically permitted, the normal time of work under this Contract is limited to 40 hours per week, Monday through Friday. Work beyond these hours will result in additional expense to the Owner. Any expenses and/or damages, including the cost of the Engineer's on-site personnel, arising from the Contractor's operations beyond the hours and days specified above shall be borne by the Contractor. Any overtime work, as defined above as 40 hours per week, will require the Contractor to reimburse the Owner for the Engineer's on-site personnel at a rate of $80.00 per hour.

C. Charges assessed to the Contractor for additional engineering and inspection costs will be determined based on actual hours charged to the job by the Engineer. Daily rates will depend on the number and classifications of employees involved, but in no case shall such charges exceed $640 per day for field personnel based on an eight-hour workday. Additional charges will apply if multiple personnel are needed or if engineering time is required as part of the work outside the contract times.

D. Charges for additional Owner's expenses shall be in addition to any liquidated damages assessed in accordance with the Contract.

1.07 TIME OF WORK

A. The normal time of work for this Contract is limited to 40 hours per week and shall generally be between the hours of **7:00 a.m. and 6:00 p.m., Monday through Friday**. The Contractor may work beyond these hours or on weekends with written approval from the Owner provided that all costs incurred by the Owner for any additional engineering shall be borne by the Contractor. The Owner shall deduct the cost of additional engineering from monies due the Contractor.

B. If it shall become imperative to perform work outside of the normal working hours the Owner and Engineer shall be informed a reasonable time in advance of the beginning of such work. Temporary lighting and all other necessary facilities for performing and inspecting the work shall be provided and maintained by the Contractor.

C. Unless otherwise specifically permitted, all work that would be subject to damage shall be stopped during inclement, stormy or freezing weather. Only such work as will not suffer injury to workmanship or materials will be permitted. Contractor shall carefully protect his work against damage or injury from the weather, and when work is permitted during freezing weather, he shall provide and maintain approved facilities for heating the materials and for protecting the finished work.

1.08 SURVEYS AND LAYOUT

A. All work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings or as directed by the Engineer. Contractor shall be responsible for confirming locations and elevations of existing site utilities, site improvements and grades. Elevations of existing ground and appurtenances are believed to be reasonably correct but are not guaranteed to be absolute and therefore are presented only as an approximation. Any error or apparent discrepancy in the data shown or omissions of data required for accurately accomplishing the stake out survey shall be referred immediately to the Engineer for interpretation or correction.

B. All survey work for construction control purposes shall be made by the Contractor at his expense. The Contractor shall provide a Licensed Surveyor as Chief of Party, competently qualified survey party, all necessary instruments, stakes, and other material to perform the work.

C. Contractor shall establish all baselines for the location of the principal component parts of the work together with a suitable number of bench marks adjacent to the work. Based upon the information provided by the Contract Drawings, the Contractor shall develop and make all

detail surveys necessary for construction, including stakes for all working points, lines and elevations.

D. Contractor shall have the responsibility to carefully preserve the bench marks, reference points and stakes, and in the case of destruction thereof by the Contractor or resulting from his negligence, the Contractor shall be charged with the expense and damage resulting therefrom and shall be responsible for any mistakes that may be caused by the unnecessary loss or disturbance of such bench marks, reference points and stakes.

E. Existing or new control points, property markers and monuments that will be or are destroyed during the normal causes of construction shall be reestablished by the Contractor and all reference ties recorded therefore shall be furnished to the Engineer. All computations necessary to establish the exact position of the work shall be made and preserved by the Contractor.

F. The Engineer may check all or any portion of the work and the Contractor shall afford all necessary assistance to the Engineer in carrying out such checks. Any necessary corrections to the work shall be immediately made by the Contractor. Such checking by the Engineer shall not relieve the Contractor of any responsibilities for the accuracy or completeness of his work.

G. At completion of the work, the Contractor shall furnish Record Drawings with survey data indicating the final layout of all constructed piping, equipment, structures and finished grades constructed or changed as part of this work.

1.09 FIRE PROTECTION

A. Contractor shall take all necessary precautions to prevent fires at or adjacent to the work and shall provide adequate facilities for extinguishing fires which do occur. Burning shall not be permitted on site.

B. When fire or explosion hazards are created in the vicinity of the work as a result of the locations of fuel tanks or similar hazardous utilities or devices, the Contractor shall immediately alert the local Fire Marshal, the Engineer, and the Owner of such tank or device. The Contractor shall exercise all safety precautions and shall comply with all instructions issued by the Fire Marshal and shall cooperate with the Owner of the tank or device to prevent the occurrence of fire or explosion.

1.10 CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, or reactant of other classification, must show approval of either the EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with all applicable rules and regulations.

1.11 FIRST AID FACILITIES AND ACCIDENTS

A. First Aid Facilities

1. The Contractor shall provide at the site such equipment and facilities as are necessary to supply first aid to any of his personnel who may be injured in connection with the work.

B. Accidents

1. The Contractor shall promptly report, in writing, to the Engineer and Owner all accidents whatsoever out of, or in connection with, the performance of the work, whether on or adjacent to the site, which cause death, personal injury or property damage, giving full details and statements of witnesses.

2. If death, serious injuries, or serious damages are caused, the accident shall be reported immediately by telephone or messenger to both the Owner and the Engineer.

3. If any claim is made by anyone against the Contractor or a Subcontractor on account of any accidents, the Contractor shall promptly report the facts, in writing, to the Engineer and Owner, giving full details of the claim.

1.12 ULTIMATE DISPOSITION OF CLAIMS BY ONE CONTRACTOR ARISING FROM ALLEGED DAMAGE BY ANOTHER CONTRACTOR

A. During the progress of the Work, other Contractors may be engaged in performing other work or may be awarded other Contracts for additional work on this project. In that event, the Contractor shall coordinate the work to be done hereunder with the work of such other Contractors and the Contractor shall fully cooperate with such other Contractors and carefully fit its own work to that provided under other Contracts as may be directed by the Engineer. The Contractor shall not commit or permit any act which will interfere with the performance of work by any other Contractor.

B. If the Engineer shall determine that the Contractor is failing to coordinate his work with the work of the other Contractors as the Engineer directed, then the Owner shall have the right to withhold any payments otherwise due hereunder until the Contractor completely complies with the Engineer's directions.

C. If the Contractor notifies the Engineer in writing that another Contractor is failing to coordinate his work with the work of this Contract as directed, the Engineer will promptly investigate the charge. If the Engineer finds it to be true, he will promptly issue such directions to the other Contractor with respect thereto as the situation may require. The Owner, the Engineer, nor any of their agents shall not, however, be liable for any damages suffered by the Contractor by reason of the other Contractor's failure to promptly comply with the directions so issued by the Engineer, or by reason of another Contractor's default in performance, it being understood that the Owner does not guarantee the responsibility or continued efficiency of any Contractor.

D. The Contractor shall indemnify and hold the Owner and the Engineer harmless from any and all claims of judgments for damages and from costs and expenses to which the Owner may be subjected or which it may suffer or incur by reason of the Contractor's failure to promptly comply with the Engineer's directions.

E. Should the Contractor sustain any damage through any act or omission of any other Contractor having a Contract with the Owner for the performance of work upon the site or of work which may be necessary to be performed for the proper execution of the work to be performed hereunder, or through any act or omission of a Subcontractor of such Contract, the Contractor shall have no claim against the Owner or the Engineer for such damage, but shall have a right to recover such damage from the other Contractor under the provision similar to the following provisions which have been or will be inserted in the Contracts with such other Contractors.

F. Should any other Contractor having or who shall hereafter have a Contract with the Owner for the performance of work upon the site sustain any damage through any act or omission of the Contractor hereunder or through any act or omission of any Subcontractor of the Contractor, the Contractor agrees to reimburse such other Contractor for all such damages and to defend at his own expense any suit based upon such claim and if any judgment or claims against the Owner shall be allowed, the Contractor shall pay or satisfy such judgment or claim and pay all costs and expenses in connection therewith and shall indemnify and hold the Owner harmless from all such claims.

G. The Owner's right to indemnification hereunder shall in no way be diminished, waived or discharged, by its recourse to assessment of liquidated damages as provided in the Contract, or by the exercise of any other remedy provided for by Contract Documents or by law.

1.13 LIMITS OF WORK AREA

A. The Contractor shall confine his construction operations within the Contract limits shown on the Drawings and/or property lines and/or fence lines. Storage of equipment and materials, or erection and use of sheds outside of the Contract limits, if such areas are the property of the Owner, shall be used only with the Owner's approval. Such storage or temporary structures, even within the Contract's limits, shall not be placed on properties designated as easements or rights-of-way unless specifically permitted elsewhere in the Contract Documents.

B. The Contractor shall secure, insure, maintain, rent/lease, and restore staging area.

C. The Contractor shall provide Engineer and Owner copy of agreement with landowner of staging areas.

1.14 WEATHER CONDITIONS

A. No work shall be done when the weather is unsuitable. The Contractor shall take necessary precautions (in the event of impending storms) to protect all work, materials, or equipment from damage or deterioration due to floods, driving rain, or wind, and snow storms. The Owner reserves the right, through the opinion of the Engineer, to order that additional protection measures over and beyond those proposed by the Contractor, be taken to safeguard all components of the Project. The Contractor shall not claim any compensation for such precautionary measures so ordered, nor claim any compensation from the Owner for damage to the work from weather elements.

1.15 PERIODIC CLEANUP: BASIC SITE RESTORATION

A. During construction, the Contractor shall regularly remove from the site of the work all accumulated debris and surplus materials of any kind which result from his operations. Unused equipment and tools shall be stored at the Contractor's staging area for the Project.

B. The Contractor shall perform the cleanup work on a regular basis and as frequently as ordered by the Engineer. Basic site restoration in a particular area shall be accomplished immediately following the installation or completion of the required facilities in that area. Furthermore, such work shall also be accomplished, when ordered by the Engineer, if partially completed facilities must remain incomplete for some time period due to unforeseen circumstances.

C. Upon failure of the Contractor to perform periodic cleanup and basic restoration of the site to the Engineer's satisfaction, the Owner may, upon five (5) days prior written notice to the Contractor, without prejudice to any other rights or remedies of the Owner, cause such work for which the Contractor is responsible to be accomplished to the extent deemed necessary by the Engineer, and all costs resulting therefrom shall be charged to the Contractor and deducted from the amounts of money that may be due him.

1.16 USE OF FACILITIES BEFORE COMPLETION

A. The Owner reserves the right to enter the site and use any portion of the constructed facilities before final completion of the whole work to be done under this Contract. However, only those portions of the facilities which have been completed to the Engineer's satisfaction, as evidenced by his issuing a Certificate of Substantial Completion covering that part of the work, shall be placed in service.

B. It shall be the Owner's responsibility to prevent premature connections to or use of any portion of the installed facilities by private or public parties, persons or groups of persons,

before the Engineer issues his Certificate of Substantial Completion covering that portion of the work to be placed in service.

C. Consistent with the approved progress schedule, the Contractor shall cooperate with the Owner, his agents, and the Engineer to accelerate completion of those facilities, or portions thereof, which have been designated for early use by the Owner.

1.17 CONSTRUCTION VIDEO

A. The Contractor shall video the entire project site including all concrete and asphalt pavements, curb and gutter, fencing to remain, structures to be demolished, and existing structures that are to remain or be modified. The original video image shall be turned over to the Engineer prior to beginning construction activities. The video shall be provided as an Audio Video Interleave File (.avi) and shall be provided on DVD+R/DVD-ROM compatible media only. The video shall clearly identify existing site and structural conditions prior to construction.

1.18 CONTINUOUS OPERATION

A. The existing system must be maintained in continuous operation in such a manner that it meets all local, state, and federal requirements. The Contractor is responsible not to deactivate, demolish, or interfere with any system until a temporary or new permanent-like system has been installed and is operational. The Contractor is responsible for payment of all fines resulting from any action or inaction on his part or the part of his subcontractors during performance of the Work that is illegal.

B. The Contractor shall be responsible for maintaining the existing conveyance of all wastewater through the treatment plant throughout construction. If necessary, the Contractor shall utilize bypass pumping at no additional expense to the Owner. The Contractor must notify the Engineer and Owner of any bypass pumping in accordance with Section 01520 – 1.02 M.

1.19 SAFETY REGULATIONS & COMPLIANCE

A. The Contractor shall comply with OSHA (P.L. 91-596) and the Contract Work Hours and Safety Standards Act (P.L. 91-54). Contractor must also comply with Title VI of the Civil Rights Act of 1964.

PART 2 – PRODUCT

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01015 - WORK SEQUENCE

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contract shall conform to all miscellaneous requirements as contained in the Contract.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Conditions: Section 00700

B. Summary of Work: Section 01010

C. Coordination: Section 01040

PART 2 – PRODUCT

2.01 MATERIALS

A. The Contractor shall comply with the Specifications for type of work to be done.

PART 3 – EXECUTION

3.01 SEQUENCE OF CONSTRUCTION OPERATIONS

The Contractor shall submit to the Engineer for review and acceptance a complete schedule (progress chart) 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 construction of the project. The Contractor shall schedule the various construction activities to complete the project throughout the entire allotted time period. This schedule requirement in no way prevents the Contractor from completing the project in a shorter time frame than scheduled. The construction schedule along with a cost breakdown schedule shall be submitted and approved by the Owner prior to the submittal of the first partial payment request in accordance with the general conditions. A revised construction schedule shall be submitted to the Owner with each pay request. This revised schedule must be approved by the Owner prior to payment.

3.02 SPECIAL WORK SEQUENCE CONDITIONS

A. There shall be no bypass pumping of wastewater or non-potable water into the stream.

B. The Contractor shall submit to the Engineer for review and acceptance a complete schedule of the proposed sequence of construction operations prior to commencement of work. This submittal shall include estimated tie-in dates to the existing plant, each with a contingency plan due to weather related delays.

C. This project involves the modification of the existing systems at the plant which interface and potentially impact the existing treatment plant operations. Plant operations and effluent water quality must be maintained throughout construction; therefore, the various construction activities associated with work must be properly sequenced. The information given in this section regarding work sequence is intended to help the Contractor in identifying constraints with respect to keeping the existing plant in operation and in compliance with the discharge permit and assist the Contractor in planning its work.

D. In general, each existing process or item of equipment cannot be removed from service until a new, like system is operational and all downstream systems are operational. "Operational" means constructed, installed, inspected, checked by the manufacturer's factory representative, tested, and operated by the Contractor for an adequate time period. Use of any equipment, improvement, or process by Owner necessary for sequencing of construction shall not determine substantial completion or initiation of any warranty period.

E. All work requiring the shut-off of flow through the treatment process shall be conducted at night when the flows are below 6 MGD. Influent flow may be diverted to the storage tank and RAS flow may be shut off for a maximum of four hours.

F. Coordinate with owner to take certain basins offline for construction in within the basins. The number of basins required to meet permit effluent limits must be kept online for long term work.

END OF SECTION

SECTION 01025 - MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

The Contractor shall furnish all necessary labor, machinery, tools, apparatus, equipment, materials, service, other necessary supplies and perform all work including all excavation and backfilling (without additional compensation, except where specifically set out in these specifications) at the contract lump sum bid for the work described in the plans and specifications.

1.02 PROGRESS AND PAYMENTS SCHEDULES

A. The Contractor's construction schedule must be approved by the Engineer before any payments shall be made on this contract. Refer to Section 01320.

B. Within fifteen (15) days after the date of formal execution of the Agreement (Contract), the Contractor shall prepare and submit to the Engineer, for approval, a schedule of values. The schedule of values depicts the Contractor's cost for completing the contract requirements and identify 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 schedule of values must be approved by the Engineer before any payments shall be made on this contract.

C. The Engineer's decision as to sufficiency and completeness of the Contractor's construction schedule and schedule of values shall be final.

D. The Contractor must make current, to the satisfaction of the Engineer, the construction schedule and schedule of values each time it requests a payment on this contract.

E. The Contractor's construction schedule and schedule of values 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 schedule of values and be current. Further, the current schedule of values and construction schedule (both updated and revised) shall be submitted for review and approval by the Engineer before monthly payments shall be made by the Owner. The Contractor may submit stored materials for pay purposes provided proper documentation is provided.

G. Refer to Section 00800 14.02.A.6-8 for retainage requirements.

1.03 CLAIMS FOR EXTRA WORK

A. If the Contractor claims that any instructions by Drawings or otherwise involve extra cost, it shall give the Engineer written notice of said claim within seven (7) 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 its 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, shall 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 the Contractor 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 it has visited the site of the proposed work and fully acquainted itself with the conditions there existing relating to construction and labor, and that it fully understands the facilities, difficulties, and restrictions attending the execution of the work under this Contract. The Contractor further warrants that it 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 its failure when it was bidding on this Contract to receive or examine any form, instrument or document, or to visit the site and acquaint itself with conditions there existing, in no way relieves the Contractor 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 it should have been on notice as a result thereof.

1.04 DETERMINATION OF THE VALUE OF EXTRA (ADDITIONAL) OR OMITTED WORK

A. The value of extra (additional) or omitted work shall be determined in one or more of the following ways:

1. On the basis of the actual cost of all the items of labor (including on-the-job supervision), materials, and use of equipment, plus a maximum 15 percent for added work or a minimum 15 percent for deleted work which shall cover the Contractor's general supervision, overhead and profit.

    a. Labor may include on-site supervision, on-site project management, in addition to field personal associated with the work.

    b. In case of subcontracts, the 15 percent (maximum for added work and minimum for deleted work) is interpreted to mean the subcontractor's supervision, overhead and profit, and an additional 5 percent (maximum for added work and minimum for deleted work) may then be added to such costs to cover the General Contractor's supervision, overhead and profit.

    c. The cost of labor shall include required insurance, taxes and fringe benefits.

    d. Equipment costs shall be based on current rental rates in Lexington, KY.

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.

1.05 PAY ITEMS

A. Item No. 1 – Base Bid for Installation/Construction of the Biological Phosphorus Removal (BPR) mixers per the Contract Documents.

The Contractor shall furnish all necessary labor, machinery, tools, apparatus, equipment, materials service and other necessary supplies and perform all Work shown on the Drawings and/or described in the Specifications and Contract Documents at the lump sum price as indicated by the Bidder in the Bid. The Owner (Lexington-Fayette Urban County Government) will purchase the mixers associated guide rail systems, and hoist assembly as indicated in the Specifications. The Contract shall include in this item any additional materials, labor, goods, services, resources, and manpower necessary to complete the work for the item. The Contractor shall include the cost for the mixer manufacturer's representative to provide start-up services and training. The price does not include the cost for Item No. 4.

B. Item No. 2 – Base Bid for Installation/Construction of the Online Nutrient Process Monitoring System and associated equipment per the Contract Documents.

The Contractor shall furnish all necessary labor, machinery, tools, apparatus, equipment, materials service and other necessary supplies and perform all Work shown on the Drawings and/or described in the Specifications and Contract Documents at the lump sum price as indicated by the Bidder in the Bid. The Contract shall include in this item any additional materials, labor, goods, services, resources, and manpower necessary to complete the work for the Online Nutrient Process Monitoring System. This includes all sample pumps, piping, valves, mounting brackets, and any other accessories necessary for a fully functional system. The Contractor shall include the cost for the equipment manufacturer's representative to provide start-up services and training. The price does not include the cost for Item No. 4.

C. Item No. 3 – Base Bid for Installation/Construction of the Chemical Feed Pumps and associated equipment per the Contract Documents.

The Contractor shall furnish all necessary labor, machinery, tools, apparatus, equipment, materials service and other necessary supplies and perform all Work shown on the Drawings and/or described in the Specifications and Contract Documents at the lump sum price as indicated by the Bidder in the Bid. The Contract shall include in this item any additional materials, labor, goods, services, resources, and manpower necessary to complete the work for the allowance items. The Contractor shall include the cost for the equipment manufacturer's representative to provide start-up services and training. The price does not include the cost for Item No. 4.

D. Item No. 4 – Allowance: SCADA Integration - Intellimodus

1. This is an undefined allowance for SCADA Integration. The allowance shown in the Bid form represents the pricing as provided by the supplier and as negotiated by the Owner for supply of goods and services as specified in Section 18000 – SCADA. Contractor shall include any additional items, goods, services, resources, and manpower necessary to complete the work in the lump sum item, Item No. 1 – Base Bid.

2. This item includes all SCADA system programming, reprogramming and components required to add the new equipment and update to the existing LFUCG integrated SCADA system. Integrator shall update all graphics, add new graphics as required, add report generator as required, and program all alarms and logic on the existing LFUCG SCADA system. All graphics shall match the current graphics for the West Hickman Wastewater Treatment Plant. Intellimodus's proposal is included in Appendix A.

3. Payment will be based on the actual itemized invoice amount in accordance with the Specifications. No markup or increase by the Contractor of the SCADA subcontractor invoice is to be included in this item.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01040 - COORDINATION

PART 1 - GENERAL

1.01 REQUIREMENTS

A. The Contractor shall allow the Owner or his agents, and other project Contractors or their agents, to enter upon the work for the purpose of constructing, operating, maintaining, removing, repairing, altering, or replacing such pipes, sewers, conduits, manholes, wires, poles, or other structures and appliances which may be required to be installed at or in the work. The Contractor shall cooperate with all aforesaid parties and shall allow reasonable provisions for the prosecution of any other work by the Owner, or others, to be done in connection with his work, or in connection with normal use of the facilities.

B. Each Contractor shall cooperate fully with the Owner, the Engineer, and all other Contractors employed on the Work, to effect proper coordination and progress to complete the project on schedule and in proper sequence. Insofar as possible, decisions of all kinds required from the Engineer shall be anticipated by the Contractor to provide ample time for inspection, or the preparation of instructions.

C. Each Contractor shall assume full responsibility for the correlation of all parts of his work with that of other Contractors. Each Contractor's superintendent shall correlate all work with other Contractors in the laying out of work. Each Contractor shall lay out his own work in accordance with the Drawings, Specifications, and instructions of latest issue and with due regard to the work of other Contractors.

D. Monthly general progress coordination meetings will be held at regularly scheduled times convenient for all parties involved. These meetings are in addition to specific meetings held for other purposes, such as special pre-installation meetings. Representation at each meeting by every part currently involved in coordination or planning for the work of the entire project is requested. Meetings shall be conducted in a manner that will resolve coordination problems. Results of the meetings shall be recorded and copies distributed to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

E. The Contractor will be responsible for coordinating with the West Hickman Wastewater Treatment Plant personnel and Superintendent Jim Worten, for any work which will affect normal daily operation of the wastewater treatment plant.

F. The Contractor will be responsible for maintaining all wastewater conveyance to the wastewater treatment plant at all times. Contractor shall be responsible for bypass pumping if necessary. Bypass pumping must be coordinated with the Owner and Engineer in accordance with Section 01520 – 2.01 M.

G. The Contractor shall be responsible for maintaining a minimum of 15 feet of clearance from all Kentucky Utility transmission and distribution wires during construction. The 15 foot clearance includes both horizontal and vertical clearance.

H. There shall be no disturbance of soil within 25 feet of any Kentucky Utilities transmission or distribution electrical poles.

I. A fiber optic is located onsite. The Contractor will be responsible for locating and protecting the fiber optic. If the fiber optic is hit, contact Robert Bowman with LFUCG, DWQ 859-425-2456.

1.02 COORDINATION OF CRAFTS, TRADES, AND SUBCONTRACTORS

A. The Contractor shall coordinate the work of all 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.

B. 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 and Specifications applicable to his work to the end that complete coordination between trades will be effected. Consult the Engineer if conflicts exist on the Drawings.

C. Contractor's Superintendent, or his designee who is employed by Contractor, must be on site at all times when work is being performed, except for periods which will not exceed 1 hour.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01200 - PROJECT MEETINGS

PART 1 - GENERAL

1.01 PRECONSTRUCTION MEETING

A. A preconstruction meeting will be held after Award of Contract, but prior to starting work at the site. Contractor's Project Manager and Site Superintendent are required to attend, as are representatives of all major subcontractors. Progress schedule update shall be submitted in advance of each meeting.

1.02 PROGRESS MEETINGS

A. Progress meetings will be held monthly at the Division of Water Quality offices during the performance of the Work. Additional progress meetings may be called as progress of work dictates. Prior to each progress meeting, Contractor shall submit a progress report summarizing the work completed over the past month and providing a look ahead at the work to be done over the next month.

B. Minimum Agenda for meeting shall include:

1. Review and approve minutes of previous meetings.
2. Review progress of Work since last meeting.
3. Review proposed 30 day construction schedule.
4. Note and identify problems which impede planned progress.
5. Develop corrective measures and procedures to regain planned schedule.
6. Revise construction schedule as indicated and plan progress during next work period.
7. Maintaining of quality and work standards.
8. Complete other current business.
9. Schedule next progress meeting.

1.03 SPECIAL MEETINGS

A. Owner or Engineer may schedule special meetings at the site or at Division of Water Quality offices to resolve construction issues. Contractor and when appropriate, subcontractors, shall attend upon request. No additional compensation shall be paid for meeting attendance.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01210 - ALLOWANCES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section includes administrative and procedural requirements governing allowances. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Defined, allowances. Defined allowances include equipment, systems, or services that have been selected by the Owner from a designated supplier. These will be handled in accordance with paragraph 1.06 of this specification.

2. Undefined allowances. Undefined allowances are intended for work which has an unknown scope at the time of bidding or professional services provided that may require variable effort, increase or decrease, to complete the work. These will be handled in accordance with paragraph 1.07 of this specification.

C. The following allowances shall be included in the Contractor's bid:

1. Intellimodus - SCADA Integration- $136,000, undefined allowance

1.02 RELATED DOCUMENTS

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

1.03 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, Contractor shall advise Engineer of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Engineer's request, obtain proposals for each allowance for use in making final selections and include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by the Engineer from the designated supplier.

1.04 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Submit invoices for undefined allowances, professional services; that includes an itemization of dates worked, hours for each individual and each date worked, detail description of effort associated with hours, hourly rates for each individual, summary cost for each individual and each date, and summary cost for total invoice.

D. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.05 COORDINATION

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

1.06 DEFINED ALLOWANCES

A. Defined allowances shall include cost to Contractor of specific products and materials ordered by the Contractor under allowance and shall include taxes, freight, and delivery to the project site.

B. Contractor's costs at the Project site for labor, installation, overhead and profit, and similar costs related to the equipment ordered under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Contractor shall not be allowed any markup of subcontractors work or materials under the allowances. Markup shall be included as part of the Contract sum and not part of the allowance.

1.07 UNDEFINED ALLOWANCES

A. Undefined allowances shall include work for which the scope is not yet determined or require professional services to be provided that may have variable amounts efforts, increase or decrease, to complete the work. The allowance amount is not guaranteed and is solely for the purpose of determining an initial Contract Price.

B. Once the scope of work is defined, the Contractor shall present cost and schedule as listed in 1.04.A above.

1.08 UNUSED MATERIALS

A. Contractor shall be responsible for returning unused materials purchased under an allowance to the manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

B. When it is not economically practical to return material for credit, Contractor shall be responsible for preparing and delivering unused material to Owner's designated storage location. Otherwise, disposal of unused material shall be Contractor's responsibility.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

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

END OF SECTION

SECTION 01300 - SUBMITTALS

PART 1 - GENERAL

1.01 REQUIREMENTS

A. Progress Schedule

1. Within thirty (30) days after execution of the Agreement, but at least 20 days prior to submitting the first application for a progress payment, the Contractor shall prepare and submit three (3) copies of his proposed progress schedule to the Engineer for review and approval.

2. If so required, the schedule shall be revised until it is approved by the Engineer.

3. The schedule shall be updated monthly, depicting progress to the last day of the month and three (3) copies submitted to the Engineer not later than the fifth day of the month with the application for progress payment.

4. The schedule shall be prepared in the form of a horizontal bar chart showing in detail the proposed sequence of the work and identifying construction activities for each structure and for each portion of work.

5. The schedule shall be time scaled, identifying the first day of each week. The Schedule shall be provided with estimated dates for Early Start, Early Finish, Late Start and Late Finish as applicable. The work shall be scheduled to complete the Project within the Contract time. The Late Finish date shall equal the Contract Completion Date.

6. The schedule shall show duration (number of days) and float for each activity. Float shall be defined as the measure of leeway in starting or completing a scheduled activity without adversely affecting the project completion date established by the Contract Documents.

7. The updated schedule shall show all changes since the previous submittal.

8. All revisions to the schedule must reviewed and commented on by the Engineer.

B. Equipment and Material Orders Schedule

1. Contractor shall prepare and submit three (3) copies of his schedule of principal items of equipment and materials to be purchased to the Engineer for review and approval.

2. If so required, the schedule shall be revised until it is approved by the Engineer.

3. The schedule shall be updated monthly and three (3) copies submitted to the Engineer not later than the fifth day of every month with the application for progress payment.

4. The updated schedule shall be based on the Progress Schedule developed under the requirements of Paragraph 1.01(A) of this Section.

5. The schedule shall be in tabular form with appropriate spaces to insert the following information for principal items of equipment and materials:

   a. Dates on which Shop Drawings are requested and received from the manufacturer.

   b. Dates on which certification is received from the manufacturer and transmitted to the Engineer.

c. Dates on which Shop Drawings are submitted to the Engineer and returned by the Engineer for revision.

d. Dates on which Shop Drawings are revised by manufacturer and resubmitted to the Engineer.

e. Date on which Shop Drawings are returned by Engineer annotated either "Furnish as Submitted" or "Furnish as Corrected".

f. Date on which accepted Shop Drawings are transmitted to manufacturer.

g. Date of manufacturer's scheduled delivery.

h. Date on which delivery is actually made.

C. Working Drawings

1. Within thirty (30) days after the Notice to Proceed, Contractor shall prepare and submit three (3) copies of his preliminary schedule of Working Drawing submittals to the Engineer for review and approval. If so required, the schedule shall be revised until it is approved by the Engineer.

2. Working Drawings include, but are not limited to, Shop Drawings, layout drawings in plan and elevation, installation drawings, etc. Contractor shall be responsible for securing all of the information, details, dimensions, Drawings, etc., necessary to prepare the Working Drawings required and necessary under this Contract and to fulfill all other requirements of his Contract. Contractor shall secure such information, details, Drawings, etc., from all possible sources including the Drawings, Working Drawings prepared by subcontractors, Engineers, suppliers, etc.

3. In the event that the Engineer is required to provide additional engineering services as a result of a substitution of materials or equipment by the Contractor, the additional services will be provided in accordance with Section 01010 - Summary of Work, and will be covered in supplementary or revised Drawings which will be issued to the Contractor. All changes indicated that are necessary to accommodate the equipment and appurtenances shall be incorporated into the Working Drawings submitted to the Engineer.

4. Shop Drawings and Manufactured Item Information

   a. Contractor shall submit for review by the Engineer Shop Drawings for all fabricated work and for all manufactured items required to be furnished by the Contract Documents.

   b. Structural and all other layout Drawings prepared specifically for the Project shall have a plan scale of not less than 1/4-inch = 1 foot.

   c. The submitted documents shall provide information indicating that the materials are in conformance with the Technical Specifications and Contract Documents.

   d. Where manufacturer's publications in the form of catalogs, brochures, illustrations or other data sheets are submitted in lieu of prepared Shop Drawings, such submittals shall specifically indicate the item for which approval is requested. Identification of items shall be made in ink, and submittals showing only general information are not acceptable.

5. Contractor Responsibilities

a. All submittals from subcontractors, manufacturers or suppliers shall be sent directly to the Contractor for checking. Contractor shall thoroughly check all Drawings for accuracy and conformance to the intent of the Contract Documents. Drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors, manufacturers, or suppliers by the Contractor for correction before submitting them to the Engineer.

b. All submittals shall be bound, dated, properly labeled and consecutively numbered. Information on the label shall indicate Specification Section, Drawing number, subcontractors', manufacturer's or supplier's name and the name or type of item the submittal covers. Each part of a submittal shall be marked and tabulated.

c. Working Drawings shall be submitted as a single complete package including all associated drawings relating to a complete assembly of the various parts necessary for a complete unit or system.

d. Shop Drawings shall be submitted as a single complete package for any operating system and shall include all items of equipment and any mechanical units involved or necessary for the functioning of such system.

e. ALL SUBMITTALS SHALL BE THOROUGHLY CHECKED BY THE CONTRACTOR FOR ACCURACY AND CONFORMANCE TO THE INTENT OF THE CONTRACT DOCUMENTS BEFORE BEING SUBMITTED TO THE ENGINEER AND SHALL BEAR THE CONTRACTOR'S STAMP OF APPROVAL CERTIFYING THAT THEY HAVE BEEN SO CHECKED. SUBMITTALS WITHOUT THE CONTRACTOR'S STAMP OF APPROVAL WILL NOT BE REVIEWED BY THE ENGINEER AND WILL BE RETURNED TO THE CONTRACTOR. Any comments added to the drawings by the Contractor shall be done in green ink so as to denote any Contractor notes.

f. If the submittals contain any departures from the Contract Documents, specific mention thereof shall be made in the Contractor's letter of transmittal. Otherwise, the review of such submittals shall not constitute approval of the departure.

g. No materials shall be ordered, fabricated or shipped or any work performed until the Engineer returns to the Contractor the submittals, herein required, annotated either "Furnish as Submitted" or "Furnish as Corrected".

h. Where errors, deviations, and/or omissions are discovered at a later date in any of the submittals, the Engineer's prior review of the submittals does not relieve the Contractor of the responsibility for correcting all errors, deviations, and/or omissions.

6. Procedure for Review

a. Submittals shall be transmitted in sufficient time to allow the Engineer at least thirty (30) working days for review and processing.

b. Engineer prefers initial submittals be in electronic media for review. Once the submittal is reviewed, Contractor to provide two (2) paper hardcopies.

c. If Contractor does not have capability to submit electronic submittals, then Contractor shall submit a request to Engineer for waiver. In the event a waiver is granted, Contractor shall transmit two (2) prints of each submittal to the Engineer for review for all Drawings greater than 11-inches by 17-inches in size, as well as six (6) copies of all other material.

d. Submittal shall be accompanied by a letter of transmittal, in duplicate, containing date, project title, Contractor's name, number and titles of submittals, notification of departures and any other pertinent data to facilitate review.

e. Submittals will be annotated by the Engineer in one of the following ways:

"Furnish as Submitted" - no exceptions are taken.

"Furnish as Corrected" - minor corrections are noted and shall be made.

"Revise and Resubmit" - major corrections are noted and a resubmittal is required.

"Rejected" - Based on the information submitted, the submission is not in conformance with the Contract Documents. The deviations from the Contract Documents are too numerous to list and a completely revised submission of the proposed equipment or a submission of other equipment is required.

f. If a submittal is satisfactory to the Engineer, the Engineer will annotate the submittal "Furnish as Submitted" or "Furnish as Corrected", retain four (4) copies and return remaining copies to the Contractor.

g. If a resubmittal is required, the Engineer will annotate the submittal "Revise and Resubmit" and transmit five (5) copies to the Contractor for appropriate action.

h. Contractor shall revise and resubmit submittals as required by the Engineer until submittals are acceptable to the Engineer. It is understood by the Contractor that Owner may charge the Contractor the Engineer's charges for review in the event a submittal is not approved (either "Furnish as Submitted" or "Furnish as Corrected") by the third submittal for a system or piece of equipment. These charges shall be for all costs associated with engineering review, meetings with the Contractor or manufacturer, etc., commencing with the fourth submittal of a system or type of equipment submitted for a particular Specification Section.

i. Acceptance of a Working Drawing by the Engineer will constitute acceptance of the subject matter for which the Drawing was submitted and not for any other structure, material, equipment or appurtenances indicated or shown.

7. Engineer's Review

a. Engineer's review of the Contractor's submittals shall in no way relieve the Contractor of any of his responsibilities under the Contract. An acceptance of a submittal shall be interpreted to mean that the Engineer has no specific objections to the submitted material, subject to conformance with the Contract Drawings and Specifications. The Engineer will denote any notes in red ink so as to record his comments on the submittal. Engineer may provide a tabular list of comments referencing the submittal, in lieu of, or in addition to marking the submittal.

b. Engineer's review will be confined to general arrangement and compliance with the Contract Drawings and Specifications only, and will not be for the purpose of checking dimensions, weights, clearances, fittings, tolerances, interferences, coordination of trades, etc.

8. Record Working Drawings

a. Prior to final payment, the Contractor shall furnish the Engineer one complete set of all accepted Working Drawings, including Shop Drawings, for equipment, piping, electrical work, heating system, ventilating system, air conditioning system, instrumentation system, plumbing system, structural, interconnection wiring diagrams, etc.

b. Manufacturer's publications, submitted in lieu of prepared Shop Drawings, will not be required in reproducible form. However, three (3) sets of such material shall be furnished by the Contractor to the Engineer.

c. Working Drawings furnished shall be corrected to include any departures from previously accepted Drawings.

D. Certified Shop Test Reports

1. Each piece of equipment for which pressure, head, capacity, rating, efficiency, performance, function or special requirements are specified or implied shall be tested in the shop of the manufacturer in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents and applicable test codes and standards. Contractor shall keep the Engineer advised of the scheduling of shop tests (at least three weeks minimum advance notice) so that the Engineer may arrange for the witnessing or inspection at the proper time and place.

2. The contractor shall secure from the manufacturers five (5) paper copies and two (2) electronic copies of the actual test data, the interpreted results and a complete description of the testing facilities and testing setup, all accompanied by a certificate of authenticity sworn to by a responsible official of the manufacturing company and notarized. These reports shall be forwarded to the Engineer for review.

3. In the event any equipment fails to meet the test requirements, the manufacturer shall make all necessary changes, adjustments or replacements and the tests shall be repeated, at no additional cost to the Owner or Engineer, until the equipment test requirements are acceptable to the Engineer.

4. No equipment shall be shipped to the Project until the Engineer notifies the Contractor, in writing, that the shop test reports are acceptable

E. Operation and Maintenance Manuals

1. See Section 01780 for requirements.

F. Construction Photographs

1. The Contractor shall take photographs at the locations and at such stages of the construction as directed by the Engineer. Digital format shall be used. Provide all pictures for a given period on a CD or DVD.

2. Provide the equivalent of 36 different exposures per month for the duration of the Contract time. When directed by the Engineer, frequency of photographs may be increased to weekly sessions provided that the equivalent number of exposures is not exceeded. Engineer may waive requirements for photographs during inactive construction periods in favor of increased photographs during active construction sequences.

G. Stormwater Pollution Prevention Plan (SWPPP), if required

1. Within thirty (30) days after execution of the Agreement, but at least 20 days prior to submitting the first application for a progress payment, the Contractor shall prepare and submit a sequenced SWPPP. The sequenced SWPPP must align with the Contractor's construction activities.

2. The SWPPP shall be updated monthly, depicting the current SWPPP, submitted to the Engineer not later than the fifth day of the month with the application for progress payment.

3. The Contactor shall submit an updated SWPPP to the Engineer prior to beginning and after completing construction on the affected areas.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01320 - PROGRESS SCHEDULES

PART 1 - GENERAL

1.01 REQUIREMENTS

A. Scheduling Responsibilities:

1. In order to provide a definitive basis for determining job progress, a construction schedule of a type approved by the Owner will be used to monitor the project.

2. Each week the Contractor shall be responsible for preparing the schedule and updating it based on a tentative two week basis. It shall at all times remain the Contractor's responsibility to schedule and direct his forces in a manner that will allow for the completion of the work within the contractual period.

B. Construction Hours: see Section 01010 – Summary of Work – for construction working hours requirements.

C. Progress of the Work:

1. The work shall be started within ten (10) days following the Notice to Proceed and shall be executed with such progress as may be required to prevent delay to other Contractors or to the general completion of the project. The work shall be executed at such times and in or on such parts of the project, and with such forces, material and equipment, to assure completion of the work in the time established by the Contract.

2. The Contractor agrees that whenever it becomes apparent from the current monthly schedule update that delays have resulted and, hence, that the Contract completion date will not be met or when so directed by the Owner, he will take some or all of the following actions at no additional cost to the Owner:

a. Increase construction manpower in such quantities and crafts as will substantially eliminate the backlog of work.

b. Increase the number of working hours per shift, shifts per working day or days per week, the amount of construction equipment, or any combination of the foregoing to substantially eliminate the backlog of work.

c. Reschedule activities to achieve maximum practical concurrency of accomplishment of activities, and comply with the revised schedule.

d. The Contractor shall submit to the Owner or the Owner's representative for review a written statement of the steps he intends to take to remove or arrest the delay to the critical path in the accepted schedule.

1.02 CONSTRUCTION SCHEDULE

A. Within fifteen (15) calendar days of the Notice to Proceed, the Contractor shall submit to the Engineer five (5) copies of his proposed schedule. Schedule shall be Critical Path Method (CPM) type which depicts the Contractor's plan for completing the contract requirements and show work placement in dollars versus contract time. The schedule will be the subject of a schedule review meeting with the Contractor, the Engineer and the Owner or the Owner's representative within one (1) week of its submission. The Contractor will revise and resubmit the schedule until it is acceptable and accepted by the Owner or the Owner's representative.

1.03 CONTRACT COMPLETION TIME

A. Causes for Extensions:

The Contract completion time will be adjusted only for causes specified in this Contract. In the event the Contractor requests an extension of any Contract completion date, he shall furnish such justification and supporting evidence as the Owner or the Owner's representative may deem necessary for a determination as to whether the Contractor is entitled to an extension of time under the provisions of this Contract. The Owner, with the assistance of the Engineer, will, after receipt of such justification and supporting evidence, make findings of fact and will advise the Contractor in writing thereof.

B. Requests for Time Extension:

Each request for change in any Contract completion date shall be initially submitted to the Owner within the time frame stated in the General Conditions. All information known to the Contractor at that time concerning the nature and extent of the delay shall be transmitted to the Owner at that time. Within the time frame stated in the General Conditions but before the date of final payment under this Contract, all information as required above concerning the delay must be submitted to the Owner. No time extension will be granted for requests which are not submitted within the foregoing time limits.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01380 - CONSTRUCTION PHOTOGRAPHS AND VIDEO

PART 1 - GENERAL

1.01 WORK INCLUDED

Provide monthly photographs of the construction throughout the progress of the Work. Provide video of the length of construction area prior to commencement of work, monthly progress, and at completion of work.

1.02 RELATED WORK

A. General Conditions

B. Section 01700 - Contract Closeout

1.03 PHOTOGRAPHY

A. Provide monthly photographs (two sets) of the construction throughout progress of the Work. Provide twenty-four (24) views of Work each month or more as may be necessary to clearly show any new Work.

B. Take the photographs at the beginning, during, and completion of each element of construction listed below:

1. Unclassified excavation.
2. Trenching.
3. Pipe installation.
4. Mixer removal / basin cleaning.
5. Installation of all equipment.
6. Installation of all electric work.
7. All other aspects of construction.

1.04 PRINTS

A. Color: two (2) prints of each view, bound into separate sets.

B. Paper: single weight, neutral black image tone, white base.

C. Finish: matte.

D. Size: 3" x 5". Mount with binder tabs.

E. Label each print on back. List project name and Contract number, orientation of view, date and time of view, work being performed, location of work, and Contractor's name.

1.05 DIGITAL PHOTOGRAPHS

All photographs shall be digital. Digital photographs of all views shall be provided on compact disc (CD) or digital video disc (DVD) to the Owner. The CD or DVD shall be included monthly along with the two sets of prints. Digital pictures shall be time and date stamped one labeled the same as prints.

1.06 DIGITAL VIDEO

A. All video shall be digital. Digital video shall be provided on a compact disc (CD) or digital video disc (DVD) to the Owner. The CD or DVD shall be included monthly with the digital photographs. Digital video shall be time and date stamped.

B. Initial video shall be completed prior to the arrival of any equipment for construction facilities. The video shall include all existing structures, visible utilities, parking lots, and access roads. Record any existing damage to the facilities.

C. Final video shall be completed once all equipment and construction facilities have been removed from the sites. The video shall include all items listed above plus all new modifications or alternations.

D. All video shall provide correct exposure and focus, high resolution and sharpness, maximum depth of field.

1.07 TECHNIQUE

A. All views shall provide factual presentation of the Work progress.

B. All photographs shall provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

1.08 VIEWS

The photographs shall be from varied views that show the most representative sample of the Work progress.

1.09 SUBMITTALS

Submit prints and CD or DVD at the monthly progress meetings unless specifically requested sooner by the Owner or Engineer.

- END OF SECTION -

SECTION 01400 - QUALITY CONTROL

PART 1 - GENERAL

1.01 REQUIREMENTS

A. Testing Laboratory Services

1. Laboratory and field testing and checking required by the Specifications, including the cost of transporting all samples and test specimens, shall be provided and paid for by the Owner unless otherwise indicated in the Specifications.

2. Materials to be tested include, but are not necessarily limited to the following: cement, concrete aggregate, concrete, onsite and offsite fill, and reinforcing steel.

3. Tests required by the Owner shall not relieve the Contractor from the responsibility of supplying test results and certificates from manufacturers or suppliers to demonstrate conformance with the Specifications.

4. In place testing of compacted materials will be conducted as specified or recommended by Engineer.

5. Procedures

   a. The Contractor shall plan and conduct his operations to permit taking of field samples and test specimens, as required, and to allow adequate time for laboratory tests.

   b. The collection, field preparation and storage of field samples and test specimens shall be as directed by the Engineer with the cooperation of the Contractor.

6. Significance of Tests

   a. Test results shall be binding on both the Contractor and the Owner, and shall be considered irrefutable evidence of compliance or noncompliance with the Specification requirements, unless supplementary testing shall prove, to the satisfaction of the Owner, that the initial samples were not representative of actual conditions.

7. Supplementary and Other Testing

   a. Nothing shall restrict the Contractor from conducting tests he may require. Should the Contractor at any time request the Owner to consider such test results, the test reports shall be certified by an independent testing laboratory acceptable to the Owner. Testing of this nature shall be conducted at the Contractor's expense.

1.02 IMPERFECT WORK OR MATERIALS

A. Any defective or imperfect work or materials furnished by the Contractor which is discovered before the final acceptance of the work, as established by the Certificate of Substantial Completion, or during the subsequent guarantee period, shall be removed immediately even though it may have been overlooked by the Engineer and estimated for payment. Any materials condemned or rejected by the Engineer shall be tagged as such and shall be immediately removed from the site. Satisfactory work or materials shall be substituted for that rejected.

B. The Engineer may order tests of imperfect or damaged work or materials to determine the required functional capability for possible acceptance, if there is no other reason for rejection. The cost of such tests shall be borne by the Contractor; and the nature, tester, extent and

supervision of the tests will be as determined by the Engineer. If the results of the tests indicate that the required functional capability of the work or material was not impaired, consistent with the final general appearance of same, the work or materials may be deemed acceptable. If the results of such tests reveal that the required functional capability of the questionable work or materials has been impaired, then such work or materials shall be deemed imperfect and shall be replaced. The Contractor may elect to replace the imperfect work or material in lieu of performing the tests.

1.03 INSPECTION AND TESTS

A. The Contractor shall allow the Engineer ample time and opportunity for testing materials to be used in the work. He shall advise the Engineer promptly upon placing orders for material so that arrangements may be made, if desired, for inspection before shipment from the place of manufacture. The Contractor shall at all times furnish the Engineer and his representatives, facilities including labor, and allow proper time for inspecting and testing materials and workmanship. The Contractor must anticipate possible delays that may be caused in the execution of his work due to the necessity of materials being inspected and accepted for use. The Contractor shall furnish, at his own expense, all samples of materials required by the Engineer for testing, and shall make his own arrangements for providing water, electric power, or fuel for the various inspections and tests of structures and material.

B. Where other tests or analyses are specifically required in other Sections of these Specifications, the cost thereof shall be borne by the party (Owner or Contractor) so designated in such Sections. The Owner will bear the cost of all tests, inspections, or investigations undertaken by the order of the Engineer for the purpose of determining conformance with the Contract Documents if such tests, inspection, or investigations are not specifically required by the Contract Documents, and if conformance is ascertained thereby. Whenever nonconformance is determined by the Engineer as a result of such tests, inspections, or investigations, the Contractor shall bear the full cost thereof or shall reimburse the Owner for said cost. In this connection, the cost of any additional tests and investigations, which are ordered by the Engineer to ascertain subsequent conformance with the Contract Documents, shall be borne by the Contractor.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01510 - TEMPORARY UTILITIES

PART 1 - GENERAL

1.01 REQUIREMENTS

A. The Contractor shall provide temporary light and power, heating, water service and sanitary facilities for his operations, for the construction operations of his subcontractors on this Project at the site. The temporary services shall be provided for use throughout the construction period.

B. The Contractor shall coordinate and install all temporary services in accordance with the requirements of the utility companies having jurisdiction and as required by applicable codes and regulations.

C. At the completion of the work, or when the temporary services are no longer required, the facilities shall be restored to their original conditions.

D. All costs in connection with the temporary services including, but not limited to, installation, utility company service charges, maintenance, relocation and removal shall be borne by the Contractor at no additional cost to the Owner.

E. Temporary Light and Power

1. The temporary general lighting and small power requirements shall be serviced by 120/240 V, 1 phase, 3 wire temporary systems furnished and installed by the Contractor. This service shall be furnished complete with main disconnect, overcurrent protection, meter outlet, branch circuit breakers, and wiring as required; including branch circuit breakers and wiring as required for furnishing temporary power to the subcontractor's field office service connections, all in accordance with the requirements of the servicing power company and applicable standards and codes. The meter for the temporary 120/240 V service for construction purposes shall be registered in the name of the Contractor and all energy charges for furnishing this temporary electric power shall be borne by the Contractor.

2. The Contractor shall make all necessary arrangements, and pay for all permits, inspections, and power company charges for all temporary service installations. All temporary systems shall comply with and meet the approval of the local authorities having jurisdiction. All temporary electrical systems shall consist of wiring, switches, necessary insulated supports, poles, fixtures, sockets, receptacles, lamps, guards, cutouts, and fuses as required to complete such installations. The Contractor shall furnish lamps and fuses for all temporary systems furnished by him and shall replace broken and burned out lamps, blown fuses, damaged wiring and as required to maintain these systems in adequate and safe operating condition. All such temporary light and power system shall be installed without interfering with the work of his subcontractors.

   When it is necessary during the progress of construction that a temporary electrical facility installed under this Division interferes with construction operations, the Contractor shall relocate the temporary electrical facilities to maintain temporary power as required at no additional cost to the Owner. The Contractor shall be responsible at all times for any damage or injury to equipment, materials, or personnel caused by improperly protected or installed temporary installations and equipment.

3. The various subcontractors doing the work at the site shall be permitted to connect into the temporary general lighting system small hand tools, such as drills, hammers, and grinders, provided that:

   a. Equipment and tools are suitable for 120 V, single phase, 60 Hz operation and operating input does not exceed 1,500 volt-amperes.

b. Tools are connected to outlets of the system with only one (1) unit connected to a single outlet.

c. In case of overloading of circuits, the Contractor will restrict use of equipment and tools as required for correct loading.

4. The Contractor shall keep the temporary general lighting and power systems energized fifteen minutes before the time that the earliest trade starts in the morning and de-energized fifteen minutes after the time the latest trade stops. This applies to all weekdays, Monday through Friday, inclusive, which are established as regular working days.

5. If the Contractor requires additional power and lighting other than that specified herein (including power for temporary heating equipment) shall furnish an additional service complete with all fuses, cutouts, wiring and other material and equipment necessary for a complete system between the service point and the additional power consumers and shall install his own metering equipment in accordance with the requirements of the servicing power company.

6. The temporary general lighting system shall be installed progressively in structures as the various areas are enclosed or as lighting becomes necessary because of partial enclosure. Lighting intensities shall be not less than 10 foot candles.

7. The Contractor shall provide a separate temporary night lighting circuit for construction security. This system shall be energized at the end of each normal working day and de-energized at the start of each normal working day by the Contractor. The system is to be left energized over Saturdays, Sundays, and all holidays. Lighting intensities shall be not less than 2 foot candles.

8. Electrical welders provided by each trade used in the erection and fabrication of the buildings, structures and equipment shall be provided with an independent grounding cable connected directly to the structure on which the weld is being made rather than adjacent conduit piping, etc.

   Electricians and other tradesmen necessary for the required connections and operation of welding equipment and generator, standby generators and similar equipment (and related labor) shall be furnished by the Contractor and his subcontractors.

9. Upon completion of the work, but prior to acceptance by the Owner, the Contractor shall remove all temporary services, security lighting systems, temporary general lighting systems and all temporary electrical work from the premises.

F. Temporary Heating

1. The Contractor shall provide temporary heating, ventilation coverings and enclosures necessary to properly protect all work and materials against damage by dampness and cold, to dry out the work and to facilitate work in all structures.

2. The equipment, fuel, materials, operating personnel and methods used shall be at all times satisfactory and adequate to maintain critical installation temperatures and ventilation for all work in those areas where the same is required.

3. After any structure is enclosed, the minimum temperature to be maintained is 50°F, unless otherwise specified, where work is actually being performed.

4. Before and during the application of interior finishing, painting, etc., the Contractor shall provide sufficient heat to maintain a temperature of not less than 65°F.

5. Any work damaged by dampness or insufficient or abnormal heating shall be replaced by the Contractor at no additional cost to the Owner.

G. Temporary Sanitary Service

1. Sanitary conveniences, in sufficient numbers, for the use of all persons employed on the work and properly screened from public observation, shall be provided and maintained at suitable locations by the Contractor, all as prescribed by State Labor Regulations and local ordinances. The contents of same shall be removed and disposed of in a manner consistent with local and state regulations, as the occasion requires. Contractor and his subcontractors shall rigorously prohibit the committing of nuisances within, on, or about the work. Sanitary facilities shall be removed from the site when no longer required. Employees shall not use the West Hickman WWTP facilities.

H. Temporary Water

1. The Contractor shall provide temporary water service for construction purposes, sanitary facilities, fire protection, field offices and for cleaning. The Contractor shall make all arrangements for connections to the potable water at the plant site. The Contractor shall pay all charges associated with the connection and all charges for potable water used under this Contract.

2. The Contractor shall supply potable water for his employees either by portable containers or drinking fountains.

3. An adequate number of hose bibbs, hoses, and watertight barrels shall be provided for the distribution of water.

4. Water service shall be protected from freezing and the service shall be extended and relocated as necessary to meet temporary water requirements.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01515 - FIELD OFFICES

PART 1 - GENERAL

1.01 CONTRACTOR'S FIELD OFFICE

A. The Contractor shall establish and maintain a field office on this project and have available at the office a responsible representative who can officially receive communications from the Owner and the Engineer. The Contractor shall have one complete, up-to-date set of Drawings, Specifications and Contract Documents (including all Addenda and Change Orders) in this office at all times, available for reference at any time. The office shall be provided with telephone service, toilet facilities, light, air conditioning and heat; the cost of which shall be borne by the Contractor. Notices, instructions, orders, directions or other communications from the Engineer, left at this office, shall be considered as received by the Contractor.

B. Field office and utilities shall be in accordance with all applicable codes and ordinances.

1.02 RESIDENT PROJECT REPRESENTATIVE'S (RPR) FIELD OFFICE

A. Field office for the RPR is not required

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01520 - MAINTENANCE OF UTILITY OPERATIONS DURING CONSTRUCTION

PART 1 - GENERAL

1.01 REQUIREMENTS

A. The wastewater treatment plant shall be maintained in continuous operation during the entire construction period of this Contract as hereinafter specified. The intent of this section is to outline the minimum requirements necessary to provide continuous transference of wastewater throughout the construction period.

B. Work under this Contract shall be scheduled and conducted by the Contractor so as to not reduce the quality of near-by water streams or cause odor or other nuisance except as explicitly permitted hereinafter. In performing the work shown and specified, the Contractor shall plan and schedule his work to meet the plant operating requirements, and the constraints and construction requirements as outlined in this Section. No discharge of raw or inadequately treated wastewater shall be allowed. The Contractor shall pay all civil penalties, costs, and assessments associated with any discharge of raw or inadequately treated wastewater associated with the Contractor's work.

C. The Contractor shall be responsible for coordinating the general construction and for ensuring that permanent or temporary power is available for all existing, proposed, and temporary facilities that are required to be on line at any given time.

D. The Contractor has the option of providing additional temporary facilities that can eliminate a constraint, provided it is done without cost to the Owner and provided that all requirements of these Specifications are fulfilled and approved by the Engineer.

E. All tie-ins, replacement, or modifications Work shall be accomplished as quickly as possible. If Work required extends beyond 8-hours or weather causes higher flows in the existing system during the Work, the new Work shall be stopped and the existing system shall be placed back into service. The new Work shall be properly protected from damage. Any damage to the new Work or damage to surrounding areas caused by the new Work shall be repaired or replaced at the Owner's decision by the Contractor at the Contractor's sole expense.

1.02 TEMPORARY BYPASS PUMPING

A. Requirements for this section shall apply to all pumping required for Contractor to perform tie-ins, shutdowns, etc. for construction of the work. Temporary bypass pumping shall be performed in accordance with this section unless noted otherwise herein. Temporary pumping system design calculations and equipment information shall be submitted for review by Engineer per Section 01300. Calculations shall be stamped by a professional engineer registered in the Commonwealth of Kentucky.

B. Contractor shall furnish, install, maintain, and operate temporary bypass pumping facilities as required to complete the Work. Contractor shall be responsible for all construction necessary to accommodate pumps and piping including but not limited to structure modifications, pump base construction, pipe supports, etc.

C. The Contractor shall perform a test run of the bypass pumping set-up before being allowed to continue with the full scale bypass pumping.

D. Contractor shall design the temporary bypass pumping facilities to convey flows from the upstream manholes where existing manhole or sewer tie-ins, replacement, or modifications will be conducted in a manner that will prevent backup of the existing system.

E. All tie-ins, replacement, or modifications shall be performed during low flow conditions.

F. All tie-ins, replacement, or modifications Work shall be accomplished as quickly as possible. If Work required extends beyond 8-hours or weather causes higher flows in the existing system during the Work, the new Work shall be stopped and the existing system shall be placed back into service. The new Work shall be properly protected from damage. Any damage to the new Work or damage to surrounding areas caused by the new Work shall be repaired or replaced at the Owner's decision by the Contractor at the Contractor's sole expense.

G. Contractor shall provide all power, fuel, maintenance materials, parts, and other expendables in order to maintain temporary pumping through the duration of the Work.

H. Contractor shall provide one standby pump equal in capacity to the largest pump installed. If temporary pumping requires non-identical pumps in series, a standby pump of each type shall be provided. Temporary control system shall start standby pump on high level and dial-out to local contact who will respond and be on-site within an hour to check and address problem. High-high level shall also alarm and dial-out indicating that standby pump is not maintaining level. Temporary pumping system shall be provided by company that has spare pumps ready to be delivered and installed locally if problems occur.

I. Contractor shall provide standby power or 48-hour on-site fuel storage capacity for diesel engine type pumps to ensure continuous operation at all times.

J. Contractor shall provide sound attenuation for temporary pumping facilities to limit noise levels to no more than 85 dBA at a distance of 21 feet from the noise source.

K. Temporary pumping system shall remain fully operational until all modifications are complete and approved by Owner or Engineer.

L. Following successful completion of the new Work, Contractor shall remove all temporary pumps, piping and appurtenances and restore area and/or structures to original condition prior to start of work.

M. The Contractor shall schedule bypass pumping in regular monthly progress meetings, or a minimum of two (2) weeks before a scheduled bypass. The Contractor shall be responsible for notifying the Engineer of bypass pumping 48 hours in advance for coordination with the Division of Water Quality Project Manager and Division of Water. The Contractor will be responsible for filling required forms for coordination with the Division of Water Quality Project Manager and Division of Water. The bypass form will be provided to the Contractor after the Notice to Proceed.

1.03 MAINTENANCE OF PLANT OPERATION

A. This project involves modifications of the existing plant systems which interface with the existing treatment plant. Plant operations and finished water quality must be maintained throughout construction.

B. The Contractor will be responsible for supplying a sequence of construction shop drawing to the engineer for review prior to the beginning of any construction activities. The Contractor must note and follow the guidelines and requirements listed below:

   a. Coordination with the plant superintendent is necessary to take any basin out of service for installation of equipment.

   b. The construction process may require a basin(s) to be taken out of service for initial assembly, installation, put back in service, and taken out of service for final equipment installation.

1.04 SUBMITTALS

C. The Contractor shall submit a sequence of construction prior to the beginning of any construction activities.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01530 - PROTECTION OF EXISTING FACILITIES

PART 1 - GENERAL

1.01 REQUIREMENTS

A. Contractor shall be responsible for the preservation and protection of property adjacent to the work site against damage or injury as a result of his operations under this Contract. Any damage or injury occurring on account of any act, omission or neglect on the part of the Contractor shall be restored in a proper and satisfactory manner or replaced by and at the expense of the Contractor to an equal or superior condition than previously existed.

B. Contractor shall be responsible for locating all underground utilities in accordance with applicable regulation. Locations and elevations of all existing utilities shall be accurately marked on record drawings.

C. Contractor shall comply promptly with such safety regulations as may be prescribed by the Owner or the local authorities having jurisdiction and shall, when so directed, properly correct any unsafe conditions created by, or unsafe practices on the part of, his employees. In the event of the Contractor's failure to comply, the Owner may take the necessary measures to correct the conditions or practices complained of, and all costs thereof will be deducted from any monies due the Contractor. Failure of the Engineer to direct the correction of unsafe conditions or practices shall not relieve the Contractor of his responsibility hereunder.

D. In the event of any claims for damage or alleged damage to property as a result of work under this Contract, the Contractor shall be responsible for all costs in connection with the settlement of or defense against such claims. Prior to commencement of work in the vicinity of property adjacent to the work site, the Contractor, at his own expense, shall take such surveys as may be necessary to establish the existing condition of the property. Before final payment can be made, the Contractor shall furnish satisfactory evidence that all claims for damage have been legally settled or sufficient funds to cover such claims have been placed in escrow, or that an adequate bond to cover such claims has been obtained.

1.02 PROTECTION OF WORK AND MATERIAL

A. During the progress of the work and up to the date of final payment, the Contractor shall be solely responsible for the care and protection of all work and materials covered by the Contract.

B. All work and materials shall be protected against damage, injury or loss from any cause whatsoever, and the Contractor shall make good any such damage or loss at his own expense. Protection measures shall be subject to the approval of the Engineer.

1.03 BARRICADES, WARNING SIGNS AND LIGHTS

A. The Contractor shall provide, erect and maintain as necessary, strong and suitable barricades, danger signs and warning lights along all roads accessible to the public, as required by the Manual on Uniform Traffic Control Devices or as required by the authority having jurisdiction, to insure safety to the public. All barricades and obstructions along public roads shall include reflective material, shall be illuminated at night, and all lights for this purpose shall be kept burning from sunset to sunrise.

B. Contractor shall provide and maintain such other warning signs and barricades in areas of and around their respective work as may be required for the safety of all those employed in the work, the Owner's operating personnel, or those visiting the site.

1.04 EXISTING UTILITIES AND STRUCTURES

A. The term existing utilities shall be deemed to refer to both publicly-owned and privately-owned utilities such as electric power and lighting, telephone, water, gas, storm drains, sanitary sewers and all appurtenant structures.

B. Where existing utilities and structures are indicated on the Drawings, it shall be understood that all of the existing utilities and structures affecting the work may not be shown and that the locations of those shown are approximate only. It shall be the responsibility of the Contractor to ascertain the actual extent and exact location of existing utilities and structures. In every instance, the Contractor shall notify the proper authority having jurisdiction and obtain all necessary directions and approvals before performing any work in the vicinity of existing utilities.

C. Prior to beginning any excavation work, the Contractor shall, through field investigations, determine any conflicts or interferences between existing utilities and new utilities to be constructed under this project. This determination shall be based on the actual locations, elevations, slopes, etc., of existing utilities as determined in the field investigations, and locations, elevation, slope, or other information of new utilities as shown on the Drawings. If an interference exists, the Contractor shall bring it to the attention of the Engineer as soon as possible. If the Engineer agrees that an interference exists, he shall develop a plan to address the interference as required, and obtain the Owner's approval. Additional costs to the Contractor for this change shall be processed through a Change Order as detailed elsewhere in these Contract Documents. In the event the Contractor fails to bring a potential conflict or interference to the attention of the Engineer prior to beginning excavation work, any actual conflict or interference which does arise during the Project shall be corrected by the Contractor, as directed by the Engineer, at no additional expense to the Owner.

D. The work shall be carried out in a manner to prevent disruption of existing services and to avoid damage to the existing utilities. Temporary connections shall be provided, as required, to insure uninterruption of existing services. Any damage resulting from the work of this Contract shall be promptly repaired by the Contractor at his own expense in a manner approved by the Engineer and further subject to the requirements of any authority having jurisdiction. Where it is required by the authority having jurisdiction that they perform their own repairs or have them done by others, the Contractor shall be responsible for all costs thereof.

E. Where excavations by the Contractor require any utility lines or appurtenant structures to be temporarily supported and otherwise protected during the construction work, such support and protection shall be provided by the Contractor. All such work shall be performed in a manner satisfactory to the Engineer and the respective authority having jurisdiction over such work. In the event the Contractor fails to provide proper support or protection to any existing utility, the Engineer may, at his discretion, have the respective authority to provide such support or protection as may be necessary to insure the safety of such utility, and the costs of such measures shall be paid by the Contractor. This is not a pay item.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01540 - DEMOLITION AND REMOVAL OF EXISTING STRUCTURES AND EQUIPMENT

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. This Section covers the demolition, removal, and disposal of structures, pavement, curbs, sidewalk, and any existing equipment. The Contractor shall furnish all labor, materials and equipment to demolish and remove structures and equipment designated to be removed on Drawings.

1.02 TITLE TO EQUIPMENT AND MATERIALS

A. Contractor shall have no right or title to any of the equipment, materials or other items to be removed from the existing structures unless authorized by Owner.

1.03 CONDITION OF STRUCTURES AND EQUIPMENT

A. The Owner does not assume responsibility for the actual condition of structures and equipment to be demolished and removed.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 DEMOLITION AND REMOVALS

A. The removal of all equipment and piping, and all materials from the demolition of structures, when released by the Owner and Engineer, shall be done by the Contractor and shall become the Contractor's property, unless otherwise noted, for disposition in any manner not contrary to the Contract requirements and shall be removed from the site to the Contractor's own place of disposal.

B. Any equipment piping and appurtenances removed without proper authorization, which are necessary for the operation of the existing facilities shall be replaced to the satisfaction of the Engineer at no cost to the Owner.

C. Excavation caused by demolitions shall be backfilled with fill free from rubbish and debris.

D. All materials removed by demolition or excavation shall be lawfully and properly handled and disposed according to applicable local, state, and federal laws. Where materials shall be disposed at landfill, manifests and documentation shall be provided to Owner showing / documenting that materials have been properly handled and disposed.

E. Manhole frames and covers that have been removed shall become the property of the Contractor and shall be disposed on in a legal manner.

END OF SECTION

SECTION 01550 - SITE ACCESS AND STORAGE

PART 1 - GENERAL

1.01 REQUIREMENTS

A. Access Roads

1. The Contractor shall construct and maintain such temporary access roads as required to perform the work of this Contract.

2. Access roads shall be located within the property lines of the Owner unless the Contractor independently secures easements for his use and convenience. Contractor shall submit written documentation to the Engineer for any Contractor secured easements across privately held property. Easement agreement shall specify terms and conditions of use and provisions for site restoration. A written release from the property owner certifying that all terms of the easement agreement have been complied by the Contractor shall be furnished to the Engineer prior to final payment.

3. Existing access roads used by the Contractor shall be suitably maintained by the Contractor at his expense during construction. Contractor shall not be permitted to restrict Owner access to existing facilities. Engineer may direct Contractor to perform maintenance of existing access roads when Engineer determines that such work is required to insure all weather access by the Owner.

4. The Contractor will maintain the primary roads to be free of mud and dirt. All mud and dirt carried from the access roads to the primary roads shall be washed and cleaned immediately.

5. The Contractor shall obtain and pay all cost associated with any bonds required by the Kentucky Department of Transportation for the use of State maintained roads.

6. The primary access to the facility for this work will be from Ashgrove Pike.

7. Contractor shall maintain the road surface of the plant access road from Ashgrove Pike throughout construction. This shall include undercutting and backfilling areas which have failed or pumped, at the direction of the Engineer. Maintenance shall include patching of potholes with asphalt using "cold patch" or "hot mix", whichever is available during the maintenance period. Any additional pavement outside of the designated haul route that needs repair during construction or after construction shall be incidental to the project, and will not be paid for by the Owner.

B. Parking Areas

1. Contractor shall construct and maintain suitable parking areas for his construction personnel on the project site where approved by the Engineer and the Owner.

C. Restoration

1. At the completion of the Work, the surfaces of land used for access roads and parking areas shall be restored by the Contractor to its original condition and to the satisfaction of the Engineer.

D. Traffic Regulations

1. Contractor shall obey all traffic laws and comply with all the requirements, rules and regulations of the Kentucky Transportation Cabinet, LFUCG, and other local authorities

having jurisdiction to maintain adequate warning signs, lights, barriers, etc., for the protection of traffic on public roadways.

E. Storage of Equipment and Materials

1. Contractor shall store his equipment and materials at the job site in accordance with the requirements of the Contract Documents, and as hereinafter specified. All equipment and materials shall be stored in accordance with manufacturer's recommendations and as directed by the Owner or Engineer, and in conformity to applicable statutes, ordinances, regulations and rulings of the public authority having jurisdiction.

2. Contractor shall secure a site for staging area and material storage, including portable restroom facilities. Contractor shall not store materials or encroach upon private property without the written consent of the owners of such private property. Use of public lands must be with the written approval of the Owner.

3. Contractor shall not store unnecessary materials or equipment on the job site, and shall take care to prevent any structure from being loaded with a weight which will endanger its security or the safety of persons.

4. Materials shall not be placed within ten (10) feet of fire hydrants. Gutters, drainage channels and inlets shall be kept unobstructed at all times.

5. Contractor shall provide adequate temporary storage buildings/facilities, if required, to protect materials or equipment on the job site.

6. Contractor shall provide Engineer with copy of agreement with property owner of staging area. Contractor will be responsible for all restoration. Agreement between Contractor and property owner shall include language holding the Owner harmless from responsibility and liability.

7. The Contractor shall not have storage of material within the floodway.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01560 - TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.01 GENERAL

A. Provide and maintain equipment and temporary construction, as necessary to provide controls over environmental and safety conditions at the construction site and adjacent areas. Remove physical evidence of temporary facilities at completion of Work.

B. Prohibited Construction Activities:

1. Disposing of excess or unsuitable excavated material in wetlands or floodplains, even with the permission of the property owner.

2. Locating stockpile storage areas in environmentally sensitive areas.

3. Indiscriminate, arbitrary, or capricious operation of equipment in any stream corridors, any wetlands, any surface waters, or outside the construction limits.

4. Pumping of sediment-laden water from trenches or other excavations directly into any surface waters, any stream corridors, any wetlands, or storm sewers; all such water will be properly filtered or settled to remove silt prior to release.

5. Discharging pollutants such as chemicals, fuels, lubricants, bituminous materials, raw sewage and other harmful waste into or alongside of rivers, streams, impoundments, or into natural or manmade channels leading thereto.

6. Permanent or unspecified alteration of the flow line of any stream.

7. Damaging vegetation outside of the construction area.

8. Disposal of trees, brush, and other debris in any stream corridors, any wetlands, any surface waters, or at unspecified locations.

9. Open burning of project debris without a permit.

10. Discharging injurious silica dust concentrations into the atmosphere resulting from breaking, cutting, chipping, drilling, buffing, grinding, polishing, shaping or surfacing closer than 200 feet to places of residences or commercial, professional, quasi-public or public places of human occupation.

11. Storing construction equipment and vehicles and/or stockpiling construction materials on property, public or private, not previously authorized for such purposes as noted in Section 01550.

12. Running well point or pump discharge lines through private property or public property and rights-of-way without an easement or the written permission of the property owner and the consent of the ENGINEER.

13. Non-compliance with the Contractor's, OSHA's, or the Owner's safety requirements.

14. Operations entailing the use of vibratory hammers or compactors outside the hours listed in Section 01010 - Summary of Work, or outside the hours allowed for construction by local ordinances or regulations.

1.02 SAFETY ADVISORY

A. Scope:

1. Maintaining jobsite safety
2. Maintaining traffic safety

B. LFUCG-funded projects have a contractual and legal obligation for performance and breech of contract in regard to the safety of all exposed personnel. Reference the Occupational Safety Health Administration (OSHA) Multi Employer Citation Policy: Multi-employer Worksites, The Creating Employer, The Exposing Employer, The Correcting Employer, The Controlling Employer, Multiple Roles.

C. The Contractor shall at all times conduct the work safely in order to assure a safe work site. The Contractor shall be responsible for the safety of the Contractor's employees, agents and subcontractors, Owner's personnel and all other personnel or persons at the work site. The Contractor shall be responsible for the adequacy and safety of all construction methods or procedures and the safe prosecution of the work.

D. The Contractor shall be responsible at all times to conduct the work and keep the work site in compliance with federal, state, and local safety Laws and Regulations, including but not limited to Occupational Safety and Health (OSHA) requirements. This includes shaft drilling operations, concrete moving and placement, confined space entry requirements for trench construction, including use of a trench box or other shoring to support trench walls and proper means of exit from an excavation.

E. The Contractor shall have an authorized and competent safety representative as defined above on the work site at frequent and regular intervals, or more often, as conditions require. Failure to have such a person at the site as specified herein constitutes an unsafe practice.

F. The Contractor shall be responsible to suspend Work whenever a Work method or procedure or condition at work site is unsafe.

G. The Contractor shall submit a written notification to the Owner of any accident or injury. Such notification shall include the Contractor's investigation and what measures are appropriate to avoid such accidents. Payment applications will not be authorized until such notice is provided.

H. Failure of the Contractor to comply with any provision of this Specification section or the Owner's safety requirements or any federal, state or local safety Laws and Regulations constitute just cause for the Owner to order suspension of Work.

I. None of the provisions of the section are intended to, nor shall be construed to, create any duty or responsibility on the Owner or Engineer to provide or enforce safety requirements of the Contractor. The duty, responsibility, and liability for safety shall remain with the Contractor.

1.03 AIR POLLUTION AND NOISE CONTROL

A. Contractor's vehicles and equipment shall be such as to minimize noise to the greatest degree practicable. Noise levels shall conform to the latest OSHA standards and in no case will noise levels be permitted which interfere with the work of the Owner or others.

1. Construction activities will be limited to hours specified in Section 01010 – Summary of Work.

2. Construction equipment will be provided with intake silencers and mufflers, as required by safety standards.

3. All construction vehicles should be equipped with proper emissions control equipment.

4. Periodically check equipment and machinery for proper tuning to minimize exhaust emissions and noise.

1.04 DUST CONTROL

A. Contractor shall be responsible for controlling objectionable dust caused by his operation of vehicles and equipment, clearing or for any reason whatever. Contractor shall apply water or use other methods subject to the Engineer's approval which will keep dust in the air to a minimum. Dust control measures shall be implemented multiple times throughout each working day if necessary.

1.05 PEST AND RODENT CONTROL

A. Provide rodent and pest control as necessary to prevent infestation of construction or storage area.

1. Employ methods and use materials which will not adversely affect conditions at the site or on adjoining properties.

1.06 WATER CONTROL

A. Contractor shall comply with the Storm Water Pollution Prevention Plan (SWPPP) approved by LFUCG.

B. Provide methods to control surface water and water from excavations and structures to prevent damage to the Work, the site, or adjoining properties.

C. Provide, operate and maintain equipment and facilities of adequate size to control surface water.

D. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the site or to adjoining areas and in conformance with all environmental requirements.

1.07 POLLUTION CONTROL

A. Provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations.

B. Provide equipment and personnel, perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids.

1. Excavate and dispose of any contaminated earth offsite, and replace with suitable compacted fill and topsoil.

C. Take special measures to prevent harmful substances from entering public waters.

1. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, or in sanitary or storm sewers.

D. Provide systems for control of atmospheric pollutants.

1. Prevent toxic concentrations of chemicals.
2. Prevent harmful dispersal of pollutants into the atmosphere.

E. All Contractor's equipment used during construction shall conform to all current federal, state and local laws and regulations.

1.08 EROSION AND SEDIMENT CONTROL

A. See Section 02372 for erosion and sediment control requirements.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01570 - TRAFFIC REGULATION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Construction parking control.

B. Flagmen.

C. Flares and lights.

D. Haul routes.

E. Removal.

1.02 RELATED SECTIONS

A. Section 01005 – Special Conditions

B. Section 01530 – Protection of Existing Facilities

1.03 SUBMITTAL

A. Contractor to submit a Traffic Control Plan to the Engineer for review prior to the commencement of construction.

PART 2 - PRODUCTS

2.01 SIGNS AND DEVICES

A. Traffic Cones and Drums, Signage, Flares and Lights: as required/approved by federal, state, and local jurisdictions.

B. Flagman Equipment: as required by federal, state, and local jurisdictions.

C. All signs and control of traffic shall be in accordance with the Manual on Uniform Traffic Control Devices for Streets and Highways, latest edition, and safety requirements shall comply with the Permits Manual.

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 non-designated 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 county and state 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 and County requirements.

D. The Contractor shall be responsible for complying with appropriate temporary traffic control as described in the latest edition of the Manual on Uniform Traffic Control Devices, in accordance with the KYTC Encroachment Permit.

E. The Contractor shall advise the Engineer and KYTC District 7 Public Information Officer and local media of the location and duration of any proposed lane closures, a minimum of three (3) days prior to the closure. The KYTC District 7 Information Officer's contact information is NatashF.Lacy@ky.gov, or (all perm859) 246-2355.

F. No more than one (1) traveled-lane shall be blocked or obstructed during normal working hours. All signs and flaggers during lane closures shall conform with the Manual on Uniform Traffic Control Devices.

G. When necessary to block one (1) traveled-lane of Ashgrove Pike, the normal working hours shall be between 9:00 am and 3:30 pm. No lanes shall be blocked during normal adverse weather conditions (rain, snow, fog, etc.).

H. No nonconstruction equipment or vehicles or office trailers shall be allowed on the right of way during working hours.

I. The right of way shall be left free and clear of equipment, material, and vehicles during non-working hours.

J. All workers within the right of way shall wear high-visibility safety apparel that meets the performance Class 2 or 3 requirements of the ANSI/ISEA 107-2004 publication entitled "American National Standards for Safety Apparel and Headwear."

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 REMOVAL

Remove equipment and devices when no longer required.

- END OF SECTION -

SECTION 01580 – PROJECT IDENTIFICATION AND SIGNS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide signs 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.

PART 2 - PRODUCTS

2.01 IDENTIFICATION SIGN

A. Basic design shall be as shown in the sample on page 01580-2 below, and shall include at a minimum the names of the Project, the Owner, the Contractor, and the Engineer. This sign shall be 3' x 6' and provided and installed by the Contractor.

B. "Working Hard" sign (as shown on page 01580-3), if required, shall be provided by the Owner and mounted and installed by the Contractor. Contractor shall provide posts and backing.

C. Colors shall be as selected by the Engineer.

D. Number Required: Two (2)

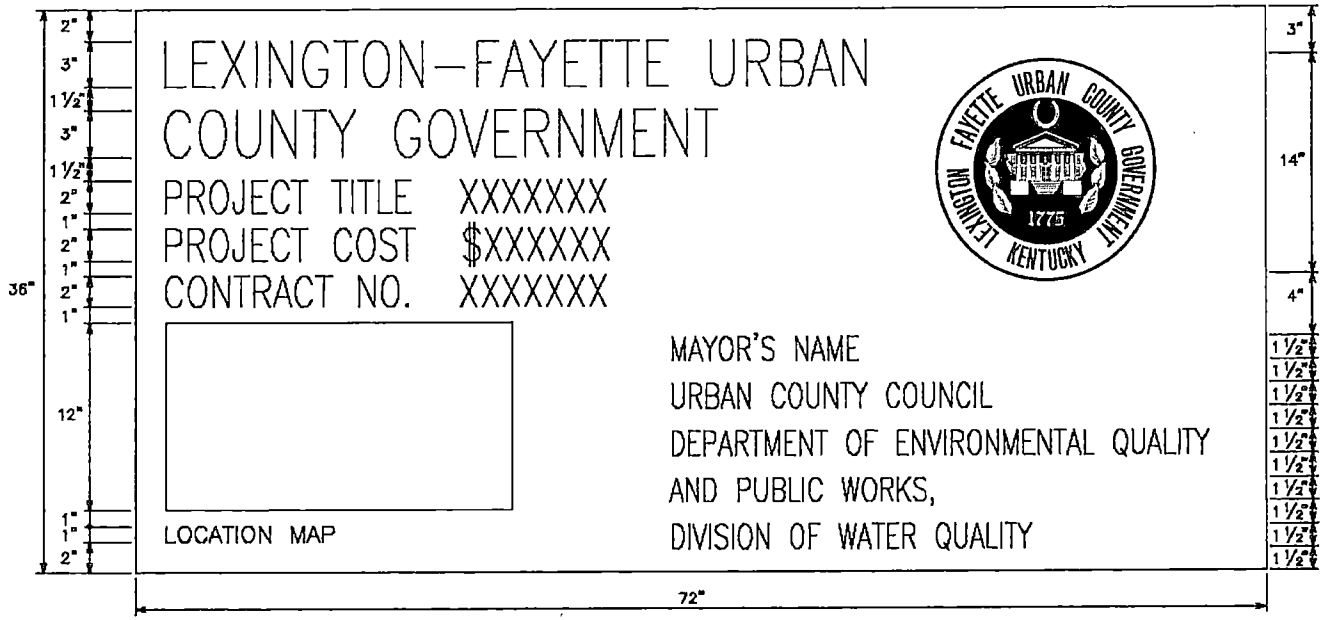
PART 3 - EXECUTION

3.01 INSTALLATIONS

A. Signs shall be installed at locations specified by the Engineer and installed in accordance with the detail below.

3.02 MAINTENANCE

A. The signs shall be maintained in good condition until the completion of the Project and then removed by the Contractor.



NOTES:

THIS SIGN SHALL BE:

1. FURNISHED AND ERECTED BY THE CONTRACTOR AT THE CONTRACTOR'S EXPENSE, IN ADDITION TO THE NORMAL WARNING AND REGULATORY SIGNS.
2. OF GOOD QUALITY EXTERIOR PLYWOOD OR OTHER APPROVED MATERIAL.
3. PAINTED WITH SOLID BLUE LETTERS ON A WHITE BACKGROUND.
4. UPDATED AS NEEDED TO INDICATE THE APPROPRIATE MAYOR'S NAME.
5. FRAMED AND BRACED SO AS TO REMAIN VERTICAL AND PLAINLY VISIBLE TO THE TRAVELING PUBLIC.
6. ERECTED PRIOR TO STARTING CONSTRUCTION WORK.
7. ERECTED AT EACH END OF THE PROJECT AT LOCATIONS DIRECTED BY THE ENGINEER AND AT OTHER LOCATIONS SPECIFIED ON THE PLANS OR IN THE PROPOSAL.
8. KEPT CLEAN AND IN GOOD CONDITION FOR THE DURATION OF THE CONSTRUCTION AS DIRECTED BY THE ENGINEER.
9. THE COST SHOWN APPLIES ONLY TO THE PORTION OF PROJECT UNDER CONSTRUCTION IN A CONTINUOUS SECTION. IN THE EVENT THE PROJECT CONSISTS OF MORE THAN ONE CONTINUOUS SECTION THE COST SHOWN SHALL BE FOR THE PARTICULAR SECTION WHERE WORK IS IN PROGRESS.

PUBLIC IMPROVEMENT SIGN EXHIBIT

END OF SECTION

SECTION 01631 - PRODUCTS AND SUBSTITUTIONS

PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. General: Substitution of materials and/or equipment is defined in the General Conditions and more fully hereinafter.

B. Substitutions: The Contractor's requests for changes in the products, materials, equipment and methods of construction required by the Contract Documents are considered requests for "substitutions", and are subject to the requirements specified herein. The following are not considered as substitutions:

1. Revisions to the Contract Documents, where requested by the Owner and Engineer are considered as "changes" not substitutions.

2. Substitutions requested during the bidding period, which have been accepted prior to the Contract Date, are included in the Contract Documents and are not subject to the requirements for substitutions as herein specified.

3. Specified Contractor options on products and construction methods included in the Contract Documents are choices available to the Contractor and are not subject to the requirements for substitutions as herein specified.

4. Except as otherwise provided in the Contract Documents, the Contractor's determination of and compliance with governing regulations and orders as issued by governing authorities do not constitute "substitutions" and do not constitute a basis for change orders.

1.02 SUBMITTALS

A. The information required to be furnished for evaluation of product substitution will be as follows:

1. Performance capabilities, and materials and construction details will be evaluated based upon conformance with the Specifications. Products that do not conform with the Specification shall not be accepted.

2. Manufacturer's production and service capabilities, and evidence of proven reliability will be acceptable if the following is furnished.

   a. Written evidence that the manufacturer has not less than (3) years experience in the design and manufacture of the substitute product.

   b. Written evidence of at least one application, of a type and size similar to the proposed substitute product, in successful operation in a wastewater treatment plant or collection system for a period of at least one year.

   c. In lieu of furnishing evidence of a manufacturer's Experience and successful operation of an application of the product to be substituted, the Contractor has the option of furnishing a cash deposit or bond which will guarantee replacement if the product the furnished does not satisfy the other requirements specified in this section. The amount of each deposit or bond will be subject to the approval.

3. Specific reference to characteristics either superior or inferior to specified requirements will be evaluated based on their net effect on the project. Products with any characteristics inferior to those specified will not be acceptable unless offset by

characteristics that, in the opinion of the Engineer, will cause the overall effect of the product on the project to be at least equal to that of those specified.

1.03 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same generic kind, from a single source, for each unit of work.

B. Compatibility of Options: Compatibility of products is a basic requirement of product selection. When the Contractor is given the option of selecting between two or more products for use on the project, the product selected must be compatible with other products previously selected, even if the products previously selected were also Contractor options. The complete compatibility between the various choices available to the Contractor is not assured by the various requirements of the Contract Documents, but must be provided by the Contractor.

C. The detailed estimate of operating and maintenance costs will be evaluated based on comparison with similar data on the specified products. Proposed substitute products which have an operating and maintenance cost that, in the opinion of the Engineer, exceeds that of the specified products will not be considered equal and will not be acceptable.

D. All equipment provided under this Contract shall meet all the requirements of the Federal and/or State Occupational Health Acts. Each equipment supplier shall submit to the Engineer certification that the equipment furnished is in compliance with OSHA.

E. The design, testing, assembly and methods of installation of the wiring materials, electrical equipment and accessories proposed under this Contract shall conform to the National Electrical Code and to applicable State and local requirements. UL listing and labeling shall be adhered to under this Contract. Any equipment that does not have a UL, FM, CSA, or other listed testing laboratory label shall be furnished with a notarized letter signed by the supplier stating that the equipment furnished has been manufactured in accordance with the Nation Electrical Code and OSHA requirements. Any additional cost resulting from any deviation from code or local requirements shall be borne by the Contractor.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Deliver, store, and handle products in accordance with manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft. Control delivery schedules to minimize long-term storage at the site and to prevent overcrowding of construction spaces. In particular coordinate delivery and installation to ensure minimum holding or storage times for items known or recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss.

1. Deliver products to the site in the manufacturer's sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.

2. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.

3. Store heavy materials away from the project construction in a manner that will not endanger the supporting construction.

PART 2 - PRODUCTS

2.01 GENERAL PRODUCT COMPLIANCE

A. General: Requirements for individual products are indicated in the Contract Documents; compliance with these requirements is in itself a Contract Requirement. These requirements may be specified in any one of several different specifying methods, or in any combination of these methods. These methods include the following:

1. Proprietary
2. Descriptive
3. Performance
4. Compliance with Reference Standards

Compliance with codes, compliance with graphic details and similar provisions of the Contract Documents also have a bearing on the review and approval outcome.

B. Procedures for Selecting Products: Contractor's options in selecting products are limited by requirements of the Contract Documents and governing regulations. They are not controlled by industry traditions or procedures experienced by the Contractor on previous construction projects.

2.02 SUBSTITUTIONS

A. Conditions: Contractor's request for substitution will be received and considered when extensive revisions to the Contract Documents are not required, when the proposed changes are in keeping with the general intent of the Contract Documents, when the request is timely, fully documented and properly submitted, and when one or more of the following conditions is satisfied, all as judged by the Engineer; otherwise the requests will be returned without action except to record non-compliance with these requirements.

1. The Engineer will consider a request for substitution where the request is directly related to an "or equal" clause or similar language in the Contract Documents.

2. The Engineer will consider a request for substitution where the specified product or method cannot be provided within the Contract Time. However, the request will not be considered if the product or method cannot be provided as a result of the Contractor's failure to pursue the work promptly or to coordinate the various activities properly.

3. The Engineer will consider a request for substitution where the specified product or method cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

4. The Engineer will consider a request for a substitution where a substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. These additional responsibilities may include such considerations as additional compensation to the Engineer for redesign and evaluation services, the increased cost of other work by the Owner or separate contractors, and similar considerations.

5. The Engineer will consider a request for substitution when the specified product or method cannot be provided in a manner which is compatible with other materials of the work, and where the Contractor certifies that the substitution will overcome the incompatibility.

6. The Engineer will consider a request for substitution when the specified product or method cannot be properly coordinated with other materials in the work, and where the Contractor certifies that the proposed substitution can be properly coordinated.

7. The Engineer will consider a request for substitution when the specified product or method cannot receive a warranty as required by the Contract Documents and where the Contractor certifies that the proposed substitution receive the required warranty.

8. The Contractor shall reimburse the Owner any costs for review by the Engineer of proposed product substitutions which require major design changes, as determined by the Owner, to related or adjacent work made necessary by the proposed substitutions.

B. Work-Related Submittals: Contractor's submittal of and the Engineer's acceptance of shop drawings, product data or samples which relate to work not complying with requirements of the Contract Documents, does not constitute an acceptable or valid request for a substitution, nor approval thereof.

2.03 GENERAL PRODUCT REQUIREMENTS

A. General: Provide products that comply with the requirements of the Contract Documents and that are undamaged and, unless otherwise indicated, unused at the time of installation. Provide products that are complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

1. Standard Products: Where they are available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

2. Continued Availability: Where, because of the nature of its application, the Owner is likely to need replacement parts or additional amounts of a product at a later date, either for maintenance and repair or replacement, provide standard, domestically produced products for which the manufacturer has published assurances that the products and its parts are likely to be available to the Owner at a later date.

PART 3 - EXECUTION

3.01 INSTALLATION OF PRODUCTS

A. General: Except as otherwise indicated in individual sections of these Specifications, comply with the manufacturer's instructions and recommendations for installation of the products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other work. Clean exposed surfaces and protect surfaces as necessary to ensure freedom from damage and deterioration at Time of Acceptance.

END OF SECTION

SECTION 01731 - CUTTING AND PATCHING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes procedural requirements for cutting and patching existing structures.

B. The Contractor shall be responsible for all cutting, fitting or patching that may be required to complete the work or to make its parts fit together properly.

C. The Contractor shall not damage or endanger any portion of the Work or the Work of the Owner or any separate contractors by cutting, patching or otherwise altering any work, or by excavation.

D. Any cutting of existing structures or facilities shall be approved in advance by Owner or Engineer. Approval shall not impact Contractor's full liability for any damage caused.

1.02 QUALITY ASSURANCE

A. Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that result in increased maintenance or decreased operational life or safety.

1.03 WARRANTY

A. Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials, to the extent practicable.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the functional performance of existing materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

3.02 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

3.03 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.

5. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

END OF SECTION

SECTION 01740 - CLEANING

PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. Maintain premises free from accumulations of waste, debris, and rubbish.

B. At completion of work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all exposed surfaces. Leave project clean and ready for occupancy.

1.02 RELATED DOCUMENTS

A. Cutting and Patching: Section 01731.

B. Project Closeout: Section 01770.

C. Cleaning for Specific Products of Work: Specification Section for that work.

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 noxious substances.

B. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

1. Do not burn or bury rubbish and waste materials on project site.

2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in 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 building, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.

B. Wet down dry materials and rubbish to lay dust and prevent 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 Owner's property.

F. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

G. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

3.02 FINAL CLEANING

A. Employ experienced workmen, or professional cleaners, for final cleaning.

B. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.

C. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from sight-exposed interior or exterior finished surfaces; polish surfaces so designated to shine finish.

D. Repair, patch and touch up marred surfaces to specified finish, to match adjacent surfaces.

E. Broom clean paved surfaces; rake clean other surfaces of grounds.

F. Maintain cleaning until project, or portion thereof, is occupied by Owner.

END OF SECTION

SECTION 01770 - PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Liquidated Damages: Supplemental General Conditions

B. Cleaning: Section 01740.

C. Project Record Documents: Section 01785.

1.02 SUBSTANTIAL COMPLETION

A. In order to initiate project closeout procedures, the Contractor shall submit the following:

1. Written certification to Engineer that project is Substantially Complete.

2. List of major items to be completed or corrected.

B. Engineer will make an inspection within seven (7) 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 01740.

   b. Owner will occupy Project, under provisions stated in Certificates of Substantial Completion.

4. Contractor: Complete work listed for completion or correction, within designated time.

D. Should Engineer consider that work is not Substantially Complete:

1. Engineer shall immediately notify Contractor, in writing, stating reasons.

2. Contractor: Complete work, and send second written certification to Engineer, certifying that Project or designated portion of Project is substantially complete.

3. Engineer will reinspect work.

E. Should Engineer consider that work is still not finally complete:

1. Engineer shall notify Contractor, in writing, stating reasons.

2. Contractor shall take immediate steps to remedy the stated deficiencies and send third written notice to the Engineer certifying that the work is complete.

3. Engineer and Owner will reinspect work at Contractor's expense.

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. Engineer 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 CLOSEOUT SUBMITTALS

A. Project Record Documents: To requirements of Section 01785.

B. Guarantees, Warranties and Bonds: To requirements of particular technical Specifications and Section 01782.

1.05 INSTRUCTION

A. Instruct Owner's personnel in operation of all systems, mechanical, electrical, and other equipment.

1.06 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit final applications in accordance with requirements of General Conditions.

1.07 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.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01780 – OPERATIONS AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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. 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.

C. Related requirements specified elsewhere:

1. Submittals: Section 01300.
2. Project Closeout: Section 01770.
3. Project Record Documents: Section 01785.
4. Warranties and Bonds: Section 01782.

1.02 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 in. x 11 in.
2. Paper: 20 pound minimum, white.
3. Text: Manufacturer's printed data.
4. Photo copies must be clear and legible.
5. Drawings:
   a. Provide reinforced punched binder tab, bind in with text.
   b. Fold large drawings to the size of the text pages where feasible.
   c. For flow or piping diagrams that cannot be detailed on the standard size drawings, a larger, appropriate size drawing may be submitted and supplied in a properly marked map packet.
6. 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.
7. 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" D-ring binders, with oil and moisture resistant hard covers.

2. When multiple binders are used, correlate the data into related consistent grouping.

3. Imprinted on the front cover and side of each binder shall be the name of the Plant, the Contract Number and Volume Number.

4. Binders shall be new and not recycled form a prior data manual.

D. Each Equipment O & M manual shall be provided with an electronic disk, matching the content of the final approved printed O & M manual. The information shall be saved in a single pdf file, with bookmarks for each chapter, section, appendices, etc., as well as each piece of equipment. Where numerous pieces of equipment may be addressed within a section, a second tier of bookmarks shall be provided to allow quick access to each piece of equipment or key piece of information.

1.03 SUBMITTAL SCHEDULE

A. Submit one (1) copy of preliminary draft of proposed formats and outlines of contents prior to operation of equipment. Engineer will review draft and return with comments.

B. Submit one (1) copy of completed data for final review prior to the completion of the Contract and before payment in excess of 90% of the total Contract amount is authorized.

C. Provide two (2) copies plus pdf on CD of approved completed O & M Manual in final form ten (10) days prior to final inspection or acceptance to the Owner. Final version of each manual shall reflect any changes made during testing and start-up of equipment.

1.04 QUALITY ASSURANCE

A. Preparation of data shall be done by personnel:

1. Trained and experienced in maintenance and operation of the described products.

2. Completely familiar with requirements of this Section.

3. Skilled as a technical writer to the extent required to communicate essential data.

4. Skilled as a draftsman competent to prepare required drawings.

1.05 CONTENTS OF MANUAL

A. Each item of equipment shall be placed in a logical sequential order, as listed or ordered in the Contract Documents.

B. Content, for each unit of equipment and system, as appropriate:

1. Detailed description of the process and operation procedures as applicable.

2. Instructions for all components of the equipment whether manufactured by the supplier or

not, including valves, controllers and other miscellaneous components.

3. Description of unit and component parts.
   a. Function, normal operating characteristics, and limiting conditions.
   b. Performance curves, engineering data and tests.
   c. Complete nomenclature and commercial number of all replaceable parts.
   d. Exploded and/or sectional drawing views.
   e. Equipment model number.
4. Operating procedures:
   a. Start-up, break-in, routine and normal operating instructions.
   b. Regulation, control, stopping, shutdown and emergency instructions.
   c. Summer and winter operating instructions.
   d. Special operating instructions.
5. Maintenance Procedures:
   a. Routine operations.
   b. Guide to "trouble-shooting".
   c. Disassembly, repair and reassembly.
   d. Alignment, adjusting and checking.
   e. Preventative maintenance schedule.
   f. Recommended spare parts list and quantities.
   g. Equipment parts list.
   h. Local service center.
6. Servicing and Lubrication schedule.
   a. List of lubricants required.
   b. Lubrication procedures.
   c. Lubrication schedule.
7. Internal and external wiring and piping diagrams numbered to correspond to the installation.
8. Description of sequence of operation by control supplier.
9. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
   a. Predicted life of parts subject to wear.

10. As-installed control diagrams by controls supplier.

11. Each Contractor's coordination drawings.

    a. As-installed color coded piping diagrams.

12. Charts of valve tag numbers, with the location and function of each valve.

13. Other data as required under pertinent sections of Specifications.

C. Content, for each electrical system, as appropriate:

1. Description of system and component parts.

    a. Function, normal operating characteristics, and limiting conditions.

    b. Performance curves, engineering data and tests.

    c. Complete nomenclature and commercial number of replacement parts.

2. Circuit directories of panel boards.

    a. Electrical service.

    b. Controls.

    c. Communications.

3. As-installed color-coded wiring diagrams.

4. Operating procedures:

    a. Routine and normal operating instructions.

    b. Sequences required.

    c. Special operating instructions.

5. Maintenance procedures:

    a. Routine operations.

    b. Guide to "trouble-shooting".

    c. Disassembly, repair and reassembly.

    d. Adjustment and checking.

6. Manufacturer's printed operating and maintenance instructions.

7. List of original manufacturer's recommended spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

8. Other data as required under pertinent sections of Specifications.

D. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.

E. Additional requirements for operating and maintenance data: The respective section of Specifications.

F. The Contractor must provide as part of the O & M Manual a videotape of any training completed by the equipment representative.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01782 - WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

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. Submit to Engineer for review and transmittal to Owner.

1.02 RELATED DOCUMENTS

A. Bid Bond: Instructions to Bidders.

B. Performance and Payment Bonds: General Conditions and Supplemental General Conditions.

C. Guaranty: General Conditions and Supplemental General Conditions.

D. General Warranty of Construction: General Conditions.

E. Project Closeout: Section 01770.

F. Warranties and Bonds required for specific products: As listed herein.

G. Provisions of Warranties and Bonds, Duration: Respective specification sections for particular products.

1.03 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.

1.04 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.

a. 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.

1.05 TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during progress of construction:

1. 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.

D. Equipment Warranty will not begin until after successful start-up, training, and acceptance by Owner for Partial Utilization. Any manufacturer's request to initiate warranty period earlier than Owner's acceptance will not be valid.

E. Contractor warranty shall be a minimum of one (1) year after final acceptance of the completed project.

1.06 SUBMITTALS REQUIRED

A. Submit warranties, bonds, service and maintenance contracts as specified in the respective sections of the Specifications.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01785 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 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.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 01300.

1.03 MARKING DEVICES

A. Provide colored pencil or felt-tip marking pen for all marking.

1.04 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 surveyed and 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.

1.05 SUBMITTALS

A. At completion of project, deliver two hard copies and one CD with pdf of all 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.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

DIVISION 02

SITE CONSTRUCTION

SECTION 02110 - SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

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 COMPLIANCE

Conform to applicable local codes and ordinances for disposal of debris.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 REMOVAL OF EXISTING TREES AND OTHER VEGETATION

A. Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees that receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing. The Contractor shall not cut or injure any trees or other vegetation outside areas to be cleared, as indicated on the drawings, without written permission from the Engineer. The Contractor shall be responsible for all damages 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 necessary for pipe installation unless otherwise directed by the Engineer.

3.03 GRUBBING

From areas to be grubbed, the Contractor shall remove completely all stumps, remove to a depth of 12 inches all roots larger than 3-inch diameter, and remove to a depth of six (6) inches all roots larger than 1/2-inch diameter. Such depths shall be measured from 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 six (6) inches or to depths required by the Engineer. Do not strip topsoil in a muddy condition and avoid mixture of subsoil. Stockpile the stripped topsoil onsite for use in finish grading and site restoration. Topsoil stockpiled shall be free from trash, brush, stones over two (2) inches 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 DISPOSAL

A. All materials resulting from clearing and grubbing and not scheduled for reuse shall become the property of the Contractor and shall be suitably 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 the material and shall not be left until the final period of cleaning up.

- END OF SECTION -

SECTION 02225 - EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Excavating of trenches.

B. Bedding of pipe.

C. Backfilling trenches.

D. Installing identification tape.

PART 2 - PRODUCTS

2.01 BEDDING AND BACKFILLING STONE

A. Crushed Stone material shall conform to the Kentucky Transportation Cabinet's Standard Specifications for Road and Bridge Construction, Current Edition, latest revision.

B. Dense Grade Aggregate material shall conform to the Kentucky Transportation Cabinet's Standard Specifications for Road and Bridge Construction, Current Edition, latest revision.

C. Bedding Stone: No. 9 Crushed Limestone

D. Backfill Stone: No. 9 Crushed Limestone

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Trenching may be accomplished by means of a backhoe, trenching machine, hydro-excavation or by hand depending on the construction area.

B. Clearing - All trees, stumps, bushes, shrubbery, and abandoned concrete or masonry structures within the limits of the trench shall be removed by the Contractor and disposed of in accordance with federal, state and local regulations. All clearing work shall be considered as incidental to the cost of laying pipe.

C. Bracing and Sheeting - Bracing and sheeting shall be provided to adequately protect the workers during pipe line installation.

1. All requirements of the Occupational Safety and Health Act (OSHA) shall be met during trenching and backfill operations.

2. As backfill is placed, the sheeting shall be withdrawn in increments not exceeding one (1) foot and the void left by the withdrawn sheeting shall be filled and with #9 stone.

3. The Contractor is solely responsible for determining requirements for bracing or sheeting. The Owner or Engineer will not be responsible for determining these requirements.

3.02 TRENCHING

A. General:

1. The Contractor shall perform all excavation of every description and of whatever substances encountered, including clearing over the pipeline route. All excavations for the pipeline shall be open-cut except where noted for bore and jack.

B. Trench Width:

1. Trench widths shall be the outside diameter of the pipe plus 6-inch (minimum) to 12-inch (maximum) on each side of the pipe.

2. **Contractor shall submit a shop drawing that includes a certification from the pipe manufacturer stating the recommended trench width for each pipe size and material being used.**

C. Trench Depth:

1. The trench shall be excavated to a minimum of six (6) inches below pipe grade.

3.03 BLASTING AND EXPLOSIVES

A. No blasting is allowed.

3.04 PIPE BEDDING

A. The trench shall be excavated to a depth to allow a minimum of 36 inches cover over the top of the pipe.

B. Bedding shall be 6-inch (minimum) No. 9 crushed stone.

3.05 PIPE BACKFILLING

A. Backfill to 12-inches above pipe shall be No. 9 crushed stone. Remaining fill shall be soil, with no rock greater than 6-inches. Place topsoil final 6-inch fill, with no rock allowed.

3.06 INSTALLING IDENTIFICATION TAPE

A. Detectable underground marking tape shall be installed over all force mains. Marking tape is not required for gravity sewers. 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 plastic utility line below it, such as "Caution – Buried 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 green for sewer and brown for force main.

END OF SECTION

SECTION 02260 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section includes, but is not limited to, the following:

1. Shoring and bracing necessary to protect existing buildings, streets, walkways, utilities, and other improvements and excavation against loss of ground or caving embankments.

2. Maintenance of shoring and bracing.

3. Removal of shoring and bracing, as required.

B. Types of shoring and bracing systems include, but are not limited to, the following:

1. Steel H-section (soldier) piles.

2. Timber lagging.

3. Steel sheet piles.

4. Portable steel trench box.

C. Building excavation is specified in another Division 2 Section.

1.02 RELATED DOCUMENTS

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

1.03 QUALITY ASSURANCE

A. Engineer Qualifications: A professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing successful engineering services for excavation support systems similar in extent required for this Project.

B. Supervision: Engage and assign supervision of excavation support system to a qualified professional engineer foundation consultant.

C. Regulations: Comply with codes and ordinances of governing authorities having jurisdiction.

D. Layout drawings for excavation support system shall be prepared by, or under the supervision of, a qualified professional engineer. System design and calculations must be acceptable to local authorities having jurisdiction.

1.04 JOB CONDITIONS

A. Before starting work, verify governing dimensions and elevations. Verify condition of adjoining properties. Take photographs to record any existing settlement or cracking of structures, pavements, and other improvements. Prepare a list of such damages, verified by dated photographs, and signed by Contractor and others conducting investigation.

B. Survey adjacent structures and improvements, employing qualified professional engineer, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

C. During excavation, resurvey benchmarks weekly, maintaining accurate log of surveyed elevations for comparison with original elevations. Promptly notify Engineer if changes in elevations occur or if cracks, sags, or other damage is evident.

1.05 EXISTING UTILITIES

A. Protect existing active sewer, water, gas, electricity and other utility services and structures.

B. Notify municipal agencies and service utility companies having jurisdiction. Comply with requirements of governing authorities and agencies for protection, relocation, removal, and discontinuing of services.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Provide adequate shoring and bracing materials which will support loads imposed. Materials need not be new, but should be in serviceable condition.

B. Structural Steel: ASTM A 36.

C. Steel Sheet Piles: ASTM A 328.

D. Timber Lagging: Any species, rough-cut, mixed hardwood, nominal 3 inches thick, unless otherwise indicated.

E. Portable Steel Trench Box shall be OSHA approved.

PART 3 - EXECUTION

3.01 SHORING

A. Wherever shoring is required, locate the system to clear permanent construction and to permit forming and finishing of concrete surfaces. Provide shoring system adequately anchored and braced to resist earth and hydrostatic pressures.

B. Shoring systems retaining earth on which the support or stability of existing structures is dependent must be left in place at completion of work.

3.02 BRACING

A. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move a brace, install new bracing prior to removal of original brace.

B. Do not place bracing where it will be cast into or included in permanent concrete work, except as otherwise acceptable to Engineer.

C. Install internal bracing, if required, to prevent spreading or distortion of braced frames.

D. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

E. Remove sheeting, shoring, and bracing in stages to avoid disturbance to underlying soils and damage to structures, pavements, facilities, and utilities.

F. Repair or replace, as acceptable to Engineer, adjacent work damaged or displaced through installation or removal of shoring and bracing work.

END OF SECTION

SECTION 02371 – STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

PART 1 - GENERAL

1.01 GENERAL

A. Contractor shall prepare its own SWPPP and submit to LFUCG Division of Water Quality for approval. No additional payment will be allowed for the Erosion and Sediment Control and conformance with SWPPP.

B. The SWPPP, including an Erosion and Sediment Control Plan, shall be prepared by a professional engineer licensed in the Commonwealth of Kentucky, meeting all of the requirements of KYR10 and Chapter 16-Article X, Division 5 of the LFUCG Code of Ordinances.

SECTION 02372 - EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, and equipment required for installing, maintaining, amending, and removing temporary soil erosion, sediment, and pollutant controls as shown in the Stormwater Pollution Prevention Plan (SWPPP) and as specified herein and as required by the LFUCG Land Disturbance Permit, Chapter 16-Article X, Division 5 of the LFUCG Code of Ordinances, and the KPDES General Permit for Stormwater Discharges Associated with Construction Activities (KYR10).

B. The Contractor shall take all site management measures necessary to minimize erosion and contain sediment, construction materials (including excavation and backfill), and pollutants (such as chemicals, fuels, lubricants, bitumen, raw sewage, and other harmful waste) and prevent them from being discharged into or alongside any body of water or into natural or man-made channels leading thereto.

C. The Contractor shall at all times minimize disturbance and the period of time that the disturbed area is exposed without stabilization practices. In "critical areas" (within 25 feet of a stream) erosion prevention measures such as erosion control mats/blankets, mulch, or straw blown in and stabilized with tackifiers or by treading, etc. shall be implemented on disturbed areas within 24 hours or "as soon as practical" after completion of disturbance/grading or following cessation of activities.

D. Temporary erosion controls include, but are not limited to grassing, mulching, seeding, providing erosion control and turf reinforcement mats 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.

E. Temporary sedimentation controls include, but are not limited to, silt dams, traps, barriers, and appurtenances on sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits.

F. Contractor is responsible for providing and maintaining effective temporary erosion and sediment control measures prior to and during construction or until final controls become effective.

G. Prior to construction, the Contractor shall obtain, if necessary, a LFUCG Land Disturbance Permit and shall obtain coverage under the KPDES General Permit for Stormwater Discharges Associated with Construction Activities (KYR10) (see Article 3.24 in this Section). The Contractor shall be responsible for placement of pollutant, erosion, and sedimentation controls as shown in the Stormwater Pollution Prevention Plan (SWPPP) prior to excavation, fill or grade work. If during the course of construction, the state and/or LFUCG determine additional controls are required, the Contractor shall furnish, install and maintain additional mulch, blankets, sediment barriers, and/or other controls as necessary to control pollution, erosion, and sedimentation to the satisfaction of the regulatory agency.

H. The Contractor shall inspect and repair all erosion and sedimentation controls as follows:

1. At least once every seven (7) calendar days, and

2. Within 24 hours after any storm event of 0.5 inch or greater.

I. Final stabilization practices on those portions of the project where construction activities have permanently ceased shall be initiated within fourteen (14) days of the date of cessation of

construction activities. Temporary stabilization practices on those portions of the project where construction activities have temporarily ceased shall be initiated within fourteen (14) days of the date of cessation of construction activities.

J. **Erosion and Sediment Control prevention measures shall be installed prior to removal of vegetation and/or stripping of topsoil.** The Contractor is responsible for preparing and submitting the state Notice of Intent and attachments and obtaining state permit approval prior to the beginning of any construction activities.

1.02 PERMITS AND NOTIFICATION REQUIREMENTS

A. The Contractor is responsible to prepare a Stormwater Pollution Prevention Plan (SWPPP) for inclusion with permit submittals. The SWPPP, including an Erosion and Sediment Control Plan, shall be prepared by a professional engineer licensed in the Commonwealth of Kentucky, meeting all of the requirements of KYR10 and Chapter 16-Article X, Division 5 of the LFUCG Code of Ordinances.

B. The Contractor shall submit, if necessary, a Notice of Intent specifically for Construction Activities (NOI-SWCA) before beginning any site disturbance, and shall implement erosion, sediment and pollution control measures as may be required by state, local and federal agencies. Contractor shall submit a signed Notice of Intent form and required attachments to the Division of Water at least seven (7) days prior to beginning of construction activity. **See Article 3.24 in this Section for detailed requirements.**

C. A Land Disturbance Permit, if necessary, shall be obtained from the Lexington-Fayette Urban County Government. **See Article 3.25 in this Section for detailed requirements.**

D. The Contractor shall comply with all additional requirements of LFUCG. It is the Contractor's responsibility to provide evidence to the Owner that all permits have been obtained prior to initiation of construction.

1.03 RELATED WORK

A. Section 02371 – Storm Water Pollution Prevention Plan (SWPPP)

B. Applicable LFUCG Storm Water Manual Standard Drawings are included at the end of this Section 02372.

PART 2 – PRODUCTS

2.01 MULCH

A. Mulch shall be used as a soil stabilization measure for any disturbed area inactive for 14 days or longer. Areas requiring stabilization during December through February shall receive only mulch held in place with bituminous material. Mulching shall be used whenever permanent or temporary seeding is used. The anchoring of mulch shall be in accordance with the Construction Drawings except all mulch placed in December through February shall be anchored with bituminous materials regardless of the slope. Permanent mulches shall be used in conjunction with planting trees, shrubs, and other ground covers that do not provide adequate soil stabilization.

B. Straw shall come from wheat, rye, or barley and may be spread by hand or machine. Straw shall be anchored. Straw shall be applied at two tons per acre or 90 pounds per 1,000 square feet. Straw shall be free from weeds and coarse matter.

C. Wood chips do not require tacking. Wood chips shall be applied at 270 cubic yards per acre or 6 cubic yard per 1,000 square feet and approximately 2 inches deep. Wood chips shall be

treated with 20 pounds of nitrogen per acre or shall be treated with 12 pounds slow-release nitrogen per ton to prevent nutrient deficiency in plants.

D. Bark chips or shredded bark shall be applied at 70 cubic yards per acre or 1.5 to 2 cubic yards per 1,000 square feet and about one-half inch thick. Bark does not require additional nitrogen fertilizer.

E. Manufacturer's recommendations shall be followed during application of manufactured wood fiber and recycled paper sold as mulch materials applied in a hydroseeder slurry with binders/tackifiers. Recycled paper (newsprint) or wood fiber shall be mixed at 50 pounds per 100 gallons of water and applied according to manufacturer's recommendations and model of hydroseeder in use.

F. Liquid mulch binders/tackifiers shall be applied according to manufacturer's recommendations. Chemical soil stabilizers or soil binders/tackifiers/emulsions shall not be used alone.

G. Netting and mats shall be used in critical areas such as waterways where concentrated flows are expected.

H. Before the gravel or crushed stone is applied, it shall be washed. Aggregate cover shall only be used in relatively small areas and shall be incorporated into an overall landscaping plan.

2.02 TEMPORARY SEED

A. Temporary seeding shall be used for soil stabilization when grades are not ready for permanent seeding, except during December through February. The seed shall be applied within 14 days after grading has stopped. Only rye grain or annual rye grass seed shall be used for temporary seeding.

2.03 PERMANENT SEED

A. Permanent seeding shall be applied within 14 days after final grade has been reached, except during December through February. Permanent seeding shall also be applied on any areas that will not be disturbed again for a year even if final grades have not been reached. The use of mulch and erosion matting and netting with permanent seeding shall be in accordance with applicable sections of this Specification. "Seed mats" may be used for permanent seeding in accordance with manufacturers' recommendations.

B. Permanent seeding shall be used on disturbed areas where permanent, long-lived vegetative cover is needed to stabilize the soil and on rough graded areas that will not be brought to final grade for one year or more.

C. The area to be seeded shall be protected from excess runoff as necessary with diversions, grassed waterways, terraces, or sediment ponds.

D. Contractor shall use the following Permanent Seed Mix, with the following exceptions:

   a. If a property owner landscaping agreement differs from this specification, the property owner landscaping agreement shall be followed on that property, or

   b. The area to be seeded is within 25 feet of a stream bank, in which case Contractor shall follow the seed mix provided in Section 02373, or

   c. The Construction Drawings identify a different seed mix.

The Permanent Seed Mix shall consist of the following mix spread at a rate of 12.5 pounds/1,000 square feet:

Common Name	%	lbs per 1,000 sq. ft.
Bluegrass	24%	3
Perennial ryegrass (turf)	16%	2
+ bluegrass	20%	2.5
Tall fescue (turf type)	32%	4
+ bluegrass	8%	1
TOTAL	100%	12.5

E. Vegetative cover alone shall not be used to provide erosion control cover and prevent soil slippage on a soil that is not stable due to its structure, water movement, or excessive slope.

F. Permanent seeding may be done at any time except December through February.

G. Soil material shall be capable of supporting permanent vegetation and have at least 25 percent silt and clay to provide an adequate amount of moisture holding capacity. An excessive amount of sand will not consistently provide sufficient moisture for good growth regardless of other soil factors.

H. Fertilizer shall be applied at a rate of 800 pounds per acre of 10-10-10 analysis or equivalent, unless soil test results indicate a different rate is appropriate. Lime shall be applied at a rate of 100 pounds per 1,000 square feet or two tons per acre of agricultural ground limestone, unless soil test results indicate differently.

2.04 SOD

A. Sod shall be used for disturbed areas that require immediate vegetative cover, *e.g.*, the area surrounding a drop inlet in a grassed waterway, the design flow perimeter of a grassed waterway that will convey flow before vegetation can be established, and the inlet of a culvert. Sod may be installed throughout the year. "Seed mats" and seed with geotextiles may be used in place of sod when done in accordance with manufacturers' recommendations.

B. Contractor shall use tall fescue sod, unless another species is specified in the Construction Drawings or unless the property owner landscaping agreement differs from this specification.

C. Sod shall not be used to provide erosion control and prevent soil slippage on a soil that is not stable due to its structure, water movement, or excessive slope.

D. Sod shall be installed within 36 hours of digging and removal from the field. Sod should not be used on slopes steeper than 2H:1V. If it is to be mowed, installation should be on slopes no greater than 3H:1V.

E. Soil material shall be capable of supporting permanent vegetation and shall consist of at least 25 percent silt and clay to provide an adequate amount of moisture holding capacity. An excessive amount of sand will not consistently provide sufficient moisture for the sod regardless of other soil factors.

F. Fertilizer shall be applied at a rate of 1,000 pounds per acre of 10-10-10 analysis or equivalent, unless soil test results indicate a different rate is appropriate. Lime shall be applied at a rate of 100 pounds per 1,000 square feet or two tons per acre of agricultural ground limestone, unless soil test results indicate differently.

G. The sod shall consist of strips of live, vigorously growing grasses. The sod shall be free of noxious and secondary noxious weeds and shall be obtained from good, solid, thick-growing

stands. The sod shall be cut and transferred to the job in the largest continuous pieces that will hold together and are practical to handle.

H. The sod shall be cut with smooth clean edges and square ends to facilitate laying and fitting. The sod shall be cut to a uniform thickness of not less than three-fourth inch measured from the crown of the plants to the bottom of the sod strips for all grasses except bluegrass. Bluegrass sod shall be cut to a uniform thickness of not less than one and one-half inches.

I. The sod shall be mowed to a height of not less than two inches and no more than four inches prior to cutting.

J. The sod shall be kept moist and covered during hauling and preparation for placement on the sod bed.

2.05 ROAD/PARKING STABILIZATION

A. Gravel or paved material shall be used to stabilize permanent roads or parking areas or roads or parking areas used repeatedly by construction traffic. Stabilization shall be accomplished within 14 days of grading or initiation of use for construction traffic. Unstabilized roads are not acceptable except in instances where the road will be used less than one month.

B. Road/parking stabilization shall be used wherever roads or parking areas are constructed, whether permanent or temporary, for use by construction traffic.

C. Stabilization shall be accomplished with a minimum depth of six inches of crushed stone. Stabilized construction roadbeds shall be at least 14 feet wide for one-way traffic and at least 20 feet wide for two-way traffic.

D. Temporary roads shall follow the contour of the natural terrain to the extent possible. Slopes shall not exceed 10 percent.

E. Temporary parking areas shall be located on naturally flat areas to minimize grading. Grades shall be sufficient to provide drainage but shall not exceed 4 percent.

F. All cuts and fills shall be 2H:1V or flatter.

G. Drainage ditches shall be provided as needed.

H. Crushed stone shall be KYTC aggregate No. 2 (1.5 to 3 inches in diameter), or equivalent.

2.06 CONSTRUCTION ENTRANCE

A. A stabilized construction entrance shall be constructed wherever vehicles are leaving a construction site to enter a public road or at any unpaved entrance/exit location where there is a risk of transporting mud or sediment onto paved roads. A construction entrance shall be constructed at the beginning of the project before construction traffic begins to enter and exit the site.

B. A stabilized construction entrance shall be constructed of crushed stone a minimum of 6 inches thick laid over geotextile (filter fabric).

C. The width shall be at least 20 feet and as wide as the entire width of the access. At sites where traffic volume is high, the entrance shall be wide enough for two vehicles to pass safely. The length shall be at least 50 feet, and where practical, shall be extended to 100 feet. The entrance shall be flared where it meets the existing road to provide a turning radius.

D. Stormwater and wash water runoff from a stabilized construction entrance shall drain to a sediment trap or sediment pond. If conditions on the site are such that the majority of the mud is not removed by the vehicles traveling over the gravel, then the tires of the vehicles shall be washed before entering a public road.

E. Pipe placed under the entrance to handle runoff shall be protected with a mountable berm.

F. Dust control shall be provided in accordance with the applicable sections of this Specification.

G. Crushed stone shall be KYTC aggregate No. 2 (1.5 to 3 inches in diameter), or equivalent.

H. Geotextile filter fabric shall be KYTC Type III.

2.07 DUST CONTROL

A. Dust control measures shall be implemented on the site.

B. Construction activities shall be phased to minimize the total area unstabilized at any given time, thereby reducing erosion due to air and water movement.

C. Construction roads shall be watered as needed to minimize dust.

D. Existing trees, shrubs, and ground cover shall be retained as long as possible during the construction. Initial land clearing should be conducted only in those areas to be regraded or where construction is to occur. Areas to be cleared only for new vegetation or landscaping shall be stabilized with seed and mulch immediately following clearing.

E. Vegetative cover is the most effective means of dust and erosion control, when appropriate. See sections on Temporary Seed, Permanent Seed, Mulch, and Sod of this Specification.

F. When areas have been regraded and brought to final grade, they shall be stabilized using temporary or permanent seed and mulch or other measures.

G. Mulch with mulch binders may be used as an interim dust control measure in areas where vegetation may not be appropriate.

H. See sections on Temporary Seed, Permanent Seed, Sod, Mulch, Road/Parking Stabilization, and Construction Entrance of this Specification.

2.08 NETS AND MATS

A. Mulch netting, erosion control matting, or turf reinforcement matting (TRM) shall be used on sloping areas as indicated in the Construction Drawings. Mats or nets and permanent seeding may be used as an alternate to sod for culvert entrances and grassed waterways. TRMs shall be used at the water line to control wave action in wet ponds. TRMs shall be used in accordance with manufacturer's recommendations. Erosion control matting may be used to stabilize channels and swales and on recently planted slopes to protect seedlings until they become established.

B. Effective netting and matting shall require firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold the soil and erosion will occur underneath the material.

C. Nets and mats shall be suitable for their intended purpose and shall be as indicated in the Construction Drawings.

2.09 TEMPORARY DIVERSION DITCH

A. Temporary diversion ditches shall be used to collect sediment-laden runoff from disturbed areas and direct it to a sediment pond where applicable. Temporary ditches are those expected to be in use for less than one year. Temporary diversion ditches do not require stabilization, unless otherwise indicated on the Construction Drawings.

B. Temporary diversion ditches shall have stable outlets. The combination of conditions of site, slopes, and soils should be so that the ditch can be maintained throughout its planned life.

C. Temporary diversion ditches shall not be constructed below high sediment-producing areas unless land treatment practices or structural measures, designed to prevent damaging accumulations of sediment in the channels, are installed with or before the diversion.

D. A typical diversion cross section consists of a channel and a supporting ridge. In the case of an excavated-type diversion, the natural ground serves as the diversion ridge. Diversion cross sections shall be adapted to the equipment that will be used for their construction and maintenance.

E. The channel may be parabolic or trapezoidal in shape. V-shaped ditches shall not be constructed.

F. Diversions shall be located so that water will empty onto an established area such as a stable watercourse, waterway, or structure.

G. Any high sediment-producing area above a diversion shall be controlled by good land use management or by structural measures to prevent excessive sediment accumulation in the diversion channel.

H. Temporary diversions above steep slopes or across graded rights-of-way shall have a berm with a minimum top width of 2 feet, side slopes of 2:1 or flatter and a minimum height of 18 inches measured from the channel bottom.

I. Diversions installed to intercept flow on graded rights-of-way shall be spaced 200 to 300 feet apart.

J. A level lip spreader shall be used at diversion outlets discharging onto areas already stabilized by vegetation.

2.10 LEVEL SPREADER

A. Level spreaders shall be constructed at the outlets of temporary diversion ditches. Level spreaders shall also be constructed at outlets of permanent constructed waterways where they terminate on undisturbed areas.

B. The length of the level spreader shall be constructed as shown on the Construction Drawings.

2.11 PERMANENT CONSTRUCTED WATERWAY

A. Permanent constructed waterways shall be used to divert stormwater runoff from upland undisturbed areas around or away from areas to be disturbed during construction. A waterway expected to be in place for at least one year shall be considered permanent. Permanent waterways shall be lined with sod or permanent seeding and nets, mats, or TRMs.

2.12 PIPE SLOPE DRAIN

A. Pipe slope drains shall be used whenever it is necessary to convey water down a steep slope, which is not stabilized or which is prone to erosion, unless paved ditch (flume) is installed.

B. Contractor shall use a 10-inch diameter pipe or larger to convey runoff from areas up to one-third acre; 12-inch or larger pipe for up to half-acre drainage areas; and 18-inch pipe for areas up to one acre, unless otherwise specified in the Construction Drawings. Multiple pipes shall be required for large areas, spaced as shown on the Construction Drawings.

C. The pipe shall be heavy duty flexible tubing designed for this purpose, *e.g.*, non-perforated, corrugated plastic pipe, or specially designed flexible tubing.

D. A standard flared end section or a standard T-section fitting secured with a watertight fitting shall be used for the inlet.

E. Extension collars shall be 12-inch long sections of corrugated pipe. All fittings shall be watertight.

2.13 IMPACT STILLING BASIN

A. Impact stilling basins shall be used at the outlet of culverts and storm sewers with calculated exit velocities greater than 15 feet per second when flowing full.

2.14 CHECK DAM

A. Check dams shall be limited to use in small, open channels that drain 10 acres or less.

B. Check dams shall not be used in streams.

C. Check dams can be constructed of stones, coir logs, or wood fiber logs.

D. Check dams shall be constructed prior to the establishment of vegetation.

E. The maximum height of a check dam shall be three feet above the ground on which the rock is placed.

F. The center of the portion of the check dam above the flat portion of the channel shall be at least 1 foot lower than the outer edges. The outer edges of the check dam shall extend up the side slopes of the channel to a point 3 feet in elevation above the center portion of the check dam or to the top of the side slopes.

G. The maximum spacing between rock check dams in a ditch should be such that the toe of the upstream dam is at the same elevation as the top of the next downstream dam.

H. The spacing of coir and wood fiber check dams is one log every 100 feet for velocities of 5 fps, 50 feet for velocities between 5 and 7.5 fps, and 25 feet for velocities greater than 10 fps, unless otherwise shown in the Construction Documents.

I. Stone check dams shall be constructed of KYTC Class II channel lining.

J. Coir log or wood fiber log check dams shall be constructed of a single log with a diameter of at least 20 inches.

2.15 SEDIMENT TRAP

A. Sediment traps shall be installed below all disturbed areas of less than 5 acres that do not

drain to a sediment pond.

B. Erosion control practices such as seeding, mulching, sodding, diversion dikes, etc., shall be used in conjunction with sediment traps to reduce the amount of sediment flowing into the trap. The amount of sediment entering a trap can be reduced by the use of stabilized diversion dikes and ditches.

C. The trap shall not be located in a stream. It shall be located to trap sediment-laden runoff before it enters the stream.

D. Trap depth shall be at least 2 feet at the inlet and 4 feet at the outlet. Effective trap width shall be at least 10 feet and trap length shall be at least 30 feet.

E. The Construction Drawings shall indicate the final disposition of the sediment trap after the upstream drainage area is stabilized. The Construction Drawings shall indicate methods for the removal of excess water lying over the sediment, stabilization of the pond site, and the disposal of any excess material.

2.16 SEDIMENT POND

A. A sediment pond shall be installed at the outlet of a disturbed area of 5 acres or more. The maximum drainage area for a single pond is 100 acres.

B. Design and construction shall comply with all federal, state, and local laws, ordinances, rules, and regulations regarding dams.

C. Erosion control practices such as seeding, mulching, sodding, diversion dikes, etc., shall be used in conjunction with sediment ponds to reduce the amount of sediment flowing into the pond.

D. The pond shall not be located in a stream. It shall be located to trap sediment-laden runoff before it enters the stream.

E. Contractor shall construct the sediment pond as shown on the Construction Drawings.

F. Permanent ponds designed for stormwater detention or water quality treatment may serve as temporary sediment ponds if site conditions make the use of these structures desirable. At the time of conversion from a sediment pond to a permanent stormwater management pond, excess sediment shall be cleaned from the pond. If the pond is converted to a water quality basin, the sand in the sand filter outlet shall be replaced with clean sand unless it is shown to be clean.

G. The Construction Drawings shall indicate the final disposition of the sediment pond after the upstream drainage area is stabilized. The Construction Drawings shall indicate methods for the removal of excess water lying over the sediment, stabilization of the pond site, and the disposal of any excess material.

H. Vegetation shall be established upon completion of construction of the embankment, emergency spillway and other areas disturbed by construction.

2.17 SILT FENCE

A. Silt fence shall be installed down-slope of areas to be disturbed prior to clearing and grading. Silt fence shall be situated such that the total area draining to the fence is not greater than one-fourth acre per 100 feet of fence. Silt fence shall be used for storm drain drop inlet protection and around soil stockpiles.

B. Under no circumstances shall silt fences be constructed in streams or in swales or ditch lines or any area of concentrated flow where discharge rates are likely to exceed 1 cubic foot per

second (cfs).

C. Synthetic filter fabric shall be a pervious sheet of propylene, nylon, and polyester or ethylene yarn and shall be certified by the manufacturer or supplier as conforming to the following requirements:

PHYSICAL PROPERTY	REQUIREMENTS
Filtering Efficiency	80% (minimum)
Tensile Strength at 20%	50 lbs./linear inch (minimum)
Flow Rate	0.3 gal./ sq. ft/ min. (minimum)

D. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0°F to 120°F.

E. Posts for synthetic fabric silt fences shall be either 2-inch by 2-inch wood or 1.33 pounds per linear foot steel with a minimum length of 5 feet. Steel posts shall have projections for fastening wire to them.

F. Wire fence reinforcement for silt fences shall be a minimum of 36 inches in height, a minimum of 14 gauge and shall have a mesh spacing of no greater than 6 inches.

2.18 STORM DRAIN INLET PROTECTION

A. Storm drain inlet protection may be utilized on drop inlets and curb inlets.

B. Storm drain inlet protection shall only be used around drop inlets when the up-slope area draining to the inlet has no other or inadequate sediment control.

C. The drainage area shall be no greater than 1 acre.

D. The inlet protection device shall be constructed in a manner that will facilitate cleanout and disposal of trapped sediment and minimize interference with construction activities.

E. Inlet protection devices shall be constructed in such a manner that any resultant ponding of stormwater will not cause flooding or excessive inconvenience or damage to adjacent areas, roadways, properties, or structures.

F. Inlet protection devices are low flow filter devices, and as such shall be constructed in such a manner as to allow for higher flows to bypass into the storm drain system to prevent flooding of the roadway or downstream properties.

2.19 FILTER STRIP

A. Filter strips shall be used on each side of permanent constructed channels.

B. Filter strips shall only be used to remove sediment from overland flow. Filter strips are not effective in removing sediment from concentrated flows.

C. If vegetative filters are proposed as a sediment control device and they do not already exist, they shall be planted and established prior to initiating land disturbing activities.

D. The minimum filter strip width shall be 50 feet for streams, wetlands, and sinkholes. The minimum filter strip width shall be ten feet for constructed waterways.

E. Where a post development floodplain or wet weather conveyance is being protected, filter strips shall be provided on each side. When a wetland or sinkhole is being protected, filter strips shall be provided around the perimeter.

F. Contractor shall construct the filter strips as shown on the Construction Drawings.

G. Existing grass or grass/legume mixtures used as filter strips shall be dense and well established, with no bare spots. When establishing new seeding, consideration shall be given to wildlife needs and soil conditions on the site. The following chart provides a list of alternative grass and grass/legume mixtures:

SEEDING MIXTURE AND SITE SUITABILITY CHART

Seeding Mixture	Rate lbs/acre	Soil Suitability
Alfalfa *Or* Red Clover *Plus* Timothy *Or* Orchardgrass *Or* Bromegrass	6 10 4 6 6	Well Drained
Ladino *Plus* Timothy *Or* Orchardgrass *Or* Bromegrass	.05 4 6 8	Wet or Well-Drained

Notes:

1. All seeding shall be in accordance with the seeding sections of this Specification.

2. Well drained sites include sites that are drained with tile as well as naturally well drained and droughty sites. Wet sites include sites that are excessively wet only a portion of the growing season.

2.20 STREAM CROSSING

A. Stream crossings shall be used in cases where construction traffic, permanent traffic, or utilities must cross existing post development floodplains. If the drainage area exceeds 1 square mile and a structure is necessary, the structure must be designed by a professional engineer licensed in Kentucky, and shall be considered a permanent structure.

B. Temporary stream crossings are applicable to flowing streams with drainage areas less than one square mile. Temporary stream crossings shall be planned to be in service for the shortest practical period of time and to be removed as soon as their function is completed.

C. All such structures, whether temporary or permanent, are subject to the rules and regulations of the U.S. Army Corps of Engineers for in-stream modifications (404 Permitting) and the Kentucky Division of Water (401 Certification). No stream crossing shall be installed without first obtaining all applicable local, state, and federal permits.

Where culverts are to be installed, compacted soil or rock shall be used to form the crossing. The depth of soil or rock cover over the culvert shall be equal to one-half the diameter of the culvert or 12 inches, whichever is greater. The sides of the fill shall be protected from erosion using the mulching and seeding erosion control measures specified in this Specification.

D. All stream crossings shall be constructed in such a manner as to avoid flooding or excessive inconvenience or damage to adjacent areas, roadways, properties, or structures.

E. When using a culvert crossing, the top of a compacted earth fill shall be covered with six inches of KYTC No. 57 stone.

F. KYTC No. 57 stone shall also be used for the stone pads forming the crossing approaches.

2.21 PUMP AROUND FLOW DIVERSION

A. A pump-around flow diversion shall be used to divert flow around construction activities occurring in a stream when those activities are reasonably expected to cause the erosion of sediment or deposition of sediment in the stream.

B. Check dams to form the diversion shall span the banks of the stream. Maintain 1-foot freeboard (minimum) on the upstream and downstream checks.

C. Check dams may be constructed of sandbags or may be a water-filled bladder such as an Aqua-Barrier.

D. The dewatering flow from the work area shall be treated in a sediment-trapping device prior to discharge to the stream.

E. Sandbags shall be woven polypropylene bags with approximate dimensions of 18-1/2 inches by 28 inches. Contractor shall tie the ends of filled bags closed using either draw strings or wire ties.

2.22 CONSTRUCTION DEWATERING

A. Sediment-laden water shall be pumped to a dewatering structure before it is discharged.

PART 3 – EXECUTION

3.01 GENERAL

A. Erosion and sediment control practices shall be consistent with the requirements of the state and local regulatory agencies and in any case shall be adequate to prevent erosion of disturbed and/or regraded areas.

B. Contractor is responsible for notifying the state regulatory agency concerning inclusion under the KPDES General Permit for Storm Water Discharges Associated with Construction Activities.

C. Gravity sewer lines, force mains and water lines that cross streams shall be constructed by methods that maintain normal stream flow and allow for a dry excavation. Water pumped from the excavation shall be contained and allowed to settle prior to reentering the stream. Excavation equipment and vehicles shall operate outside of the flowing portion of the stream. Spoil material from the line excavation shall not be allowed to enter the flowing portion of the stream. The provisions of this condition shall apply to all types of utility line stream crossings.

D. Removal of riparian vegetation in the utility line right-of-way shall be limited to that necessary for equipment access. Effective erosion and sedimentation control measures shall be employed at all times during the project to prevent degradation of waters of the Commonwealth. Site regrading and reseeding shall be accomplished with 14 days after disturbance.

3.02 MULCH

A. Seed shall be applied prior to mulching except where seed is to be applied as part of a hydroseeder slurry containing mulch.

B. Lime and fertilizer shall be incorporated and surface roughening accomplished as needed prior to mulching in accordance with applicable sections of this Specification.

C. Mulch materials shall be spread uniformly by hand or mechanically so the soil surface is covered. During or immediately following application, the mulch shall be anchored or otherwise secured to the ground according to one of the following methods:

1. Mechanical – Use a disk, crimper, or similar type tool set straight to punch or anchor the mulch material into the soil.

2. Mulch Tackifiers/Nettings/Emulsions – Use according to the manufacturer's recommendations. This is a superior method in areas of water concentration to hold mulch in place.

3. Wood Fiber – Wood fiber hydroseeder slurries may be used to tack straw mulch. This combination treatment is well suited to steep slopes and critical areas, and severe climate conditions.

D. Mulch shall be anchored using a mulch anchoring tool, a liquid binder/tackifier, or mulch nettings. Nets and mats shall be installed to obtain firm, continuous contact between the material and the soil. Without such contact, the material is useless and erosion occurs.

E. A mulch anchoring tool is a tractor-drawn implement that is typically used for anchoring straw and is designed to punch mulch approximately two inches into the soil surface. Machinery shall be operated on the contour and shall not be used on slopes steeper than 3H:1V.

F. When using liquid mulch binders and tackifiers, application shall be heaviest around edges of areas and at crests of ridges and banks to prevent wind blow. Remainder of area shall have binders/tackifiers spread uniformly in accordance with manufacturer's recommendations.

G. When using a mulch net, it shall be used in conjunction with an organic mulch and shall be installed immediately after the application and spreading of the mulch. Mulch net shall be installed over the mulch except when the mulch manufacturer recommends otherwise.

H. Excelsior blankets and mats with mulch are considered protective mulches and may be used alone on erodible soils and during all times of year. Erosion control mats shall be installed in accordance with manufacturer's recommendations.

I. Mulched areas shall be inspected at least weekly and after each rainfall of one-half inch or more. When mulch material is found to be loosened or removed, the mulch cover shall be replaced within 48 hours.

3.03 TEMPORARY SEED

A. The site shall be graded as needed to permit the use of conventional equipment for seedbed preparation, seeding, mulch application, and anchoring.

B. The needed erosion control practices, such as diversions, temporary waterways for diversion outlets, and sediment ponds, shall be installed prior to seeding.

C. Prior to seeding, lime and fertilizer shall be worked into the soil with a disk harrow, springtooth harrow, or similar tools to a depth of two inches. On sloping areas, the final operation shall be on the contour.

D. The seed shall be applied uniformly with a cyclone seeder, drill, cultipacker, seeder, or hydroseeder (slurry may include seed and fertilizer) preferably on a firm, moist seedbed. Seed shall be sown no deeper than one-fourth inch to one-half inch.

E. The seedbed shall be firmed following seeding operations with a cultipacker, roller, or light drag.

F. On sloping land, seeding operations shall be on the contour wherever possible.

G. Mulch shall be applied, in the amounts described in the mulch section of this Specification, to protect the soil and provide a better environment for plant growth.

H. New seed shall have adequate water for growth, through either natural means or irrigation, until plants are firmly established.

I. Seeded areas shall be inspected at least weekly after planting and after each rainfall of one-half inch or more. Areas requiring additional seed and mulch shall be repaired within 48 hours.

J. If vegetative cover is not established within 21 days, the area shall be reseeded.

3.04 PERMANENT SEED

A. During site preparation, topsoil shall be stockpiled for use in establishing permanent vegetation.

B. The site shall be graded as needed to permit the use of conventional equipment for seedbed preparation, seeding, mulch application, and anchoring.

C. The needed erosion control practices, such as diversions, temporary waterways for diversion outlets, and sediment ponds, shall be installed prior to seeding.

D. Prior to seeding, lime and fertilizer shall be worked into the soil with a disk harrow, springtooth harrow, or similar tools to a depth of four inches. On sloping areas, the final operation shall be on the contour.

E. Where compacted soils occur, they shall be broken up sufficiently to create a favorable rooting depth of six to eight inches.

F. The seed shall be applied uniformly with a cyclone seeder, drill, cultipacker, seeder, or hydroseeder (slurry may include seed and fertilizer) preferably on a firm, moist seedbed. Seed shall be sown no deeper than one-fourth inch to one-half inch.

G. The seedbed shall be firmed following seeding operations with a cultipacker, roller, or light drag.

H. On sloping land, seeding operations shall be on the contour wherever possible.

I. Mulch shall be applied, in the amounts described in the mulch section of this Specification, to protect the soil and provide a better environment for plant growth.

J. New seed shall have adequate water for growth, through either natural means or irrigation, until plants are firmly established.

K. Seeded areas shall be inspected at least weekly after planting and after each rainfall of 0.5 inches or more. Areas requiring additional seed and mulch shall be repaired within 48 hours.

L. If vegetative cover is not established (>70%) within 21 days, the area shall be reseeded. If 40 to 70 percent groundcover is established, seed and fertilize, using half of rates originally applied, and mulch. If less than 40 percent groundcover is established, follow original seedbed preparation methods, seeding and mulching specifications, and apply lime and fertilizer as needed according to soil tests.

3.05 SOD

A. The area to be sodded shall be protected from excess runoff, as necessary, with appropriate BMPs.

B. Prior to sodding, the soil surface shall be cleared of all trash, debris, and stones larger than one and one-half inches in diameter, and of all roots, brush, wire, and other objects that would interfere with the placing of the sod.

C. Compacted soils shall be broken up sufficiently to create a favorable rooting depth of six to eight inches.

D. Lime and fertilizer shall be worked into the soil with a disk harrow, springtooth harrow, or other suitable field equipment to a depth of four inches.

E. After the lime and fertilizer have been applied and just prior to the laying of the sod, the soil in the area to be sodded shall be loosened to a depth of one inch. The soil shall be thoroughly dampened immediately after the sod is laid if it is not already in a moist condition.

F. No sod shall be placed when the temperature is below 32°F. No frozen sod shall be placed nor shall any sod be placed on frozen soil.

G. When sod is placed during the periods of June 15 to September 1 or October 15 to March 1, it shall be covered immediately with a uniform layer of straw mulch approximately one-half inch thick or so the green sod is barely visible through the mulch.

H. Sod shall be carefully placed and pressed together so it will be continuous without any voids between the pieces. Joints between the ends of strips shall be staggered.

I. On gutter and channel sodding, the sod should be carefully placed on rows or strips at right angles to the centerline of the channel (*i.e.*, at right angles to the direction of flow). The edge of the sod at the outer edges of all gutters shall be sufficiently deep so that surface water will flow over onto the top of the sod.

J. On steep graded channels, each strip of sod shall be staked with at least two stakes not more than 18 inches apart.

K. On slopes 3H:1V or steeper, or where drainage into a sod gutter or channel is one-half acre or larger, the sod shall be rolled or tamped and then chicken wire, jute, or other netting shall be pegged over the sod for protection in the critical areas. The netting and sod shall be staked with at least two stakes not more than 18 inches apart. The netting shall be stapled on the side of each stake within two inches of the top of the stake. The stake should then be driven flush with the top of the sod.

L. When stakes are required, the stakes shall be wood and shall be approximately ½ inch by ¾ inch by 12 inches. They shall be driven flush with the top of the sod with the flat side against the slope and on an angle toward the slope.

M. Sod shall be tamped or rolled after placing and then watered. Watering shall consist of a thorough soaking of the sod and of the sod bed to a depth of at least 4 inches. The sod should be maintained in a moist condition by watering for a period of 30 days.

N. In the absence of adequate rainfall, watering shall be performed daily or as often as necessary during the first week to maintain moist soil to a depth of 4 inches. Watering shall be done during the heat of the day to prevent wilting. After the first week, sod shall be watered as necessary to maintain adequate moisture content.

O. The first mowing of sod shall not be attempted until the sod is firmly rooted. No more than one-third of the grass leaf shall be removed by the initial and subsequent cuttings. Grass height shall be maintained between 2 inches and 3 inches.

P. Where sod does not establish properly, the sod should be replaced immediately. Areas requiring resodding should be prepared in the same manner as the original installation.

3.06 ROAD/PARKING STABILIZATION

A. The roadbed or parking surface shall be cleared of all vegetation, roots, and other objectionable material.

B. All roadside ditches, cuts, fills, and disturbed areas adjacent to parking areas and roads shall be stabilized with appropriate temporary or permanent vegetation according to the applicable sections of this Specification.

C. Geotextile filter fabric may be applied beneath the stone for additional stability in accordance with fabric manufacturer's specifications.

D. Both temporary and permanent roads and parking areas may require periodic top dressing with new gravel. Seeded areas adjacent to the roads and parking areas shall be checked regularly to ensure that a vigorous stand of vegetation is maintained. Roadside ditches and other drainage structures shall be checked once each week to ensure that they do not have silt or other debris that reduces their effectiveness.

3.07 CONSTRUCTION ENTRANCE

A. Vegetation, roots, and all other obstructions shall be cleared in preparation for grading. Prior to placing geotextile (filter fabric), the entrance shall be graded and compacted to 80% of standard proctor density.

B. To reduce maintenance and loss of aggregate, the geotextile shall be placed over the existing ground before placing the stone for the entrance. Stone shall be placed to depth of 6 inches or greater for the entire width and length of the stabilized construction entrance.

C. If wash racks are used, they shall be installed according to manufacturer's specifications.

D. The stabilized construction entrance shall be inspected once each week and after there has been a high volume of traffic or a storm event greater than 0.2 inches.

E. The entrance shall be maintained in a condition that will prevent tracking or flow of sediments onto public rights-of-way. This may require periodic top dressing with additional stone, as conditions demand, and repair and/or cleanout of any structures used to trap sediment.

F. All materials spilled, dropped, washed, or tracked from vehicles onto roadways or into storm drains must be removed immediately.

3.08 DUST CONTROL

A. See Articles on Temporary Seed, Permanent Seed, Sod, Mulch, Road/Parking Stabilization, and Construction Entrance of this Specification Section.

B. When construction is active on the site, dust control shall be implemented as needed.

C. When using tillage as a dust control measure, Contractor shall begin plowing on windward side of area. Chisel-type plows spaced about 12 inches apart, spring-toothed harrow, and similar plows are examples of equipment that may produce the desired effect.

D. The site shall be observed daily for evidence of windblown dust and reasonable steps shall be taken to reduce dust whenever possible. When construction on a site is inactive for a period, the site shall be inspected at least weekly for evidence of dust emissions or previously windblown sediments. Dust control measures shall be implemented or upgraded if the site inspection shows evidence of wind erosion.

3.09 NETS AND MATS

A. Nets and mats shall be installed according to the manufacturer's recommendations. In the event that the manufacturer's recommendations conflict with any requirement of this Specification, the most conservative requirement, in terms of protection of public health and the environment, shall govern.

3.10 TEMPORARY DIVERSION DITCH

A. All dead furrows, ditches or other depressions to be crossed shall be filled before construction begins or as part of construction, and the earth fill used to fill the depressions shall be compacted using the treads of the construction equipment. All old terraces, fencerows, or other obstructions that will interfere with the successful operation of the diversion shall be removed.

B. The base for the diversion ridge shall be prepared so that a good bond is obtained between the original ground and the fill material. Vegetation shall be removed and the base shall be thoroughly disked prior to placement of fill.

C. The earth materials used to construct the earth fill portions of the diversions shall be obtained from the diversion channel or other approved source.

D. The earth fill materials used to construct diversions shall be compacted by running the construction equipment over the fill in such a manner that the entire surface of the fill will be traversed by not less than one tread track of the equipment.

E. When an excess of earth material results from cutting the channel cross section and grade, it shall be deposited adjacent to the supporting ridge unless otherwise directed.

F. The completed diversion shall conform to the cross section and grade shown on the Construction Drawings.

G. Temporary or permanent seeding and mulch shall be applied to the berm or ditch immediately following its construction. Contractor shall triple-seed areas below the flow line, and shall use erosion control blankets or turf reinforcement mats as needed.

H. Bare and vegetated diversion channels shall be inspected regularly to check for points of scour or bank failure; rubbish or channel obstruction; rodent holes, breaching, or settling of the ridge; and excessive wear from pedestrian or construction traffic.

I. Damaged channels or ridges shall be repaired at the time damage is detected. Sediment deposits shall be removed from diversion channels and adjoining vegetative filter strips regularly.

J. Diversions shall be reseeded and fertilized as needed to establish vegetative cover.

3.11 LEVEL SPREADER

A. The minimum acceptable width shall be 6 feet. The depth of the level spreader as measured from the lip shall be at least 6 inches and the depth shall be uniform across the entire length of the measure.

B. The grade of the channel for the last 15 feet entering the level spreader shall be less than or equal to 1%.

C. The level lip of the spreader shall be constructed on zero percent grade to insure uniform conversion of channel flow to sheet flow.

D. Level spreaders shall be constructed on undisturbed soil.

E. The entrance to the spreader shall be graded in a manner to insure that runoff enters directly onto the zero percent graded channel.

F. Storm runoff converted to sheet flow shall discharge onto undisturbed areas stabilized with vegetation.

G. All disturbed areas shall be stabilized immediately after construction is completed in accordance with the mulching and vegetation requirements of this Specification.

H. The level spreader shall be inspected after each storm event and at least once each week. Any observed damage shall be repaired immediately.

3.12 PERMANENT CONSTRUCTED WATERWAY

A. All ditches or other depressions to be crossed shall be filled before construction begins or as part of construction, and the earth fill used to fill the depressions shall be compacted using the treads of the construction equipment. All old terraces, fence rows, or other obstructions that will interfere with the successful operation of the channel shall be removed.

B. The earth materials used to construct the earth fill portions of the channel shall be obtained from the excavated portion of the channel or other approved source.

C. The earth fill materials used to construct the channel shall be compacted by running the construction equipment over the fill in such a manner that the entire surface of the fill will be traversed by at least one tread track of the equipment.

D. The completed channel shall conform to the cross section and grade shown on the Construction Drawings.

E. Channels shall be inspected regularly to check for points of scour or bank failure; rubbish or channel obstruction; rodent holes; breaching; and excessive wear from pedestrian or construction traffic.

F. Channels shall be repaired at the time damage is detected. Sediment deposits shall be removed from adjoining vegetative filter strips when they are visible.

G. Channels shall be reseeded and fertilized as needed to establish vegetative cover.

H. The subgrade of paved channels shall be constructed to the required elevations. All soft sections and unsuitable material shall be removed and replaced with suitable material. The subgrade shall be thoroughly compacted and shaped to a smooth, uniform surface. The subgrade shall be moist when pouring concrete.

I. Before permanent stabilization of the slope, the structure shall be inspected after each rainfall. Any damages to the paved channel or slope shall be repaired immediately.

3.13 PIPE SLOPE DRAIN

A. The pipe slope drain shall be placed on undisturbed or well-compacted soil.

B. Soil around and under the entrance section shall be hand-tamped in 4-inch to 8-inch lifts to the top of the dike to prevent piping failure around the inlet.

C. Filter fabric shall be placed under the inlet and extended 5 feet in front of the inlet and be keyed in 6 inches on all sides to prevent erosion.

D. Backfilling around and under the pipe with stable soil material hand compacted in lifts of 4 inches to 8 inches shall be done to ensure firm contact between the pipe and the soil at all points.

E. The pipe slope drain shall be securely staked to the slope using grommets provided for this purpose at intervals of 10 feet or less.

F. All slope drain sections shall be securely fastened together and have watertight fittings.

G. The pipe shall be extended beyond the toe of the slope and discharged at a non-erosive velocity into a stabilized area or to a sediment trap or pond.

H. The pipe slope drain shall have a minimum slope of 3 percent or steeper.

I. The height at the centerline of the earth dike shall range from a minimum of 1.0 foot over the pipe to twice the diameter of the pipe measured from the invert of the pipe. It shall also be at least 6 inches higher than the adjoining ridge on either side. At no point along the dike will the elevation of the top of the dike be less than 6 inches higher than the top of the pipe.

J. All areas disturbed by installation or removal of the pipe slope drain shall be immediately stabilized.

K. The pipe slope drain shall be inspected after every rainfall and at least weekly. Any necessary repairs shall be made immediately.

L. Contractor shall check to see that water is not bypassing the inlet and undercutting the inlet or pipe. If necessary, Contractor shall install headwall or sandbags.

M. Contractor shall check for erosion at the outlet point and shall check the pipe for breaks or clogs. Contractor shall install additional outlet protection if needed and immediately repair the breaks and clean any clogs.

N. Contractor shall not allow construction traffic to cross the pipe slope drain and shall not place any material on it.

O. If a sediment trap has been provided, it shall be cleaned out when the sediment level reaches 1/3 the design volume.

P. The pipe slope drain shall remain in place until the slope has been completely stabilized or up to 30 days after permanent slope stabilization.

3.14 IMPACT STILLING BASIN

A. Construction specifications for impact stilling basins are provided in the Construction Drawings.

3.15 CHECK DAM

A. Stone shall be placed by hand or mechanically as necessary to achieve complete coverage of the ditch and to ensure that the center of the dam is at least 1 foot lower than the outer edges. Stone shall also be placed to extend 3 feet in elevation above the center portion of the check dam or to the top of the channel side slopes.

B. Coir and wood fiber logs shall be laid on the channel bottom.

C. Check dams shall be removed when their useful life has been completed. In temporary ditches and swales, check dams shall be removed and the ditch filled in when it is no longer needed. In permanent channels, check dams shall be removed when a permanent lining can be installed. In the case of grass-lined ditches, check dams shall be removed when the grass has matured sufficiently to protect the ditch or swale. The area beneath the check dams shall be seeded and mulched or sodded (depending upon velocity) immediately after check dams are removed.

D. If stone check dams are used in grass-lined channels that will be mowed, care shall be taken to remove all stone from the channel when the dam is removed. This shall include any stone that has washed downstream.

E. Regular inspections shall be made to ensure that the check dam is in good working order and the center of the dam is lower than the edges. Erosion caused by high flows around the edges of the dam shall be corrected immediately, and the dam shall be extended beyond the repaired area.

F. Check dams shall be checked for sediment accumulation after each rainfall. Sediment shall be removed before or when it reaches one-third of the original height.

G. Check dams shall remain in place and operational until the drainage area and channel are completely stabilized, or up to 30 days after the permanent site stabilization is achieved.

3.16 SEDIMENT TRAP

A. The area to be excavated shall be cleared of all trees, stumps, roots, brush boulders, sod, and debris. All channel banks and sharp breaks shall be sloped to no steeper than 1:1. All topsoil containing excessive amounts of organic matter shall be removed.

B. Seeding, fertilizing, and mulching of the material taken from the excavation shall comply with the applicable soil stabilization sections of this Specification.

C. Construction specifications for sediment traps are provided in the Construction Drawings.

D. Any material excavated from the trap shall be placed in one of the following ways so that it will not be washed back into the trap by rainfall:

1. uniformly spread to a depth not exceeding 3 feet and graded to a continuous slope away from the trap

2. uniformly placed or shaped reasonably well with side slopes assuming the natural angle of repose for the excavated material behind a berm width not less than 12 feet.

E. Sediment shall be removed from the trap when the capacity is reduced to one third of the design volume. Contractor shall follow the methods for disposing of sediment removed from the trap as shown in the Construction Drawings.

3.17 SEDIMENT POND

A. The foundation area shall be cleared of all trees, stumps, roots, brush boulders, sod, and debris. All channel banks and sharp breaks shall be sloped to no steeper than 1:1. All topsoil containing excessive amounts of organic matter shall be removed. The surface of the foundation area shall be thoroughly scarified before placement of the embankment material.

B. A cutoff trench shall be backfilled with suitable material. The trench shall be kept free of standing water during backfill operations.

C. The pipe conduit barrel shall be placed on a firm foundation. Selected backfill material shall be placed around the conduit in layers, and each layer shall be compacted to at least the same density as the adjacent embankment. All compaction within 2 feet of the pipe spillway shall be accomplished with hand-operated tamping equipment.

D. All borrow areas outside the pond and in the drainage area shall be graded and left in such a manner that water will not be ponded.

E. The material placed in the fill shall be free of all sod, roots, frozen soil, stones more than 6 inches in diameter, and other objectionable material. The placing and spreading of the fill material shall occur in approximately 6-inch horizontal layers or of such thickness that the required compaction can be obtained with the equipment used. Each layer shall be compacted in a way that will result in achieving 95 percent of the maximum standard dry density.

F. The distribution and gradation of materials throughout the fill shall be such that there will be no lenses, pockets, stakes, or layers of material differing substantially in texture or gradation from the surrounding material. Where it is necessary to use materials of varying texture and gradation, the more impervious material shall be placed in the upstream and center portions of the fill.

G. The moisture content of fill material shall be such that the required degree of compaction can be obtained with the equipment used.

H. Fill shall not be placed on frozen, slick, or saturated soil.

I. The topsoil material saved in the site preparation shall be placed as a top dressing on the surface of the emergency spillways, embankments, and borrow areas. It shall be evenly spread.

J. A protective cover of herbaceous vegetation shall be established on all exposed surfaces of the embankment, spillway, and borrow areas to the extent practical under prevailing soil and climatic conditions.

K. Seedbed preparation, seeding, fertilizing, and mulching shall comply with the applicable sections of this Specification.

L. Any material excavated from the pond shall be placed in one of the following ways so that its weight will not endanger the stability of the side slopes and where it will not be washed back into the pond by rainfall:

   1. uniformly spread to a depth not exceeding 3 feet and graded to a continuous slope away from the pond.

   2. uniformly placed or shaped reasonably well with side slopes assuming the natural angle of repose for the excavated material behind a berm width not less than 12 feet.

M. Sediment shall be removed from the pond when the capacity is reduced to one third of the

design volume. Contractor shall follow the methods for disposing of sediment removed from the pond as shown in the Construction Drawings.

3.18 SILT FENCE

A. This Article provides construction specifications for silt fences using synthetic fabric. See the Construction Drawings for additional detail.

B. Posts shall be spaced a maximum of 10 feet apart at the barrier location and driven securely into the ground (minimum of 12 inches). When necessary because of rapid runoff, post spacing shall not exceed 6 feet.

C. A trench shall be excavated at least 6 inches wide and 6 inches deep along the line of posts and upslope from the barrier.

D. A wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy-duty wire staples at least 1 inch long, tie wires or hog rings. The wire shall extend into the trench a minimum of 2 inches and shall not extend more than 36 inches above the original ground surface.

E. The filter fabric shall be stapled or wired to the fence, and 12 inches of the fabric shall be extended into the trench. The fabric shall not extend more than 30 inches above the original ground surface. Filter fabric shall not be stapled to existing trees.

F. At joints, filter fabric shall be lapped with terminating posts with a minimum overlap of 3 feet.

G. The trench shall be backfilled and soil compacted over the filter fabric.

H. Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized.

I. Silt fences and filter barriers shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately. Knocked down fences shall be repaired at the end of each day.

J. Should the fabric on a silt fence or filter barrier decompose or become ineffective prior to the end of the expected usable life and if the barrier is still necessary, the fabric shall be replaced promptly.

K. Sediment deposits shall be removed after each storm event or when deposits reach approximately one-third the height of the barrier.

L. Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required shall be dressed to conform to the existing grade, prepared, and seeded.

M. Silt fences shall be replaced every 6 months.

3.19 STORM DRAIN INLET PROTECTION

A. For silt fence drop inlet protection, the following specifications apply:

1. For stakes, Contractor shall use 2 x 4-inch wood (preferred) or equivalent metal with a minimum length of 3 feet.

2. Stakes shall be evenly spaced around the perimeter of the inlet a maximum of 3 feet apart and securely driven into the ground, approximately 18 inches deep.
3. To provide needed stability to the installation, Contractor shall frame with 2 x 4-inch wood strips around the crest of the overflow area at a maximum of 1.5 feet above the drop inlet crest and shall brace diagonally.

4. Contractor shall place the bottom 12 inches of the fabric in a trench and backfill the trench with at least 4 inches of crushed stone or 12 inches of compacted soil.

5. Contractor shall fasten fabric securely to the stakes and frame. Joints shall be overlapped to the next stake.

B. For sod drop inlet protection, sod shall be placed to form a turf mat covering the soil for a distance of 4 feet from each side of the inlet structure. Soil preparation and sod placement shall be in accordance with the section entitled Sod.

C. For gravel curb inlet protection, the following specifications apply:

1. Wire mesh with ½-inch openings shall be placed over the curb inlet opening so that at least 12 inches of wire extends across the concrete gutter from the inlet opening.

2. KYTC No. 2 Coarse Aggregate shall be piled against the wire so as to anchor it against the gutter and inlet cover and to cover the inlet opening completely.

3. This type of device must never be used where overflow may endanger an exposed fill slope. Consideration shall also be given to the possible effects of ponding on traffic movement, nearby structures, working areas, and adjacent property.

D. For block and gravel curb inlet protection, the following specifications apply:

1. Two concrete blocks shall be placed on their sides abutting the curb at either side of the inlet opening to act as spacer blocks.

2. A 2-inch by 4-inch stud shall be cut and placed through the outer holes of each spacer block to help keep the front blocks in place.

3. Concrete blocks shall be placed on their sides across the front of the inlet and abutting the spacer blocks.

4. Wire mesh shall be placed over the outside of the concrete blocks to prevent stone from being washed through the holes in the blocks. Wire with ½-inch openings shall be used

5. KYTC No. 2 Coarse Aggregate shall be piled against the wire to the top of the barrier.

E. For stone-filled corrugated pipe curb inlet protection, the following specifications apply:

1. Two concrete "L" blocks shall be placed on their sides, with one leg fitting into the mouth of the curb opening.

2. A 6-inch corrugated pipe shall be filled with stone and covered with a filter sock.

3. The stone-filled pipe will be placed in front of the two concrete "L" blocks, and extend a minimum of the width of the curb inlet opening on either side. The total length of the stone filled pipe shall be three times the width of the curb inlet opening.

F. The structure shall be inspected after each rain, and repairs made as needed.

G. Sediment shall be removed and the device restored to its original dimensions when the sediment has accumulated to one-third the design depth of the filter. Removed sediment shall be deposited in a suitable area and in such a manner that it will not erode.

H. If a stone filter becomes clogged with sediment so that it no longer adequately performs its function, the stone must be pulled away from the blocks, cleaned, and replaced.

I. Structures shall be removed after the drainage area has been properly stabilized.

3.20 FILTER STRIP

A. When planting filter strips, Contractor shall prepare seedbed, incorporate fertilizer, and apply mulch consistent with the seeding sections of this Specification. Filter strips using areas of existing vegetation shall be over seeded, as necessary, with the specified mixtures to obtain an equivalent density of vegetation. The over seeding shall be accomplished prior to any land disturbing activities.

B. Filter strips shall be inspected regularly to ensure that a healthy vegetative growth is maintained. Any bare spots or spots where sediment deposition could lead to the destruction of vegetation shall be repaired.

C. Filter strips shall be fertilized once each year in the fall.

D. Irrigation shall be used as necessary to maintain the growth of the vegetation in the filter strip.

E. Sediment shall be removed when it becomes visible in the filter.

F. Construction traffic shall not be driven on or over filter strips.

3.21 STREAM CROSSING

A. Clearing and excavation of the streambed and banks shall be kept to a minimum.

B. The structure shall be removed as soon as it is no longer necessary for project construction.

C. Upon removal of the structure, the stream shall immediately be reshaped to its original cross section and properly stabilized.

D. The approaches to the structure shall consist of stone pads with a minimum thickness of 6 inches, a minimum width equal to the width of the structure, and a minimum approach length of 25 feet on each side.

E. The structure shall be inspected after every rainfall and at least once a week and all damages repaired immediately.

3.22 PUMP-AROUND FLOW DIVERSION

A. Operations shall be scheduled such that diversion installation, in-stream excavation, in-stream construction, stream restoration, and diversion removal are completed as quickly as possible. Contractor shall not construct in a stream when rainfall is expected during the time excavation will be occurring in the stream.

B. Check dams shall be installed across the stream during low flow conditions.

C. Stream flow shall be pumped around the check dams. Outlet protection shall be installed as required at the discharge point.

D. Contractor shall dewater the work area and pump into a sediment trapping device.

E. Contractor shall complete construction activities across the stream.

F. Contractor shall restore the streambed and banks.

G. Contractor shall remove sandbags and shut down pumping operation. (Salvage sandbags for future use if multiple stream crossings are required on the project.) Contractor shall remove all sandbags from the stream, including damaged and empty bags.

H. Pumps shall be manned around-the-clock when the pump-around diversion is in the stream.

I. This control provides short-term diversion of stream flow (typically 1 day to 3 days). Additional sandbags or pumps may be required to maintain 1-foot freeboard on the sandbag checks if flow conditions change.

J. Contractor shall add sandbags as required to seal leaks in checks.

3.23 CONSTRUCTION DEWATERING

A. Contractor shall follow the specifications for sediment traps and basins. The manufacturer's recommendations shall be followed for commercial products.

B. The dewatering structure shall be inspected frequently to ensure it is functioning properly and not overtopping. Accumulated sediment shall be spread out on site and stabilized or disposed of offsite.

3.24 KPDES GENERAL PERMIT FOR STORM WATER DISCHARGES FROM CONSTRUCTION ACTIVITIES

A. The Contractor is responsible for electronically filing the appropriate state Notice of Intent (NOI-SWCA) letter at least seven (7) days prior to start of construction activity. The Notice of Intent (NOI) is a Kentucky Pollution Discharge Elimination System (KPDES) permit application as provided by the Kentucky Revised Statutes, Chapter 224. This application is required to be submitted for construction projects that disturb one or more acres of land.

B. The NOI requires the inclusion of the descriptions of (but is not limited to) the following items:

1. Names and designated uses of any receiving waters

2. Anticipated number and locations of discharge points

3. Identification of planned construction in or along a water body

C. A topographic map showing project boundaries, areas to be disturbed, locations of anticipated discharge points and receiving waters is also required to be submitted with the NOI.

D. If the construction site is near a designated "High Quality/Impaired Waters" or a "Cold Water Aquatic Habitat Waters, Exceptional Waters, Outstanding National/State Resource Waters," additional items and/or individual permits will be required.

E. The NOI form requires an SIC code. The link to the SIC codes is http://www.osha.gov/pls/imis/sicsearch.html. The following are the typical construction SIC codes utilized:

1542 – Building Construction, nonresidential, except industrial and warehouses
1623 – Water Main Construction, Sewer Construction
1629 – Water and Wastewater Treatment Plant Construction
1711 – Water Pump Installation
1781 – Drilling Water Wells

F. The Contractor is responsible for implementing the approved Stormwater Pollution Prevention Plan (SWPPP) prior to commencement of site disturbance. The SWPPP shall include erosion prevention measures and sediment and pollutant control measures which are installed and maintained to minimize discharges of sediments and other pollutants from a 2-year, 24-hour storm event. The SWPPP must be kept at the site and available for review by LFUCG and state officials.

G. The Contractor is responsible for the description of procedures to maintain erosion and sediment control measures during the period of construction.

H. The Contractor is responsible for identifying each Contractor and Subcontractor who will install each SWPPP erosion and sediment control measure.

I. Each Contractor and Subcontractor shall sign a statement certifying the awareness of the requirements of the SWPPP related documents. Certification is attached at the end of this section.

J. The Contractor shall not start land disturbing activities until written permit coverage is obtained from the Kentucky Division of Water.

K. The inspection by qualified personnel, **provided by the Contractor**, of the site as follows:

1. at least once every seven (7) calendar days, and

2. within 24 hours after any storm event of 0.5 inch or greater

L. The Contractor is responsible for completing and maintaining the required Self-Inspection Forms. A sample is included in this specification Section.

M. Amendments to the approved SWPPP shall be made and implemented as necessary through the course of the construction project if inspections or investigations by the Contractor's inspector, site staff, or by local, state, or federal officials determine that the existing sediment control measures, erosion control measures, or other site management practices are ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the construction site. All plan amendments shall be noted on the copy of the SWPPP maintained at the project site.

N. Upon completion of the project and establishment of all permanent erosion and sediment control structures and devices, the Contractor shall submit the Notice of Termination (NOT) form to the Kentucky Division of Water, the LFUCG Division of Water Quality, and the LFUCG Division of Engineering.

O. All subcontractors shall be required to comply with the requirements of the state permit and the Stormwater Pollution Prevention Plan (SWPPP).

P. Where to submit:

1. Complete KPDES FORM NOI-SW at the following website:
   https://dep.gateway.ky.gov/eForms/default.aspx?FormID=7

2. Do not initiate work until receiving approval from the Kentucky Division of Water.

3. A complete copy of the NOI submittal shall also be provided to the following for approval/coverage verification:

   Division of Water Quality
   125 Lisle Industrial Avenue, Suite 180
   Lexington, KY 40511

   Division of Engineering
   Lexington-Fayette Urban County Government
   101 E. Vine St.
   4th Floor
   Lexington, KY 40507

3.25 LFUCG Land Disturbance Permit

A. The Contractor shall obtain a Land Disturbance Permit from the LFUCG Division of Engineering, after the LFUCG Division of Water Quality inspects the installation of the best management practices as required by the Stormwater Pollution Prevention Plan (SWPPP). The site grading plan shall show the original and finish grade contours. The grading plan shall be in conformance with the SWPPP.

B. Where to obtain:

Division of Engineering
Lexington-Fayette Urban County Government
101 E. Vine St.
4th Floor
Lexington, KY 40507
(859) 258-3410
Attn: Land Disturbance Permit Section

C. All excess earthen/rock materials hauled off the site to a location in Fayette County shall be hauled to a site permitted by the Kentucky Division of Water and the LFUCG. The haul site must be permitted in accordance with these specifications.

LFUCG LAND DISTURBANCE PERMIT APPLICATION AND ESC PLAN CHECKLIST

OWNER / DEVELOPER Name: _____ **Date:** _____ **Zone:** _____

Address: _____ **City:** _____ **State:** _____ **Zip:** _____

Contractor Name and Address: _____ **Reg #:** _____

Contact Name, Phone/ FAX/Email: _____

ITEM DESCRIPTION	Y	N	N/A	PAGE #	NOTES
I. Permits:					
KY Construction Permit (KYR10 or Indvid)	☐	☐	☐		
USCOE 404 Permit	☐	☐	☐		
KYDOW 401 Water Quality Cert.	☐	☐	☐		
KY Stream Construction Permit	☐	☐	☐		
FEMA LOMR or CLOMR	☐	☐	☐		
II. BMPS:					
Site Preparation:					
Phasing plan for large projects	☐	☐	☐		Maximum disturbed area = 25 acres
Limits of disturbance clearly marked	☐	☐	☐		25 foot undisturbed buffer strip along streams
Construction Entrance/ Exit Pad	☐	☐	☐		No. 2 stone w/ filter fabric, min. 50 ft long (100' where practical)
Temporary Diversion (Berm or Ditch)	☐	☐	☐		Offsite (clean) water routed around disturbed area
Stream Crossings	☐	☐	☐		Not allowed without US Army Corps 404 permit
Concrete Washout Area	☐	☐	☐		One washout pit for every 40 lots
Soil Stabilization:					
Seeding/sodding schedule/timing	☐	☐	☐		Applied within 14 days of reaching final grade or suspending work
Slope Protection:					
Silt Fence downslope of bare areas	☐	☐	☐		
Silt Fence installed along contour	☐	☐	☐		
Erosion Control Blankets on slopes	☐	☐	☐		Conforms with Fig. 11-1 in LFUCG Stormwater Manual
Drainage System Control:					
Inlets Protected	☐	☐	☐		
Pipe Outfall Erosion Prevention	☐	☐	☐		
Channel Lining	☐	☐	☐		Sodding or seed w/ blankets/mats immediately after construction
Check Dams	☐	☐	☐		Max drainage area = 10 acres
Sediment Basins and Traps:					
Sediment Traps (drainage area < 5 ac)	☐	☐	☐		Minimum volume = 2yr-24hr runoff volume
Sediment Basins (drainage area = > 5 ac)	☐	☐	☐		Minimum volume = 2yr-24hr runoff volume
Good Housekeeping:					
Material storage addressed	☐	☐	☐		
Spill Prevention and Control addressed	☐	☐	☐		
Dust control addressed	☐	☐	☐		
Dewatering operations are filtered	☐	☐	☐		
Narrative:					
Schedule/sequence for BMP installation	☐	☐	☐		
BMP Inspection Requirement	☐	☐	☐		Every 7 days, or every 14 days and after 0.5" of rainfall
BMP Maintenance Requirement	☐	☐	☐		
Roadway Cleaning	☐	☐	☐		

LFUCG USE ONLY: Review Date: _____ **Status:** In Compliance: Y N Additional Info Needed: Y N

Reviewed By: _____ **Department:** _____

Comments / Items Missing or Incomplete:

Form Effective Date - January 13, 2011

Kentucky Best Management Practices Plan • Construction Site Inspection Report

Company:	**Site:**	**County:**
Site Operator:		**Date:**
Receiving Water:	**Total Site Area (acres):**	**# Disturbed Acres:**
Inspector Name:	**Inspector Qualifications:**	
Inspection Type: Weekly or ½ Inch Rain	**Days Since Last Rainfall** ____	**# Inches of Last Rainfall:** _____

Field Inspection Observations

BMP Category	Compliance Yes	No	N/A	Field Indicators for Compliance
Project Operations				Notice of Intent (KPDES permit) and other local/state permits on file BMP Plan on site and available for review Project timing/schedule and activities following BMP Plan Weekly inspection and rain-event reports on BMPs available for review Diversions, silt checks/traps/basins, and silt fences/barriers installed prior to clearing Grading and clearing conducted in phases to minimize exposed soil areas No vegetation removal or operations in stream or sinkhole buffer area (25-50 ft min) Rock pad in place on all construction site exits leading to paved roads No sediment, mud, or rock on paved public roads in project area Dust control if needed when working in residential areas during dry conditions
Drainage Management				Upland runoff diverted around bare soil areas with vegetated/lined ditches/berms Drainage channels exiting the site are lined with grass/blanket/rock and stabilized Discharges from dewatering operations cleaned in silt fence enclosure or other filter No muddy runoff leaving site after rains up to 1½ inches
Erosion Protection				Exposed soil seeded/mulched after 2 weeks if no work is planned for the next 7 days Soils on steep slopes seeded/mulched/blanketed as needed to prevent rutting
Sediment Barriers				Silt fence, rock filter, or other sediment barrier below all bare soil areas on slopes Barrier installed across slope on the contour, trenched in, posts on downhill side Multiple sediment barriers at least 125 ft apart on unseeded slopes steeper than 4:1 J-hook interceptors along silt fence where heavy muddy flows run along fencing No visible undercutting or bypassing or blowout of sediment barrier Accumulated sediment is less than halfway to the top of sediment barrier
Slope Protection				Slopes tracked, disked, or conditioned after final grade is established Slopes seeded, mulched, or blanketed within 21 days, no unmanaged rills or gullying Heavy downslope flows controlled by lined downdrain channels or slope drain pipes No muddy runoff from slopes into streams, rivers, lakes, or wetlands
Inlet Protection				Inlet dam/device or filtration unit placed at all inlets receiving muddy flows No visible undercutting, bypassing, or blowout of inlet protection dam or device Accumulated sediment is less than halfway to the top of the inlet protection dam/device
Outlet Protection				High flow discharges have rock or other flow dissipaters of adequate sizing at outlet Culvert outlets show no visible signs of erosion/scour, bank failure, or collapse
Ditch and Channel Stabilization				No unmanaged channel bank erosion or bottom scouring visible within or below site Ditches with slopes more than 3% have check dams spaced as needed, if not grassed Ditch check dams tied in to banks, with center 4" lower than sides, and no bypassing Ditches with slopes of up to 5% are thickly seeded with grass (minimum requirement) Ditches 5% to 15% are lined with thick grass and erosion control blankets as needed Ditches 15% to 33% are lined with thick grass and matting or other approved product Ditches exceeding 33% are paved or lined with rock or other approved product

Sediment Traps and Basins				Storage volume is at least 134 cubic yards for each acre of bare soil area drained Trap or basin is seeded/mulched and stabilized; no collapsing sidewalls or banks Outlet structure is stable and consists of rock-lined notched overflow or outlet riser Rock overflow is 6" lower in center to control overflow discharge Outlet riser pipe has concrete & rock base, ½ inch holes every 3" to 6", and trash rack Area near pipe outlet or overflow is stable, with no scour or erosion Sediment removed before trap or basin is halfway full; disposal is away from ditches
Maintenance of EPSC Management Practices				Sediment behind silt fence and other filters does not reach halfway to top Sediment traps and basins are less than half full of sediment Gullies repaired, silt fences and other controls inspected and repaired/replaced Written documentation of controls installed, inspection results, and repairs performed All controls removed and areas graded, seeded, and stabilized before leaving site
Materials Storage, Handling, and Cleanup				Materials that may leach pollutants stored under cover and out of the weather Fuel tanks located in protected area with double containment system Fuel and/or other spills cleaned up promptly; no evidence of unmanaged spills No evidence of paint, concrete, or other material washouts near drain inlets No storage of hazardous or toxic materials near ditches or water bodies
Waste Disposal				Trash, litter, and other debris in proper containers or properly managed No litter or trash scattered around on the construction site Provisions made for restroom facilities and/or other sanitary waste management Sanitary waste facilities clean and serviced according to schedule No disposal of any wastes into curb or other inlets, ditches, streams, or water bodies

Inspection Notes and Key Observations

List of Stabilized Areas: Vegetation is Established; Ditches are Stabilized; No Exposed Soil
Other Notes or Observations:
Corrective Actions Taken and/or Proposed Revisions to BMP Plan:

I certify under penalty of law that I understand the terms and conditions of the general Kentucky Pollutant Discharge Elimination System (KPDES) permit that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification.

Signature of Inspector: _____

CONTRACTOR AND SUBCONTRACTOR CERTIFICATIONS

SWPPP Files, Updates, and Amendments

This SWPP Plan and related documents (e.g., NOI, inspection reports, US ACE permits, etc.) will be kept on file at the construction site by _____ (name and title). The SWPPP will be updated by the Owner and/or Site Manager to reflect any and all significant changes in site conditions, selection of BMPs, the presence of any unlisted potential pollutants on site, or changes in the Site Manager, contractor, subcontractors, or other key information. Updates and amendments will be made in writing within 7 days and will be appended to the original BMP Plan and available for review.

Stormwater Pollution Prevention Plan 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 gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed: _____ Date: _____

Title: _____

I certify under penalty of law that I understand the terms and conditions of the general KPDES permit that authorizes the storm water discharges associated with the construction site activity identified as part of this certification.

Subcontractor Certification

The subcontractors below certify under penalty of law that they understand the terms and conditions of the general KPDES permit that authorizes the storm water discharges associated with the construction site activity identified as part of this certification.

Signed: _____ Date: _____

Title: _____

Signed: _____ Date: _____

Title: _____

Signed: _____ Date: _____

Title: _____

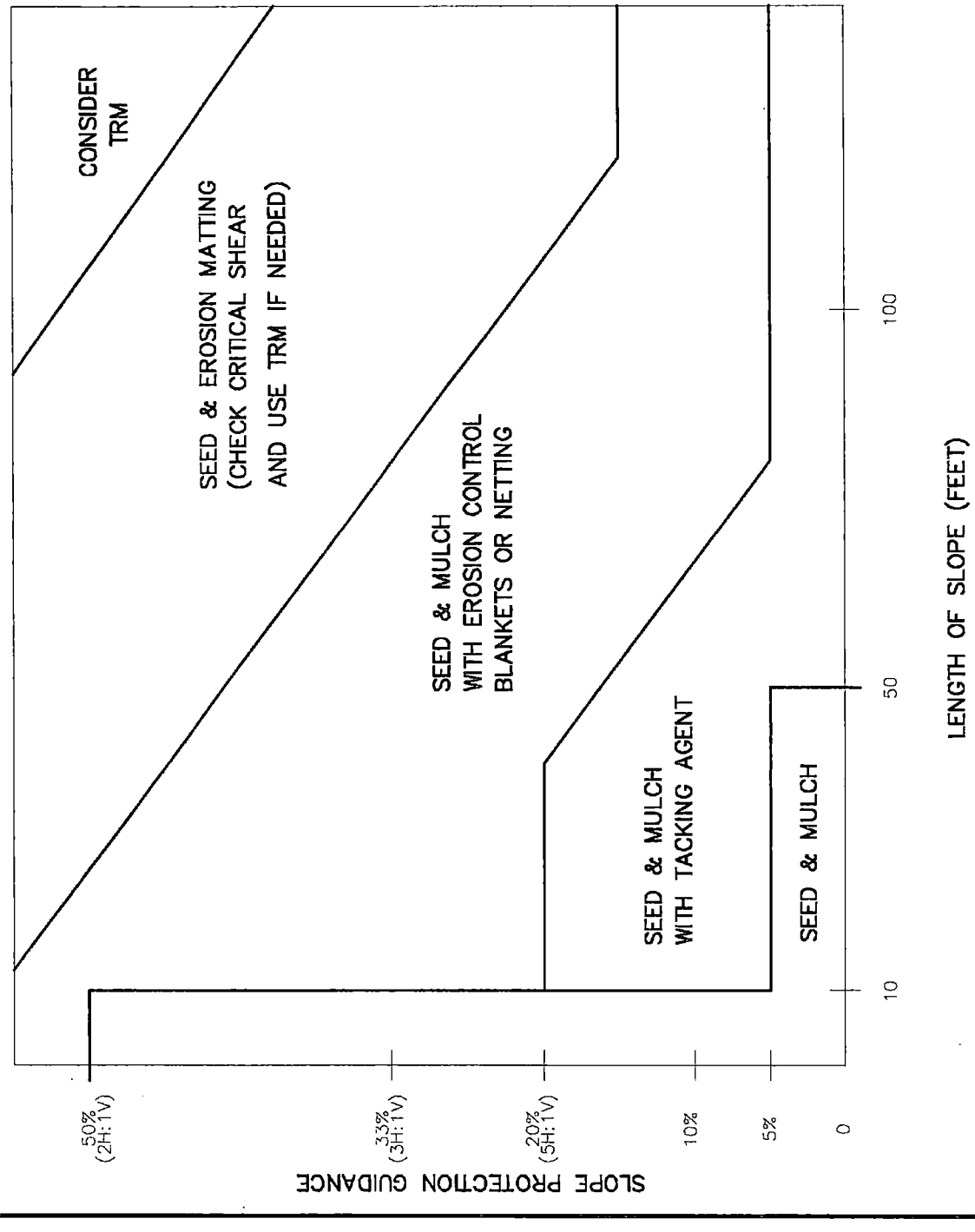
STORMWATER MANUAL

FIGURE 11–1

SLOPE PROTECTION GUIDANCE

(OCTOBER 1, 2016)

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.



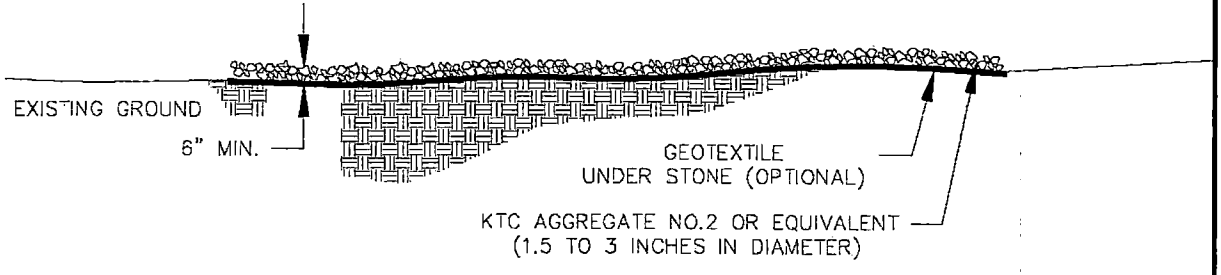
STORMWATER MANUAL

FIGURE 11–2

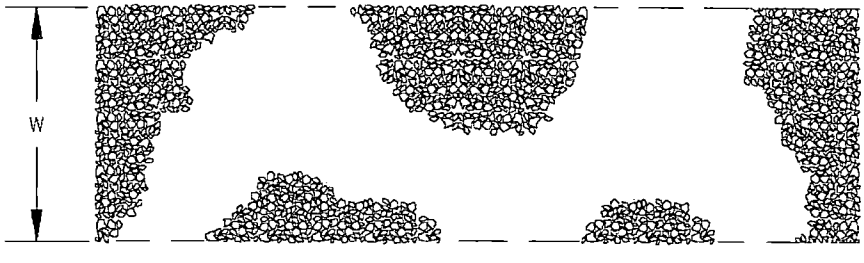
ROAD\PARKING STABILIZATION

(OCTOBER 1, 2016)

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.



CROSS SECTION



PLAN VIEW

W = 14' MIN. FOR ONE WAY TRAFFIC
20' MIN. FOR TWO WAY TRAFFIC

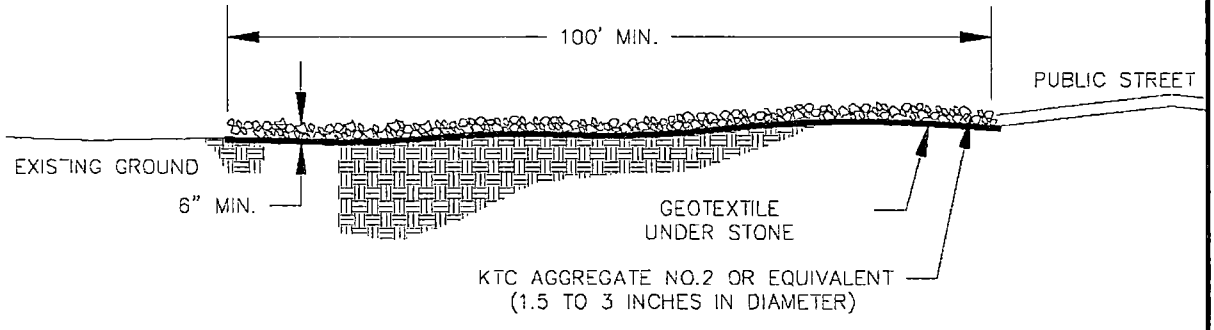
STORMWATER MANUAL

FIGURE 11-3

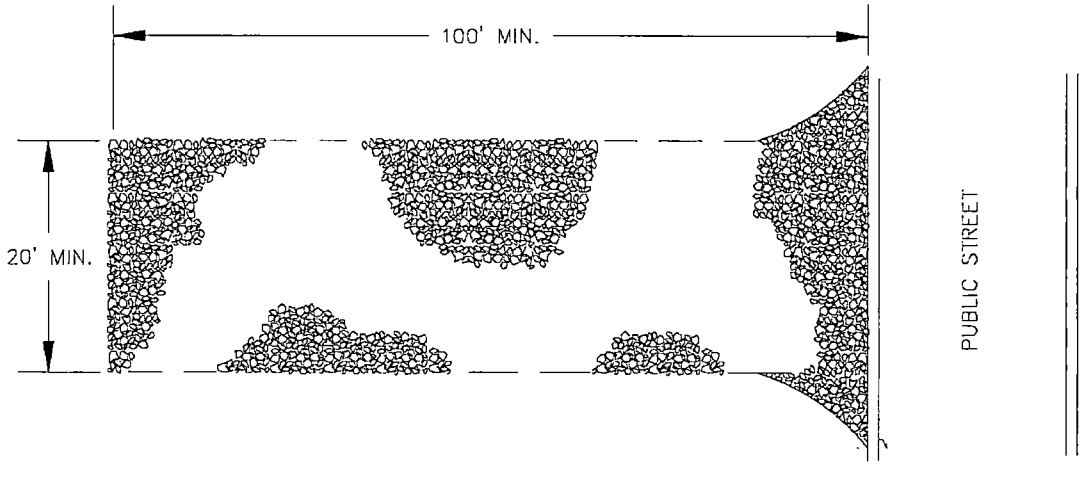
CONSTRUCTION ENTRANCE

(OCTOBER 1, 2016)

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.



CROSS SECTION



PLAN VIEW

STORMWATER MANUAL

FIGURE 11–4

CONSTRUCTION ENTRANCE
NOTES AND SPECIFICATIONS

(OCTOBER 1, 2016)

SPECIFICATIONS FOR GEOTEXTILE FABRIC

GRAB TENSILE STRENGTH	220 LBS. (MIN.) (ASTM D1682)
ELONGATION FAILURE	60% (MIN.) (ASTM D1682)
MULLEN BURST STRENGTH	430 LBS. (MIN.) (ASTM D3768)
PUNCTURE STRENGTH	125 LBS. (MIN.) (ASTM D751) (MODIFIED)
EQUIVALENT OPENING	SIZE 40–80 (US STD SIEVE) (CW–02215)

NOTES

1. A STABILIZED ENTRANCE PAD OF CRUSHED STONE SHALL BE LOCATED WHERE TRAFFIC WILL ENTER OR LEAVE THE CONSTRUCTION SITE ONTO A PUBLIC STREET.
2. SOIL STABILIZATION FABRIC SHALL BE USED AS A BASE FOR THE CONSTRUCTION ENTRANCE.
3. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC STREETS OR EXISTING PAVEMENT. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS WARRANT AND REPAIR OR CLEAN OUT OF ANY MEASURES USED TO TRAP SEDIMENT.
4. ANY SEDIMENT SPILLED, DROPPED, WASHED, OR TRACKED ONTO PUBLIC STREETS OR INTO STORM DRAINS MUST BE REMOVED IMMEDIATELY.
5. WHEN APPROPRIATE, WHEELS MUST BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTERING A PUBLIC STREET. WHEN WASHING IS REQUIRED, IT SHALL BE DONE IN AN AREA STABILIZED WITH CRUSHED STONE WHICH DRAINS INTO AN APPROVED SEDIMENT BASIN.

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11–5

STAPLE PATTERN FOR STRAW OR EXCELSIOR MATS

(OCTOBER 1, 2016)

SLOPES UP TO 1.5H:1V

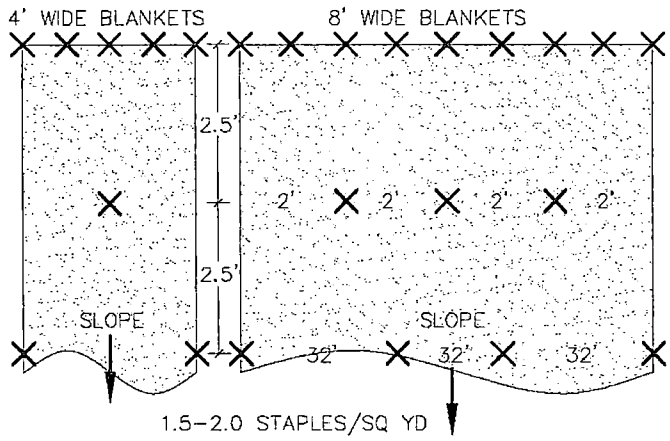
- INSTALL BLANKET VERTICALLY OR HORIZONTALLY
- USE 12" STAPLE SPACING ON STARTER ROW.

COHESIVE SOILS:

- NO OVERLAP REQUIRED ON SIDE SEAMS
- USE 6" STAPLE LENGTH

NON–COHESIVE SOILS:

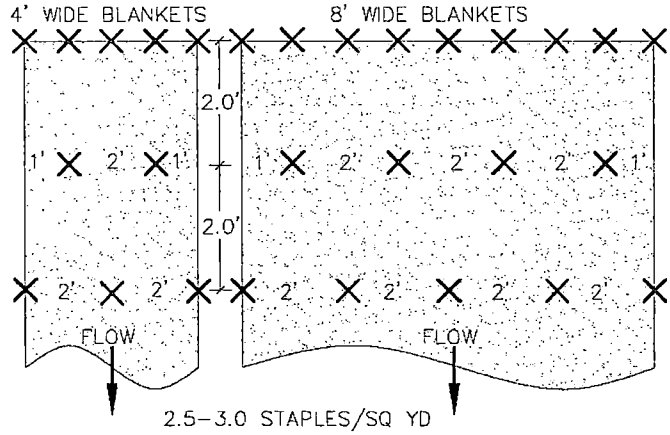
- USE 6" SIDE SEAM OVERLAP
- USE 8" STAPLE LENGTH
- USE 6" ANCHOR TRENCH AT TOP OF SLOPE



1.5–2.0 STAPLES/SQ YD

CHANNELS IN COHESIVE SOILS

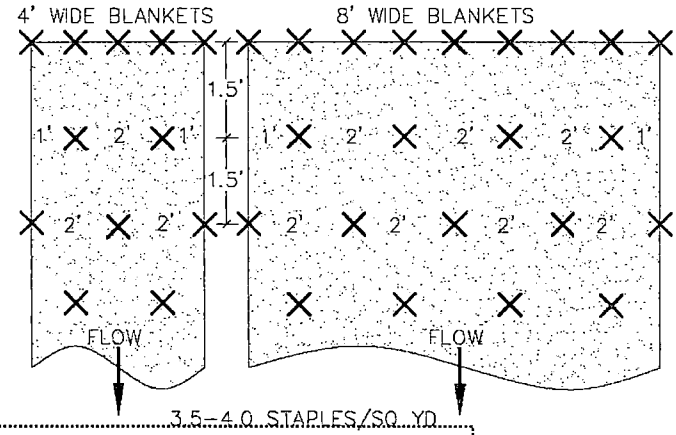
- USE 6" SIDE SEAM OVERLAP
- USE 6" STAPLE LENGTH
- USE 6" TRANSVERSE ANCHOR TRENCH AT 100–FT. INTERVALS
- USE 12" STAPLE SPACING ON STARTER ROW.
- UPSTREAM BLANKET SHOULD OVERLAP DOWNSTREAM BLANKET A DISTANCE OF 12" IN A "SHINGLE" FASHION AND BURY THE FINISHED TOE AT LEAST 6".



2.5–3.0 STAPLES/SQ YD

CHANNELS IN NON–COHESIVE SOILS

- USE 6" SIDE SEAM OVERLAP
- USE 8" STAPLE LENGTH
- USE 6" TRANSVERSE ANCHOR TRENCH AT 50–FT. INTERVALS
- USE 12" STAPLE SPACING ON STARTER ROW.
- UPSTREAM BLANKET SHOULD OVERLAP DOWNSTREAM BLANKET A DISTANCE OF 12" IN A "SHINGLE" FASHION AND BURY THE FINISHED TOE AT LEAST 6".



3.5–4.0 STAPLES/SQ YD

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

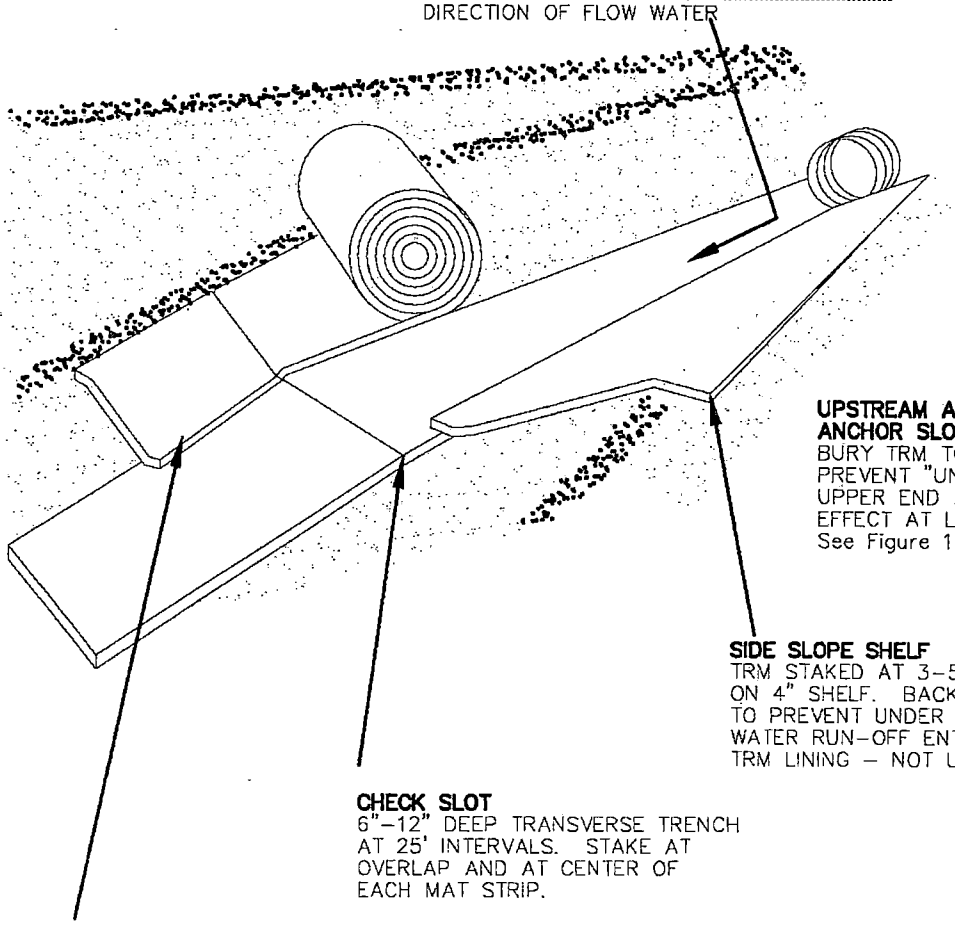
STORMWATER MANUAL

FIGURE 11-6

PLACEMENT OF TRM IN CHANNEL

(OCTOBER 1, 2016)

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.



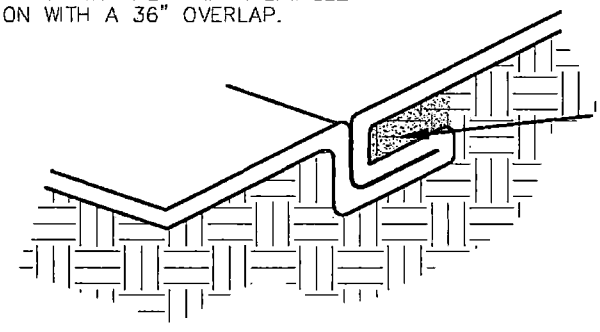
UPSTREAM AND DOWNSTREAM ANCHOR SLOTS
BURY TRM TO 12" DEPTH TO PREVENT "UNDER FLOW" AT UPPER END AND "WATERFALL" EFFECT AT LOWER END.
See Figure 11-7

SIDE SLOPE SHELF
TRM STAKED AT 3-5' INTERVALS ON 4" SHELF. BACK FILL AND TAMP TO PREVENT UNDER WASHING. WATER RUN-OFF ENTERS ONTO TRM LINING - NOT UNDER IT.

CHECK SLOT
6"-12" DEEP TRANSVERSE TRENCH AT 25' INTERVALS. STAKE AT OVERLAP AND AT CENTER OF EACH MAT STRIP.

OVERLAP IN A SHINGLE FASHION
4" OVERLAP STAKED AT 3-5' INTERVALS

WHEN ROLL TERMINATES, IT IS STAKED OVER THE ROLL WHICH EXTENDS DOWNSTREAM IN A SHINGLE FASHION WITH A 36" OVERLAP.



CHECK SLOT DETAIL
STAKE AND BACK FILL IN CHECK SLOT BEFORE CONTINUING TO PLACE UPSLOPE

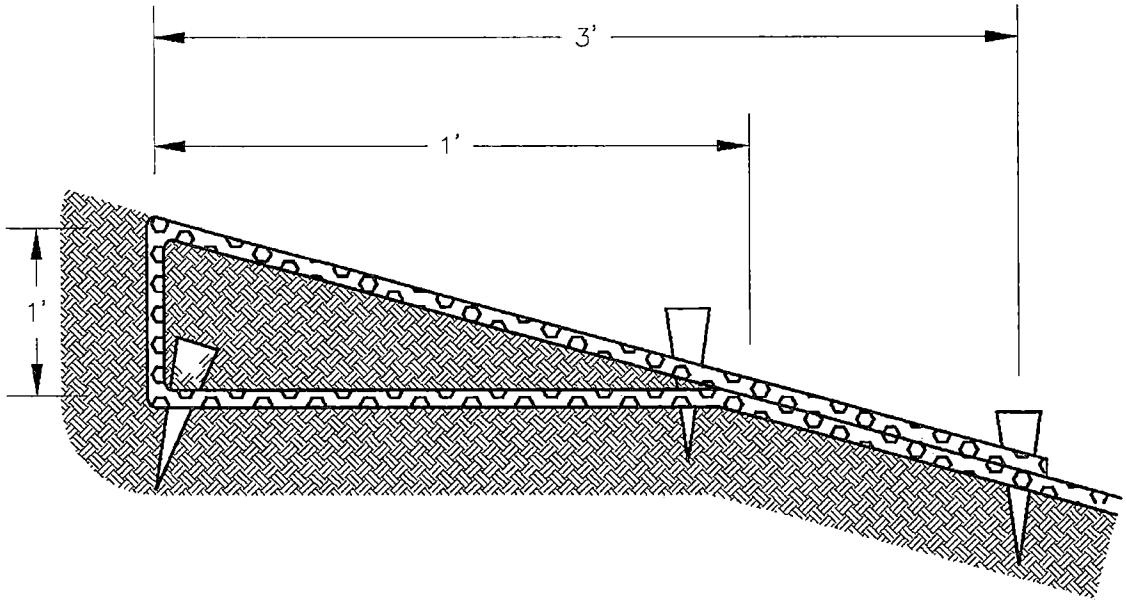
STORMWATER MANUAL

FIGURE 11–7

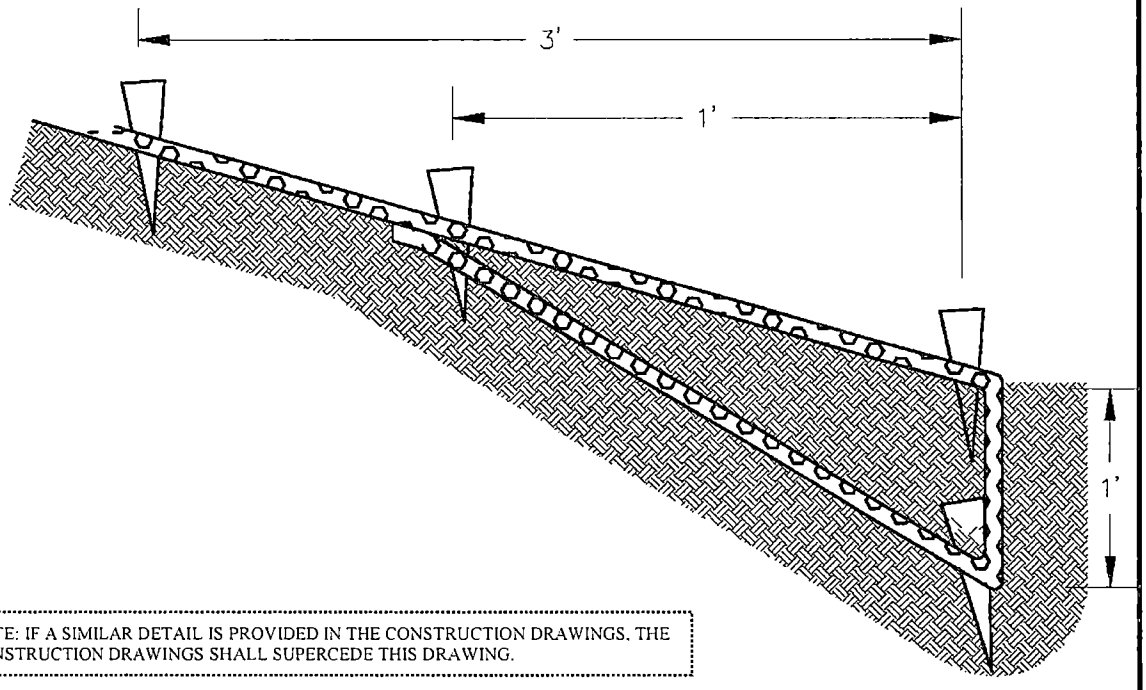
ANCHOR SLOT DETAILS FOR TRM

(OCTOBER 1, 2016)

UPSTREAM ANCHOR SLOT DETAIL



DOWNSTREAM ANCHOR SLOT DETAIL



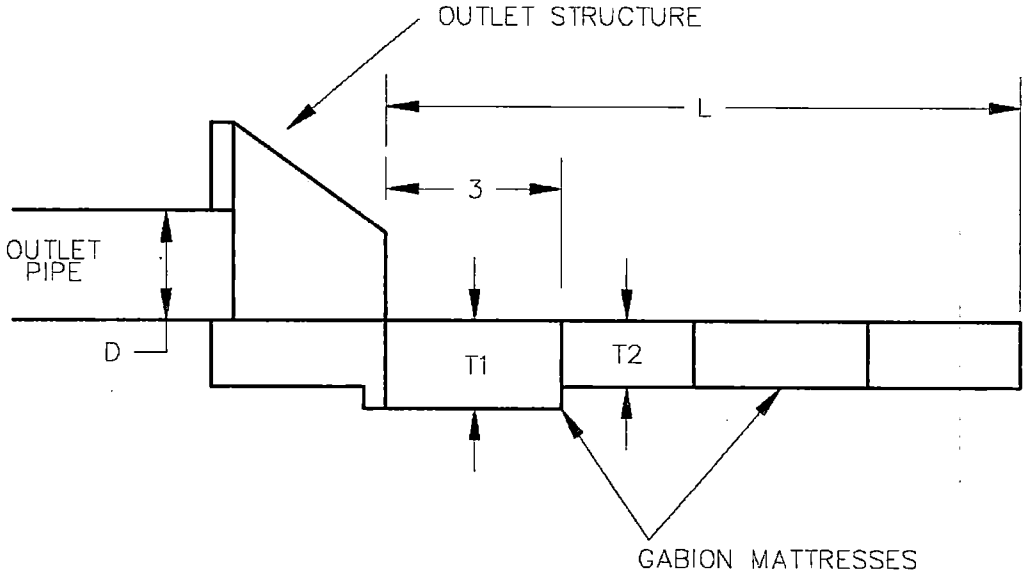
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11–8

CROSS SECTION AT
GABION MATTRESS OUTLET PROTECTION

(OCTOBER 1, 2016)



T1 = THICKNESS OF FIRST 3 FEET OF GABION MATTRESS TO MATCH DEPTH OF OUTLET STRUCTURE FOUNDATION

T2 = THICKNESS OF REMAINING GABION MATTRESS, 12 INCHES MINIMUM AND 18 INCHES MINIMUM FOR CALCULATED OUTLET VELOCITIES OF 10 TO 15 FEET PER SECOND.

FOR D < 36 INCHES, L = 12 FEET

FOR D > 36 INCHES, L = 4 x D FEET

D = HEIGHT OR WIDTH OF OUTLET, WHICHEVER IS GREATER

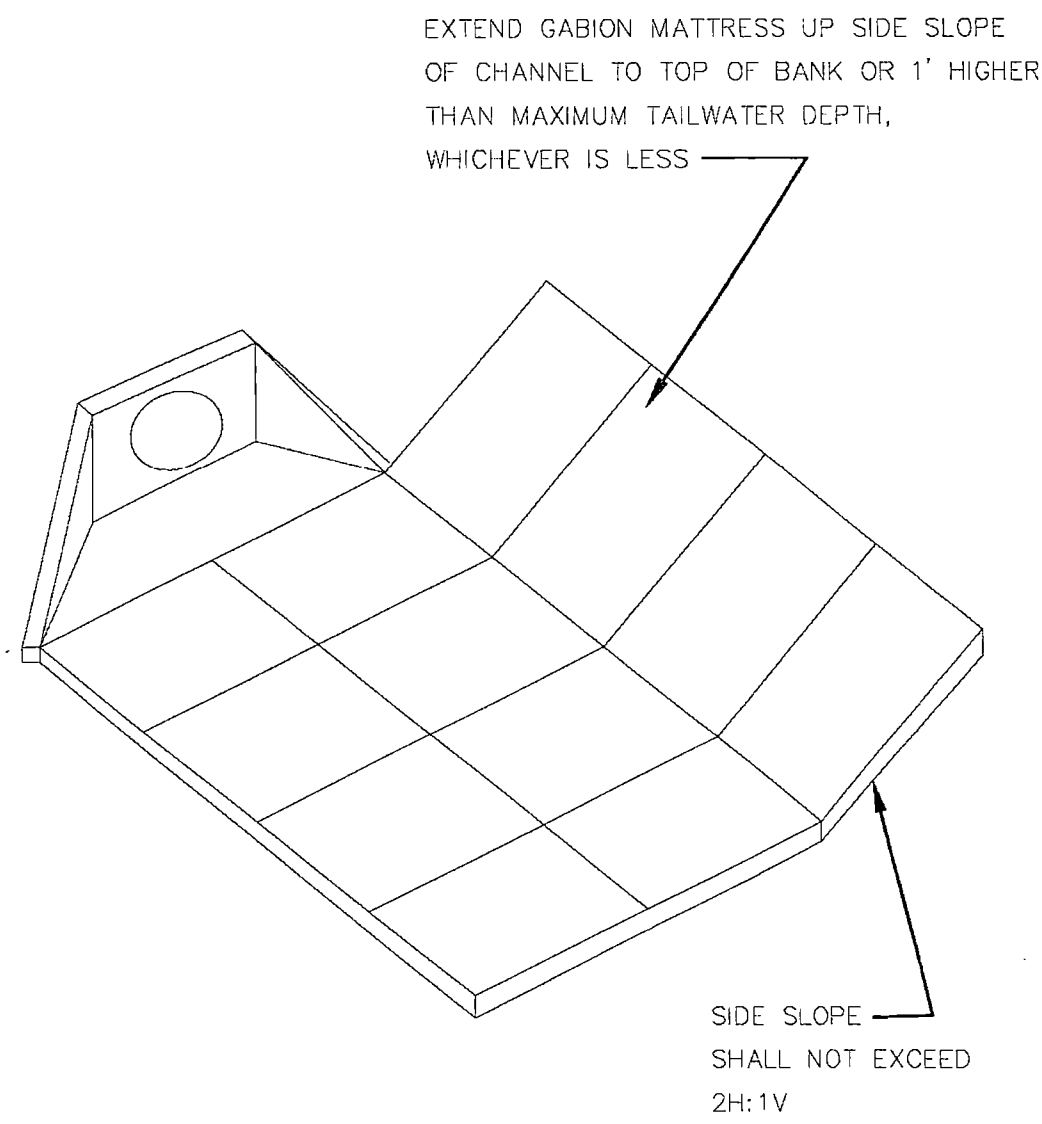
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11-9

GABION MATTRESS AT OUTLET INTO WELL-DEFINED CHANNEL

(OCTOBER 1, 2016)



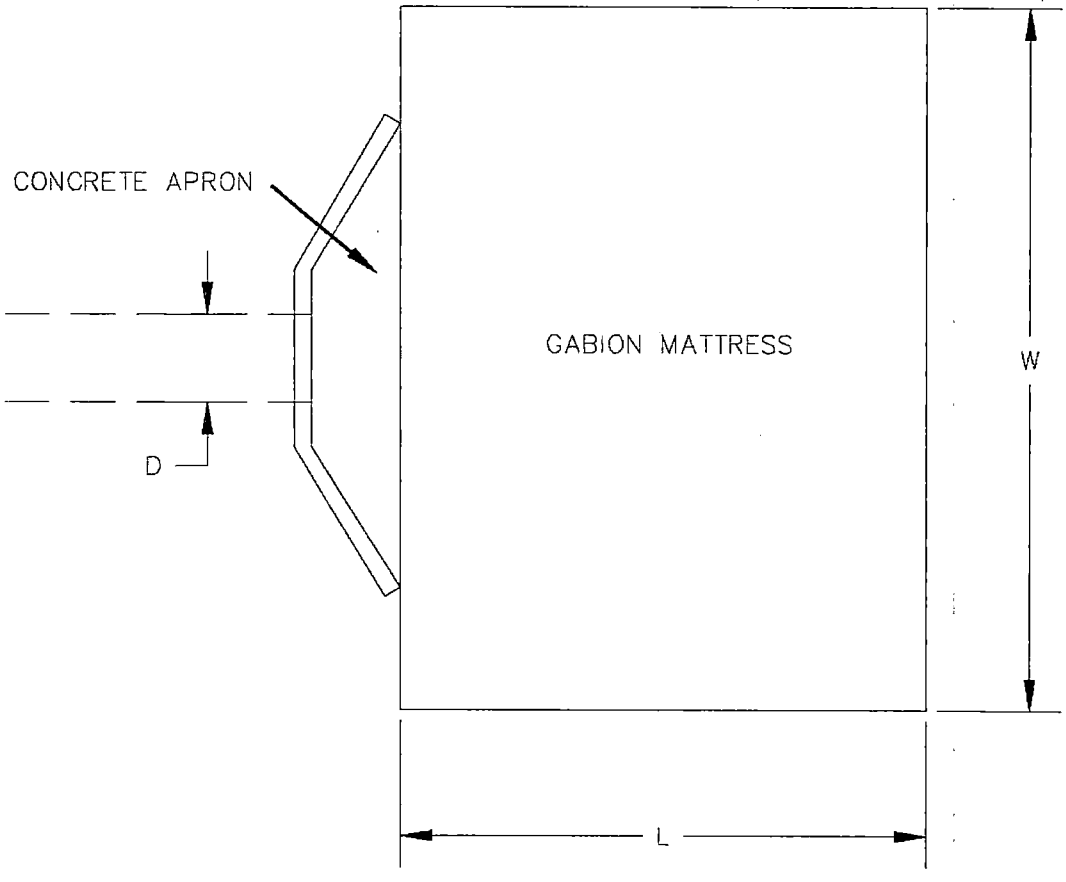
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11–10

PLAN VIEW OF GABION MATTRESS AT OUTLET INTO FLAT AREA

(OCTOBER 1, 2016)



D = HEIGHT OR WIDTH OF OUTLET, WHICHEVER IS GREATER

FOR D <= 36 INCHES:

L = 12 FEET MINIMUM

W = (18 + D) FEET MINIMUM

FOR D > 36 INCHES:

L = 4 x D FEET MINIMUM

W = (2 L + D) FEET MINIMUM

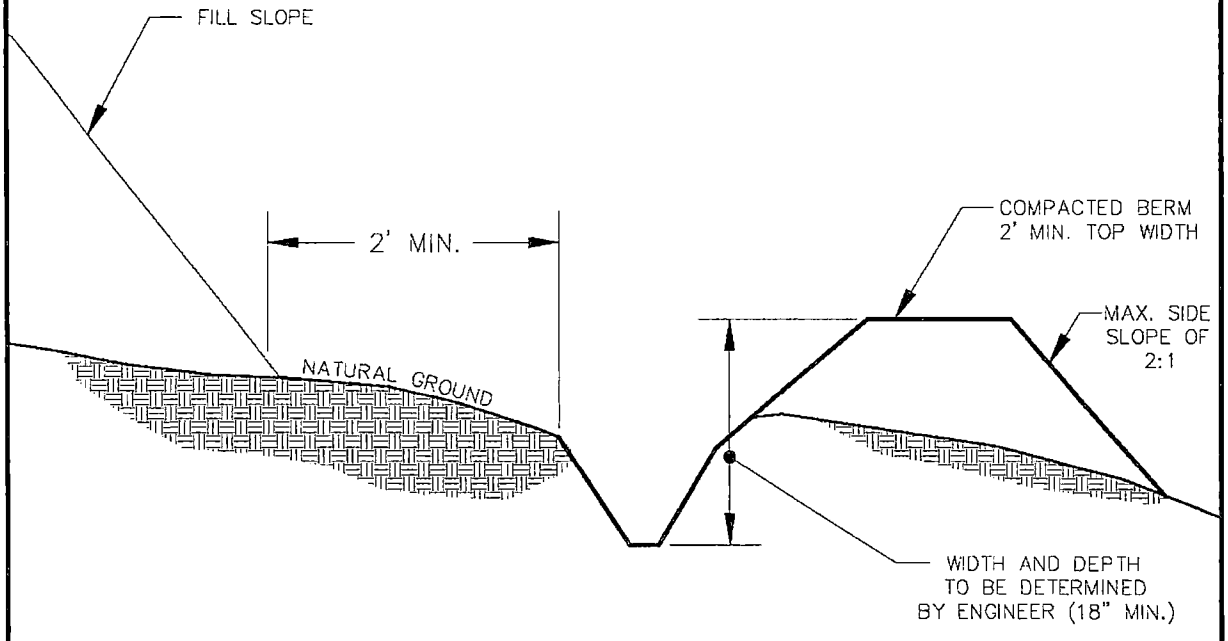
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11-12

TEMPORARY DIVERSION DITCH

(OCTOBER 1, 2016)



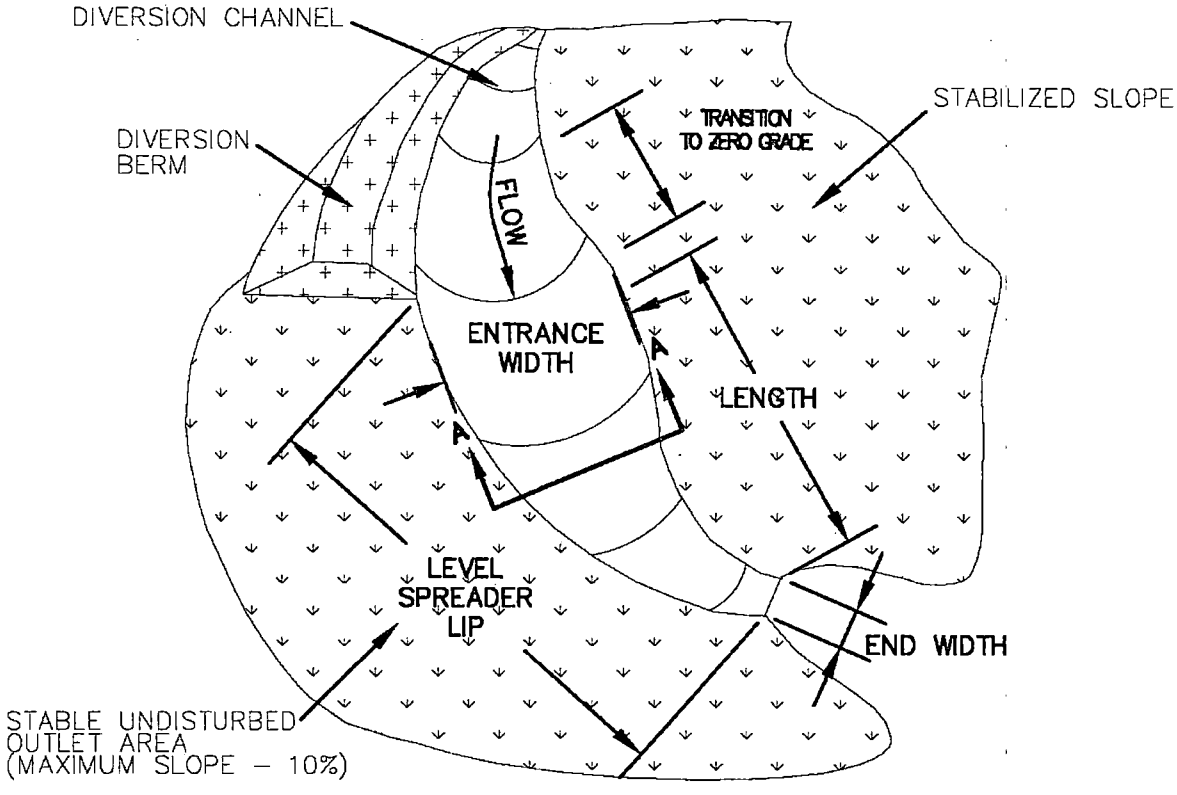
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11–13

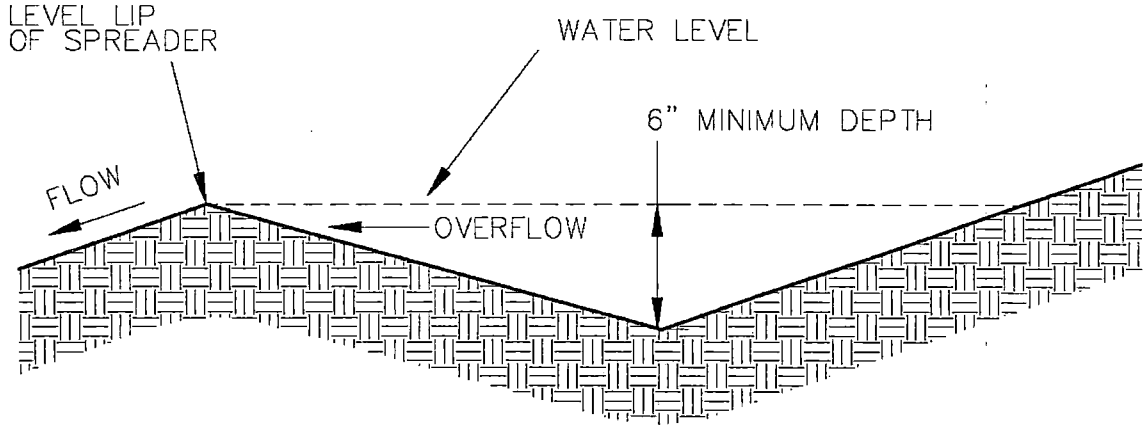
LEVEL SPREADER

(OCTOBER 1, 2016)



PERSPECTIVE

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.



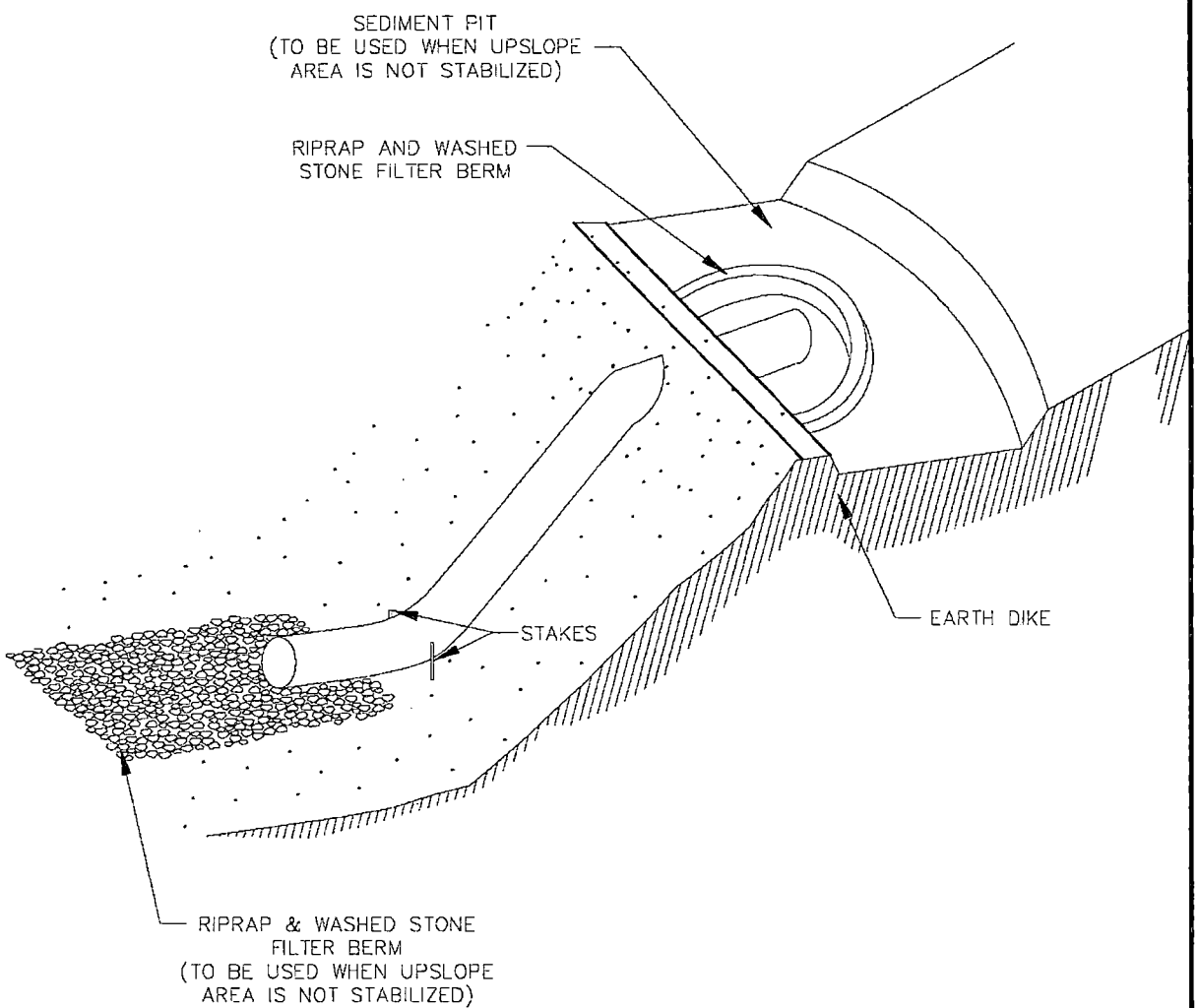
SECTION A–A

STORMWATER MANUAL

FIGURE 11–14

FLEXIBLE PIPE SLOPE DRAIN

(OCTOBER 1, 2016)



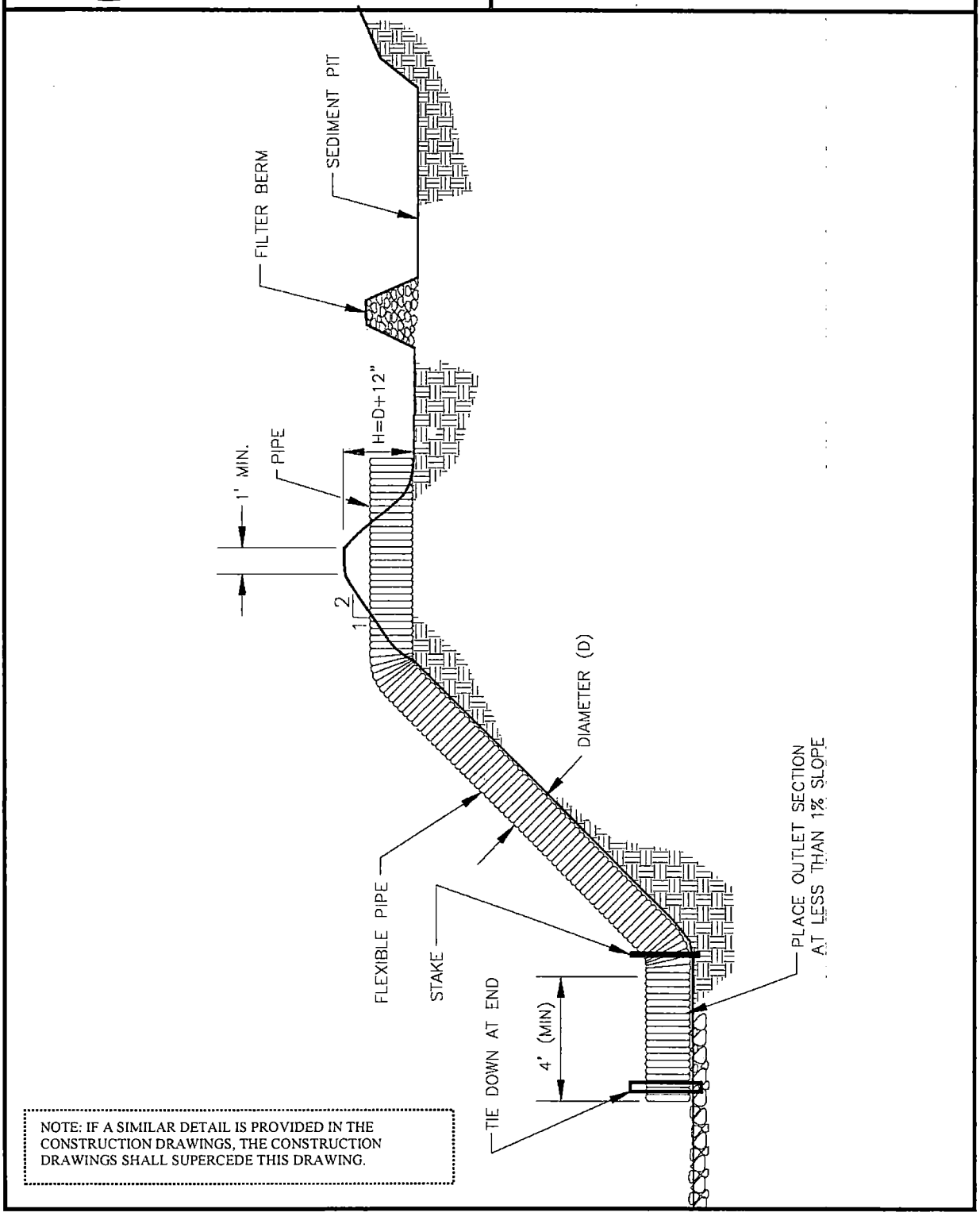
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11–15

SLOPE DRAIN – PROFILE

(OCTOBER 1, 2016)



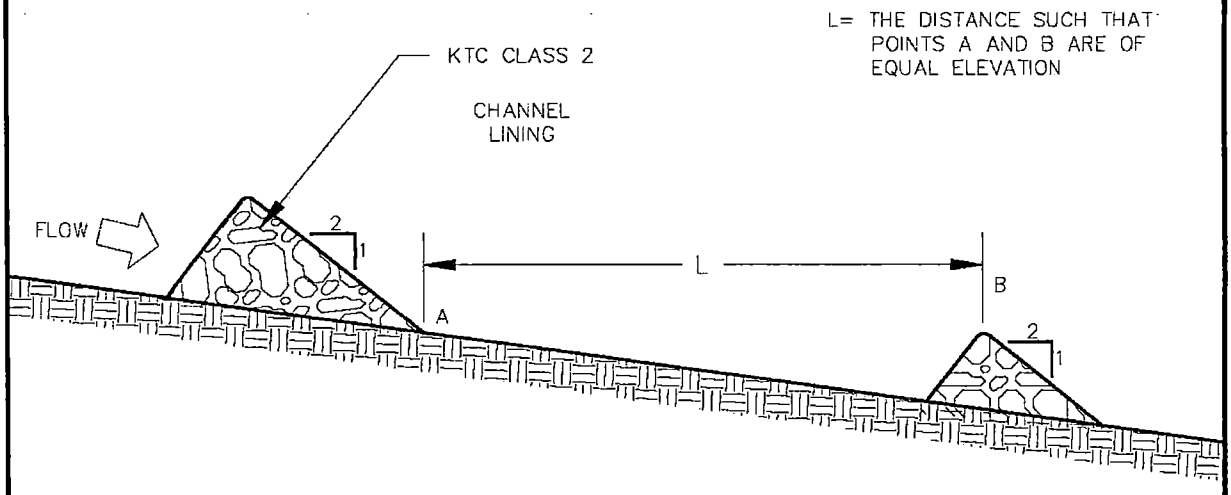
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

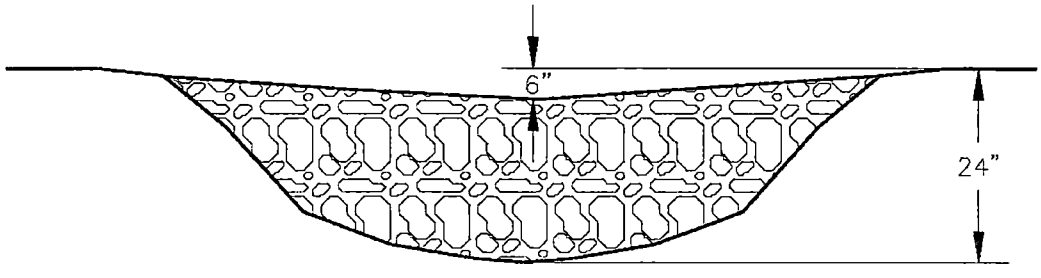
FIGURE 11–16

ROCK CHECK DAM

(OCTOBER 1, 2016)



LONGITUDINAL SECTION SHOWING SPACING BETWEEN CHECK DAMS



SECTION ACROSS CHANNEL

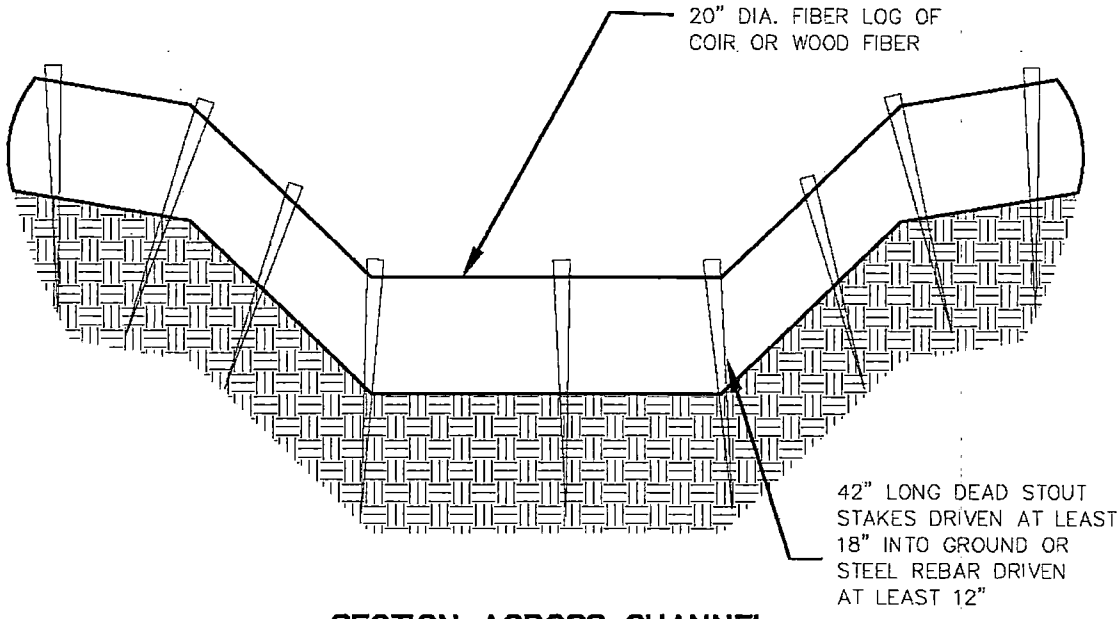
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11–17

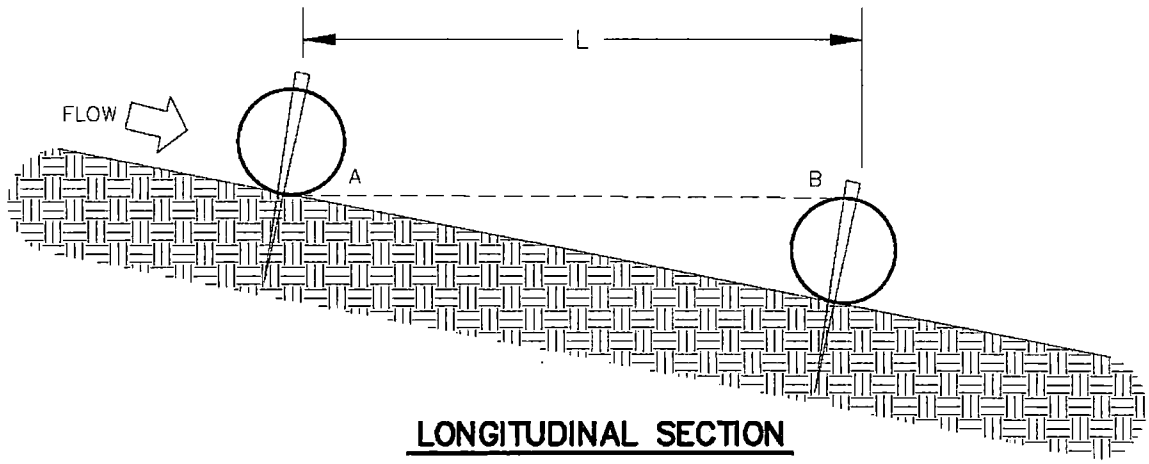
FIBER LOG CHECK DAM

(OCTOBER 1, 2016)



SECTION ACROSS CHANNEL

STAKES SHALL BE SPACED NO FURTHER THAN 24" AND SHALL BE DRIVEN AT EACH SIGNIFICANT SLOPE BREAK AND WITHIN 6" OF EACH END.



LONGITUDINAL SECTION

L = DISTANCE SUCH THAT POINTS A AND B ARE OF EQUAL ELEVATION

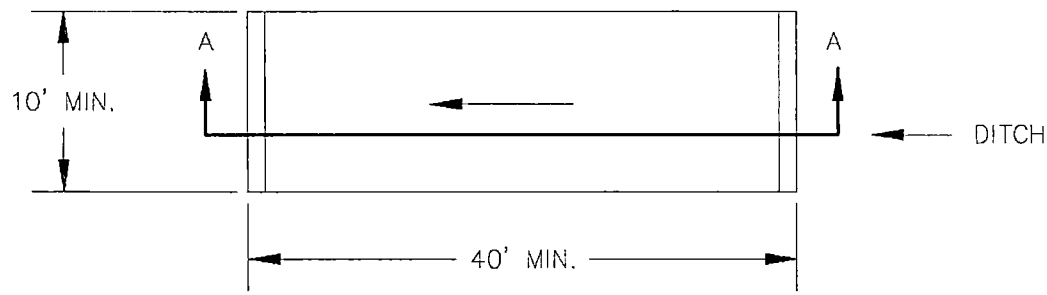
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

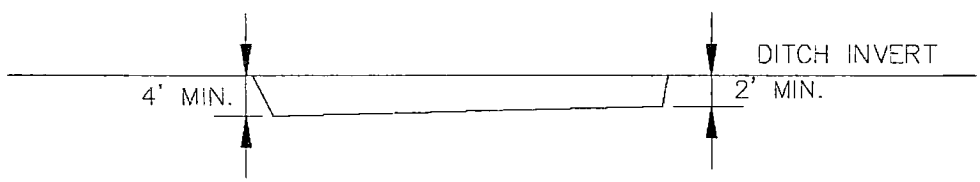
FIGURE 11–18

SEDIMENT TRAP

(OCTOBER 1, 2016)



PLAN VIEW



SECTION A–A

NOTES:

1) THE SIZE, SHAPE AND LOCATION OF TRAP MAY BE ADJUSTED FROM THAT SHOWN IN THE CONSTRUCTION PLANS, AS DIRECTED BY THE ENGINEER.
2) THE SEDIMENT TRAP MAY BE CONSTRUCTED AS DIRECTED BY THE ENGINEER AS LONG AS THE AREA AND DEPTH IS AT LEAST AS THAT INDICATED ON THE PLANS.
3) SEDIMENT TRAP SHALL BE CONSTRUCTED BY EXCAVATING THE BASIN IN NATURAL OR EXCAVATED CHANNELS. SEDIMENT DEPOSITS IN TRAP SHALL BE REMOVED EACH TIME THE TRAP IS APPROXIMATELY 50 PERCENT FILLED. WHEN THEIR USEFULNESS HAS ENDED, THE TRAPS SHALL BE REMOVED, SURPLUS MATERIAL DISPOSED OF AND THE ENTIRE DISTURBED AREA SHALL BE SEEDED AND PROTECTED, OR SODDED, AS DIRECTED. SEDIMENT TRAPS MAY REMAIN IN PLACE UPON COMPLETION OF THE PROJECT ONLY WHEN PERMITTED BY THE ENGINEER OR THE PLANS.

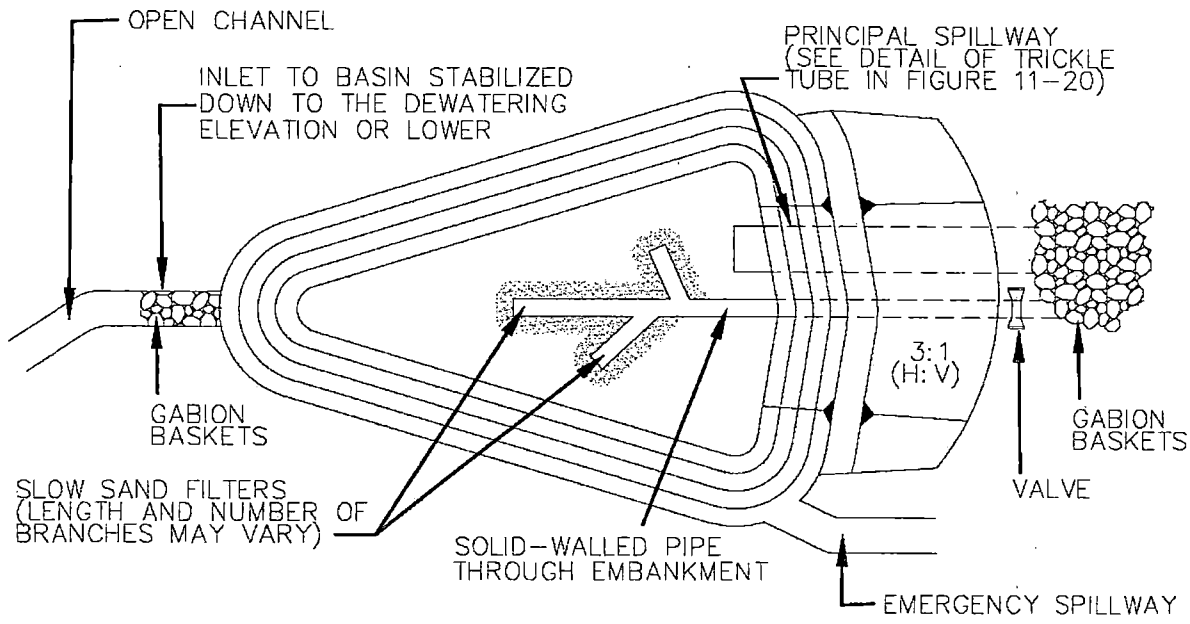
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11–19

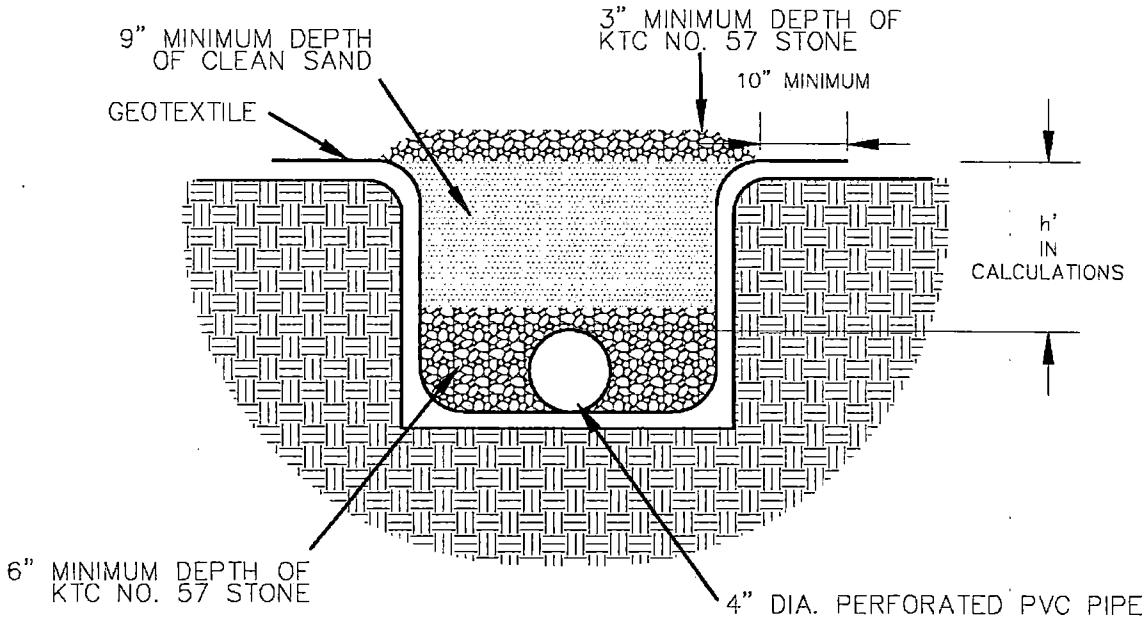
SEDIMENT POND WITH SAND FILTER OUTLET

(OCTOBER 1, 2016)



PLAN VIEW

N.T.S.



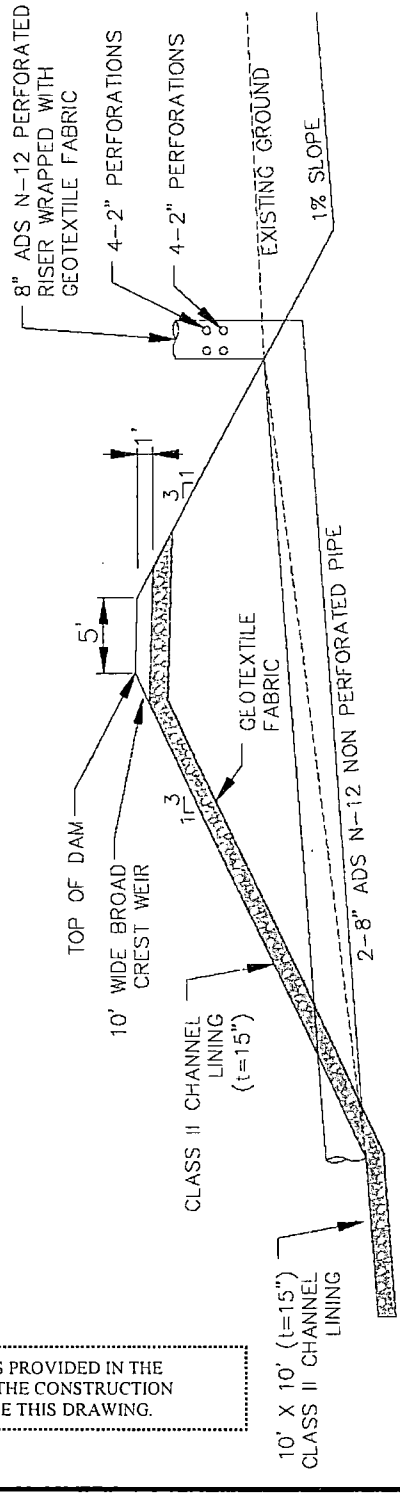
TYPICAL SECTION

N.T.S.

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11–20
TEMPORARY SEDIMENTATION BASIN
OUTLET STRUCTURE / SPILLWAY
DETAIL
(OCTOBER 1, 2016)



TEMPORARY SEDIMENTATION BASIN
OUTLET STRUCTURE / SPILLWAY
N.T.S.

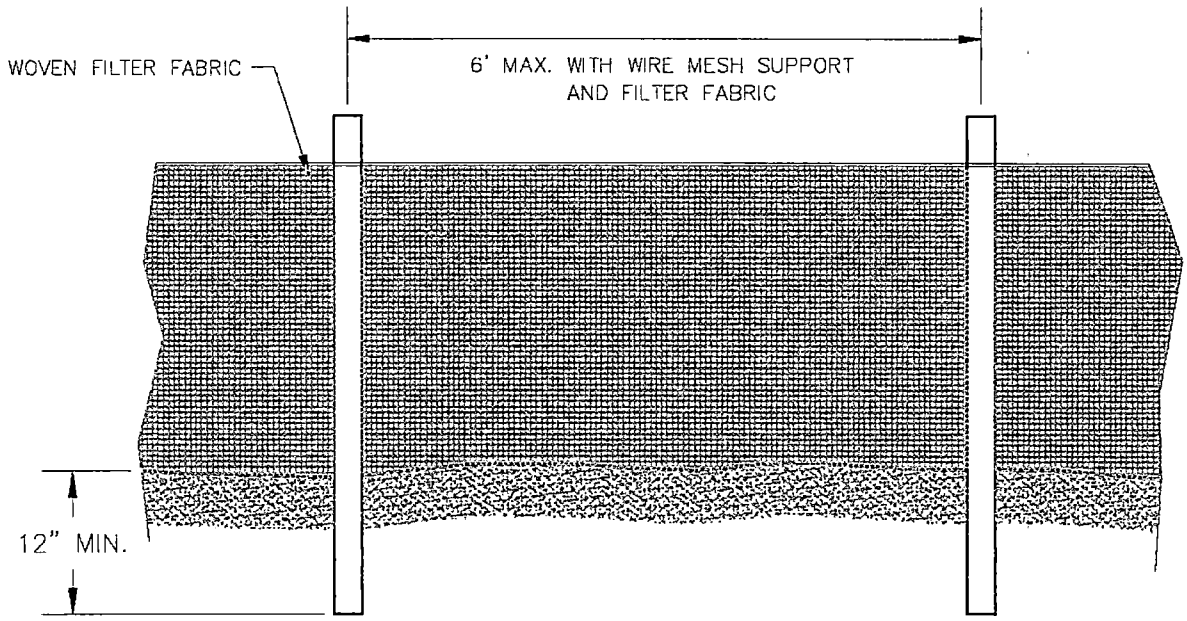
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

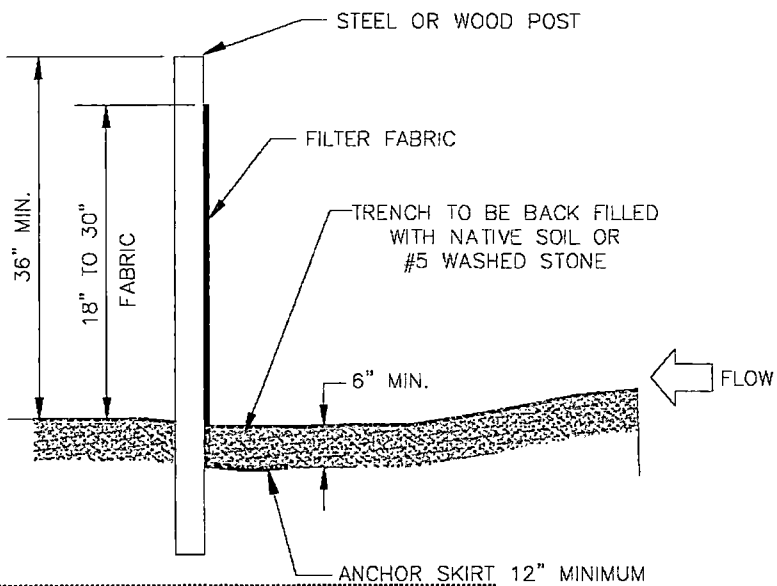
STORMWATER MANUAL

FIGURE 11-21

TEMPORARY SILT FENCE

(OCTOBER 1, 2016)





NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11-22

TEMPORARY SILT FENCE
GENERAL NOTES

(OCTOBER 1, 2016)

GENERAL NOTES

1. FILTER FABRIC SHALL BE PURCHASED IN A CONTINUOUS ROLL AND CUT TO THE LENGTH OF THE BARRIER. WHEN JOINTS CANNOT BE AVOIDED, FILTER FABRIC SHALL BE SPLICED TOGETHER ONLY AT A POST WITH 3 FOOT MIN. OVERLAP, AND SECURELY SEALED.
2. POSTS SHALL BE SPACED AT 6 FOOT INTERVALS IN AREAS OF RAPID RUNOFF.
3. POSTS SHALL BE AT LEAST 5 FEET IN LENGTH.
4. STEEL POSTS SHALL HAVE PROJECTIONS FOR FASTENING WIRE AND FABRIC.
5. WOOD POSTS SHALL BE 2 INCHES BY 2 INCHES OR EQUIVALENT. STEEL POSTS SHALL BE 1.33 LBS PER LINEAR FOOT.
6. A WIRE MESH SUPPORT FENCE SHALL BE FASTENED SECURELY TO THE UPSLOPE SIDE OF THE POSTS USING HEAVY DUTY WIRE STAPLES AT LEAST 1 INCH IN LENGTH, WIRE TIES OR HOG RINGS. THE WIRE SHALL EXTEND INTO THE TRENCH A MINIMUM OF 2 INCHES AND SHALL NOT EXTEND MORE THAN 36 INCHES ABOVE THE ORIGINAL GROUND SURFACE.
7. WASHED STONE SHALL BE USED TO BURY SKIRT WHEN SILT FENCE IS USED ADJACENT TO A CHANNEL, CREEK, OR POND.
8. TURN SILT FENCE UP SLOPE AT ENDS.

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

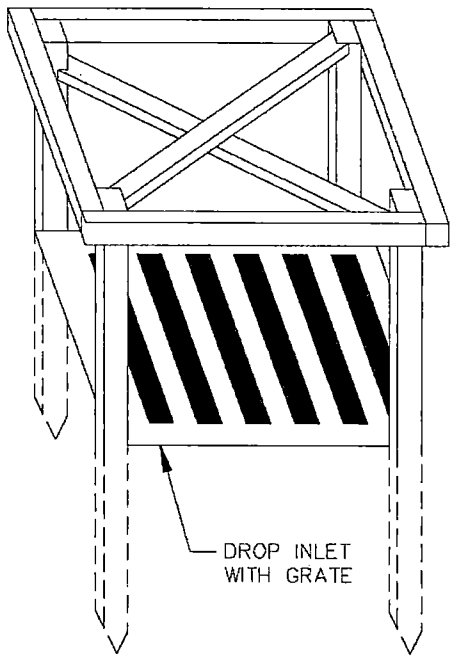
STORMWATER MANUAL

FIGURE 11–23

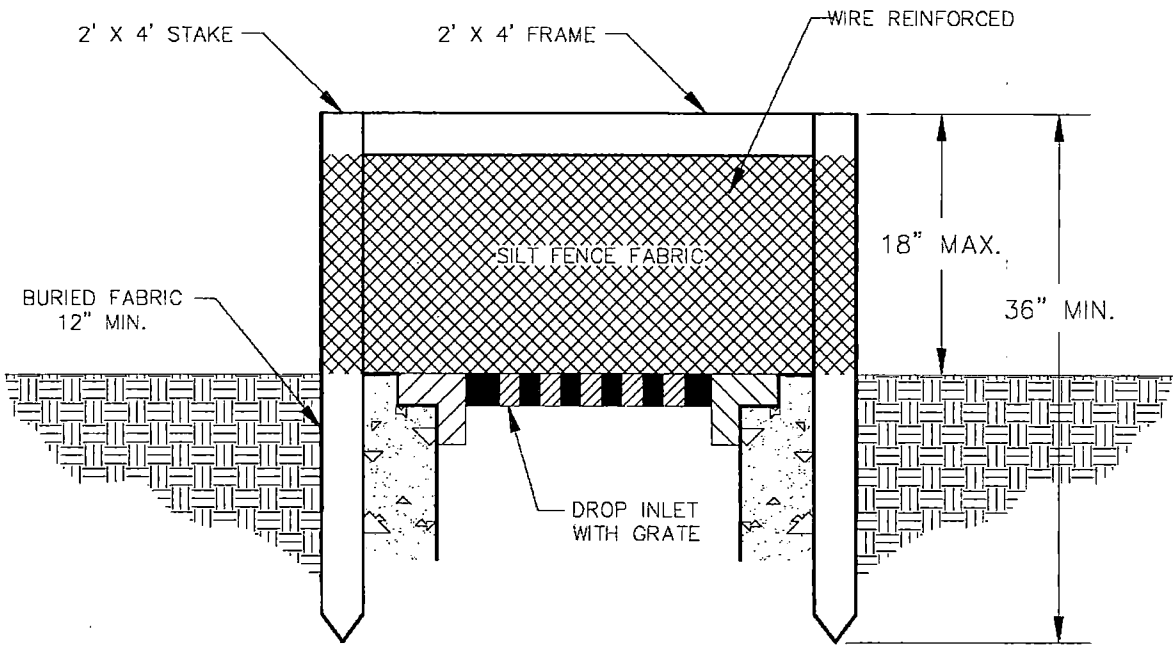
DROP INLET PROTECTION
USING SILT FENCE

(OCTOBER 1, 2016)

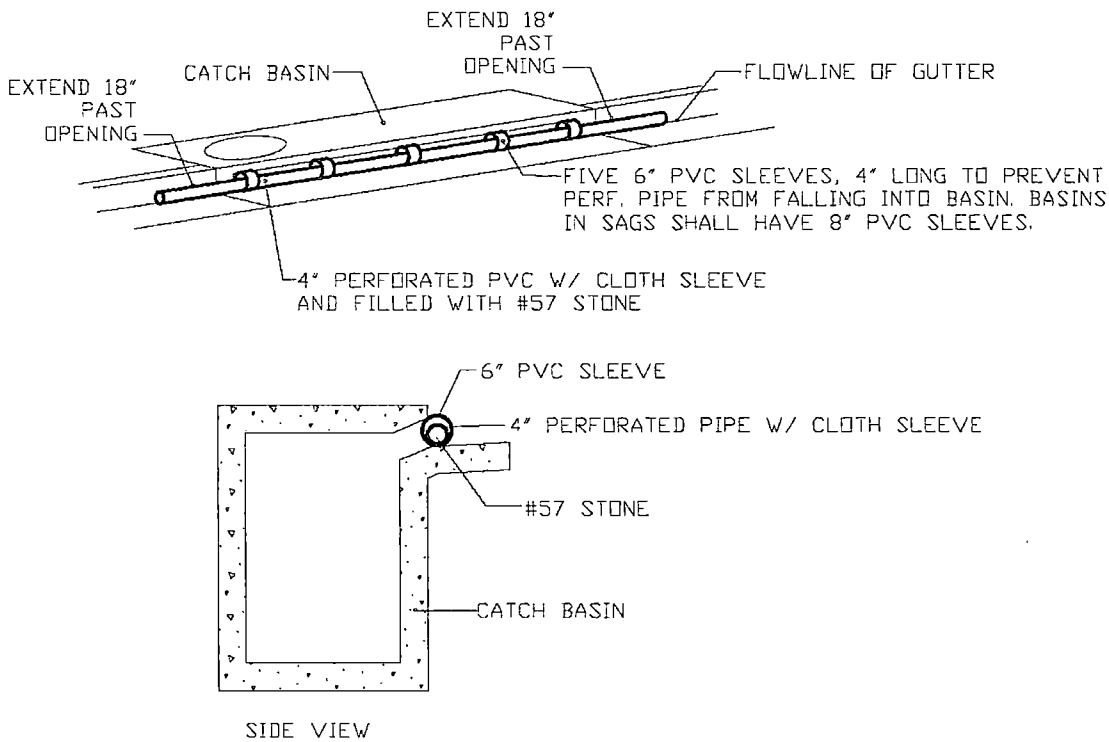
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.



ISOMETRIC VIEW OF
2 X 4 WOOD FRAME



CROSS SECTION VIEW



CATCH BASIN INLET PROTECTION DETAIL

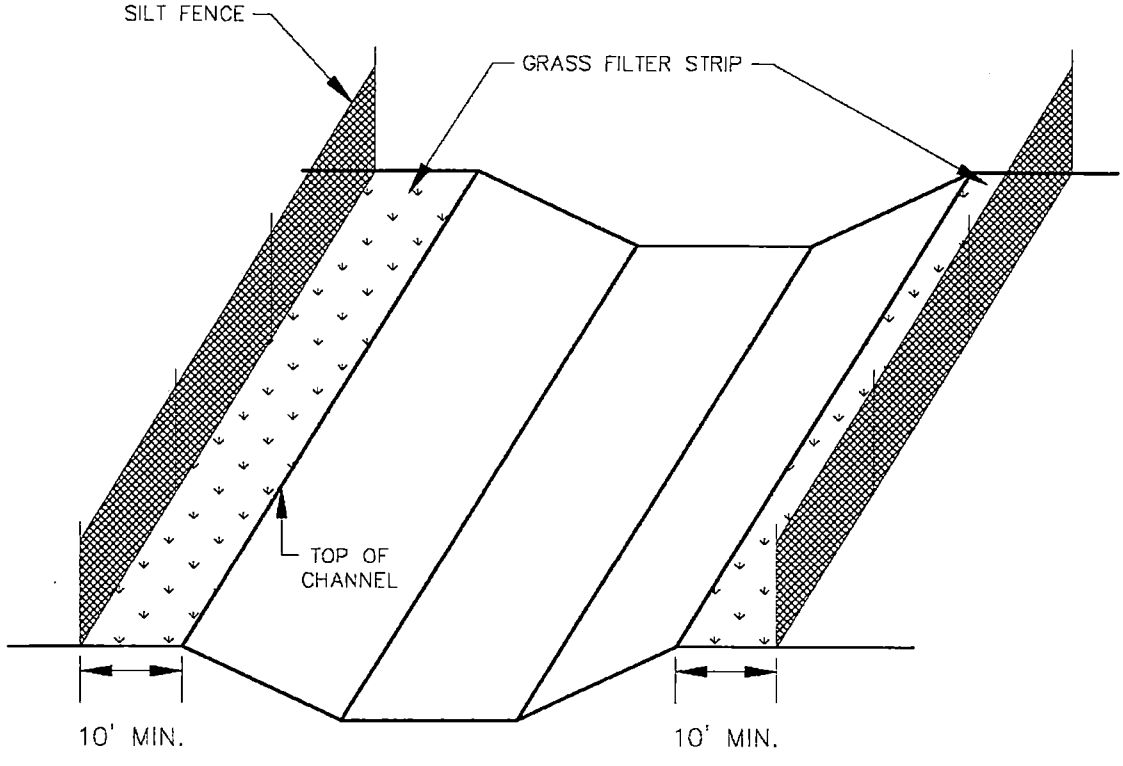
N.T.S.

NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

FIGURE 11–25
FILTER STRIP FOR
CONSTRUCTED CHANNEL

(OCTOBER 1, 2016)



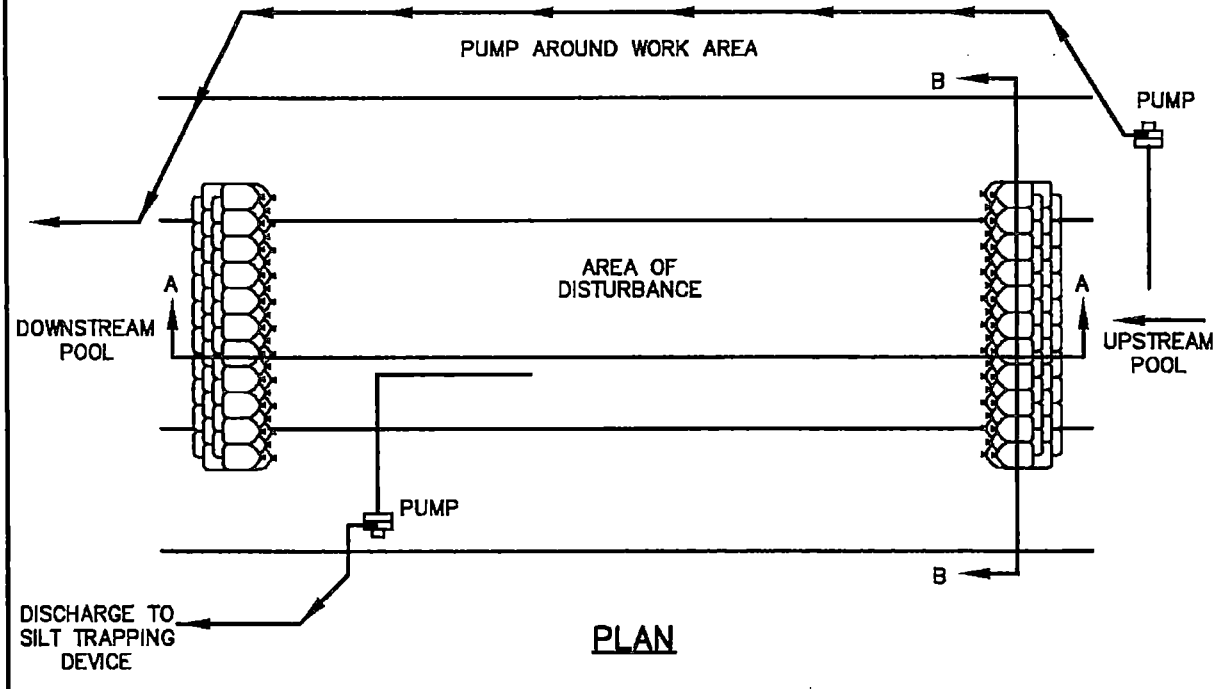
NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

STORMWATER MANUAL

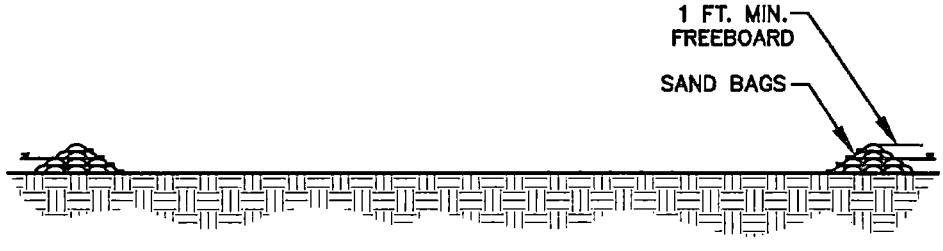
FIGURE 11–26

PUMP–AROUND FLOW DIVERSION

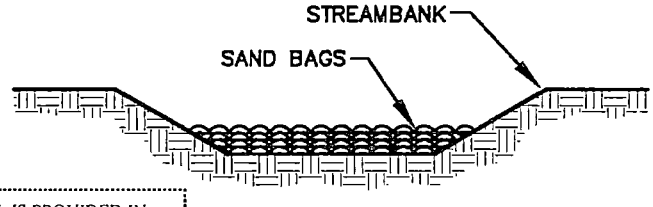
(OCTOBER 1, 2016)



PLAN



SECTION A–A



NOTE: IF A SIMILAR DETAIL IS PROVIDED IN THE CONSTRUCTION DRAWINGS, THE CONSTRUCTION DRAWINGS SHALL SUPERCEDE THIS DRAWING.

SECTION B–B

END OF SECTION

SECTION 02775 - SIDEWALKS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and services required for constructing concrete sidewalks where shown on the Drawings and as specified herein.

PART 2 - PRODUCTS

2.01 GENERAL

A. Sidewalks shall be in accordance with LFUCG Standard Drawings.

2.02 CRUSHED STONE

A. Stone for sidewalk base shall be dense grade aggregate (DGA).

2.03 CONCRETE

A. Concrete for sidewalks shall be 4,500 psi per Section 03300.

2.04 PREMOLDED EXPANSION JOINT FILLER

A. Premolded expansion joint filler shall be closed cell polyethylene foam type, Sonneborn Sonoflex F, Williams Products Expand-O-Foam, or equal. Seal joint with one-part self-leveling polyurethane sealant, Sonneborn Sonolastic SL 1, or equal, maximum 3/8 inches deep. Prepare and prime joints per manufacturer's instructions.

2.05 CURING COMPOUND

A. A white pigmented curing compound is required on all sidewalks per LFUCG Standard Drawings.

PART 3 - EXECUTION

3.01 BASE

A. Following finished grading, a base course of DGA shall be placed to a compacted thickness of four (4) inches. Immediately prior to placing concrete, DGA base shall be thoroughly wetted.

3.02 SURFACE

A. Concrete shall be in thickness shown on LFUCG Standard Drawings, struck off and worked with a float until mortar appears on the top. After surface has been thoroughly floated, it shall be brushed to leave markings of a uniform type, providing non-slip finish. No dusting or plastering will be allowed. Water shall not be added to the surface of the concrete at any time during the finishing procedure.

3.03 FINISHING

A. All joints and edges shall be finished with an edging tool. Dummy joints shall be formed about five (5) feet apart to form rectangular blocks. Expansion joints of 1/2 inch premolded

expansion joint material shall be provided at the intersection of all vertical surfaces with the sidewalk's slabs and at approximately 32 foot intervals along the walks.

END OF SECTION

SECTION 02920 - LAWNS AND GRASSES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, and services required for seeding of all disturbed areas caused by construction activities.

1.02 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to Work of this Section.

1.03 MAINTENANCE

A. Maintenance shall begin immediately following the last operation of installation for each portion of lawn.

B. Lawns shall be maintained by watering, mowing, and for resodding for a period of forty-five (45) days. At the end of this period an inspection will be made and any deficiencies, which may be attributable to the Contractor, will be noted in writing. At this time, the Owner will assume the maintenance. Another inspection will be made at the beginning of the next planting season, and any of the previously noted deficiencies still existing shall be repaired by the Contractor.

1.04 INSPECTION FOR ACCEPTANCE

A. The Inspection of the Work:

The inspection of the work of lawns to determine the completion of contract work exclusive of the possible replacement of plants, will be made by the Architect/Engineer upon written notice requesting such inspection submitted by the Contractor at least ten (10) days prior to the anticipated date.

B. Acceptance:

After inspection, the Contractor will be notified in writing by the Owner of acceptance of all work of this Section, exclusive of the possible replacement of plants subject to guaranty, or if there are any deficiencies of the requirements of completion of the Work.

PART 2 - PRODUCTS

2.01 WATER

A. Water used in this work shall be suitable for irrigation and free from ingredients harmful to plant life.

B. Hose and other watering equipment required for the Work shall be furnished by the Contractor.

2.02 TOPSOIL

A. The Contractor shall furnish and place sufficient topsoil for the seeding and installation of sod, 3-inch minimum.

2.03 FERTILIZER

A. Commercial fertilizer for lawn areas shall be complete fertilizer, formula 10-10-10, for lawns and shall conform to the applicable state fertilizer laws. Fertilizer shall be uniform in composition, dry and free flowing and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guarantee analysis. Any fertilizer which becomes caked or otherwise damaged making it unsuitable for use will not be accepted.

B. Fertilizer shall be applied at the rate of 25 pounds per 1,000 square feet.

2.04 GRASS SEED

A. The seed mixture to be sown shall be in the following proportions:

Common Name	Proportion By Weight	% of Purity	% of Germination
Fine Lawn Fescue	40	90	85
Chewings Fescue	25	90	85
Italian Rye Grass	20	90	85
Red Top	10	90	85
White Clover	5	95	90

B. All seed shall be fresh and clean and shall be delivered mixed, in unopened packages, bearing a guaranteed analysis of the seed mixture.

C. Germination must be certified to conform to the following minimums:

Purity	90%
Germination	85%

2.04 SOD

A. Sod shall be at least 70% Bluegrass, strongly rooted and free of pernicious weeds.

B. 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.

2.06 MULCH

A. Mulch for seeded areas shall be Conwed Hydro Mulch, Silva-Fiber, or equal. It shall be suitable for use in a water slurry or for application with hydraulic equipment.

B. Clean straw is acceptable as mulch. It shall be spread at the rate approximately 2 inch loose depth.

C. Mulch on slopes greater than 1: 3 shall be held in place with erosion control netting.

D. Mulch on areas subject to surface water run-off or in drainage ditches shall be held in place with erosion control netting.

PART 3 - EXECUTION

3.01 TIME OF PLANTING

A. Planting operations shall be conducted under favorable weather conditions during seasons which are normal for such work as determined by accepted practice in the locality of the project. At the option and on full responsibility of the Contractor, planting operations may be conducted under unseasonable conditions without additional compensation.

3.02 LAWNS

A. All lawn areas, including areas of cut and fill and where existing ground has been disturbed by construction operations, shall be seeded.

B. Fertilizer:

Fertilizer shall be applied at the rate of 25 pounds per 1,000 square feet to the lawn area being prepared for planting and mixed lightly into the top few inches of topsoil. Fertilizer may be mixed with and distributed with grass seed.

C. Planting of Lawns:

1. Sowing of Seed:

Immediately before any seed is to be sown, the ground shall be scarified as necessary, and shall be raked until the surface is smooth, friable and of uniformly fine texture. Lawn areas shall be seeded evenly with a mechanical spreader at the rate of 4 pounds per 1,000 square feet of area, lightly raked, rolled with a 200-pound roller and watered with a fine spray. The method of seeding may be varied at the discretion of the Contractor on his own responsibility to establish a smooth, uniform turf composed of the grasses specified. The sowing of seed shall be done only within the season extending from March 1st to May 15th and from September 1st to October 15th, unless other seasons may be approved by the Owner.

2. Laying of Sod:

Before any sod is laid, all soft spots and inequalities in grade shall be corrected. Fertilizer spread shall be raked in. Sod shall be laid so that no voids occur, tamped or rolled and then thoroughly watered. The complete sodded surface shall be true to finished grade, even and firm at all points. Sodding shall be done only within the seasons extending from March 1st to May 15th and from September 1st to October 15th, unless other seasons may be approved by the Owner.

3. Sod on Slopes:

Sod on slopes 2 to 1 or steeper shall be held in place by wooden pins about 1-inch square and about 6 inches long driven through the sod into the soil until they are flush with the top of the sod, or by other approved methods for holding the sod in place.

4. Mulching:

All seeded areas are to be mulched with Conwed Hydro Mulch, Silva-Fiber, or equal, or with clean straw as specified under PRODUCTS. Mulch shall be applied at the rate of 1,500 pounds per acre. It may be applied with hydraulic equipment or may be added to the water slurry in a hydraulic seeder and the seeding and mulching combined in one operation. Clean straw may be spread by hand to cover the seeded areas at a depth of two (2) inches. Erosion control netting shall be installed and anchored per manufacturer's instructions in areas of slopes, ditches, or surface water runoff.

3.03 CLEAN UP

A. All soil, peat or similar material which has been brought over paved areas by hauling operations or otherwise, shall be removed promptly, keeping these areas clean at all times. Upon completion of the planting all excess soil, stone and debris which have not previously been cleaned up shall be removed from the site or disposed of as directed by the Owner. All lawns shall be prepared for final inspection.

3.04 OTHER WORK

A. The Contractor also shall be responsible for the repair of any damage caused by his activities or those of his subcontractors, such as the storage of topsoil or other materials, operations or equipment, or other usages to all on-site areas outside the contract limits. Such repair operations shall include any regrading, seeding or other work necessary to restore such areas to an acceptable condition.

3.05 QUALITY CONTROL

A. Areas seeded shall be protected until a uniform stand develops, when it will be accepted and the Contractor relieved of further responsibility for maintenance. Displaced mulch shall be replaced or any damage to the seeded area shall be repaired promptly, both in a manner to cause minimum disturbance to the existing stand of grass. If necessary to obtain a uniform stand, the Contractor shall refertilize, reseed and remulch as needed. Scattered bare spots up to one (1) square yard in size will be allowed up to a maximum of 10 percent of any area.

END OF SECTION

DIVISION 03

CONCRETE

SECTION 03300 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Concrete pier
   2. Slabs-on-grade.
   3. House-keeping pad

1.02 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.03 ACTION SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

   2. Water/cement ratio (total gallons of water per cubic yard).

   3. Brand, type, and quantity of cement.

   4. Type and quantity of aggregates.

   5. Type and quantity of admixtures.

   6. Type, composition, and quantity of fly ash, slag (GGBFS), or silica fume.

   7. Unit weight (wet density).

   8. Composition strength based on 28-day compression test.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

   1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Engineer.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer manufacturer testing agency.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.

2. Admixtures.

3. Form materials and form-release agents.

4. Steel reinforcement and accessories.

5. Curing compounds.

6. Floor and slab treatments.

7. Bonding agents.

8. Adhesives.

9. Joint-filler strips.

10. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Submit laboratory test reports for concrete mix design, aggregates (particularly deleterious materials in coarse aggregate) and fly ash, slag (GGBFS) and silica fume (if used) 4 weeks before scheduled pouring.

F. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

G. Field quality-control reports.

1. Submit written reports to Engineer documenting testing and inspection results.

2. Submit mill test reports on reinforcement.

3. Submit materials certificates in lieu of laboratory test reports on other materials. Manufacturer and Contractor shall sign material certificates certifying that each

material item complies with, or exceeds, specified requirements. Submit certification from admixture manufacturers that chloride content complies with specification requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1.07 PROJECT CONDITIONS

A. Protect adjacent finish materials against spatter during concrete placement.

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1 or better.

b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

c. Structural 1, B-B or better; mill oiled and edge sealed.

d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

C. Deformed-Steel Wire: ASTM A 496/A 496M.

2.03 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.04 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I, except use Type III where applications require high-early-strength or Type II where required by Engineer for corrosive environments.

2. Use one brand of cement throughout Project, unless otherwise acceptable to Engineer.

B. Fly Ash: ASTM C 618, Type C or Type F (corrosive environments) with loss on ignition not more than 6 percent.

C. Ground Granulated Blast-Furnace Slag: ASTM C 989.

D. Silica Fume: ASTM C 1240, amorphous silica.

E. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) nominal.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

F. Water: ASTM C 94/C 94M.

2.05 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Prohibited Admixtures: Calcium chloride thyocyanates or admixtures containing more than 0.1 percent chloride ions.

2. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

5. Water Reducing, Nonchloride Accelerator Admixture: ASTM C 494, Type E.

6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

2.06 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. BASF Construction Chemical

2. ChemMasters, Inc.

3. Dayton Superior

4. Euclid Chemical Company

5. Kaufman Products, Inc.

6. L&M Construction Chemical

7. Lambert Corporation

8. Metalcrete Industries

9. Nox-Crete Products Group

10. Sika Corporation

11. SpecChem

12. Symons by Dayton Superior

13. TK Products Unitex by Dayton Superior

14. Vexcon Chemicals Inc.

15. W.R. Meadows, Inc.

2.10 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

2.11 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.

4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.

4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

A. Prepare design mixes for each concrete class and strength by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method is used, use independent testing facilities acceptable to Engineer for preparing and reporting proposed mix designs. Testing facility shall not be identical to that used for field quality control testing.

B. Fly ash shall be used to partially supplant cement content in Class A concrete, unless noted otherwise, and is optional in other classes. Replacement quantity of cement content by weight shall be not less than 15 percent for Class A.

C. For concrete Class A, concrete mix design with fly ash and silica fume shall be maximum 30 percent of cement content by weight, and shall constitute no more than 20 and 10 percent, respectively, of the total weight of cementitious materials.

D. Use of ground granulated blast furnace slag (GGBFS) shall only be approved by Engineer. Replacement quantity of cement content weight shall not be less than 35 percent or more than 50 percent.

E. Design mixes to provide normal weight concrete for following classes and properties:

1. Locations for concrete classes are as follows:

a. Class A Structural concrete (slabs, walls, columns, piers, beams, equipment bases, and slab toppings 2 inches or greater in thickness). Note: High range water-reducing admixture shall be used for all concrete walls

2. Properties for concrete classes are as follows: See contract drawings.

3. Adjustment of Concrete Mixes: Mix designs may be adjusted when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, when approved by Engineer, at no additional cost to Owner. Submit laboratory test data for revised mix design and strength results to Engineer before using in work.

4. Admixtures:

a. Use water-reducing admixture or high range water-reducing admixture (superplasticizer) in concrete for placement and workability.

b. Use nonchloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees F (10 degrees C).

c. Add air-entraining admixture at manufacturer's prescribed rate to result in placed concrete having total air content specified.

d. Use nonstructural synthetic reinforcement, monofilament polypropylene Type F1 in Class A concrete for exposed exterior surfaces without earth covering, and as specified by Engineer for other concrete mix design. Bottom slabs of open concrete tanks do not require synthetic reinforcement. The synthetic reinforcing fibers shall be added to the concrete mix at the rate of 1.5 pounds per cubic yard and in accordance with manufacturer's recommendations.

2.13 FABRICATING REINFORCEMENT

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

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

B. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.

2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.

2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.03 REMOVING AND REUSING FORMS

A. Vertical Forms not supporting concrete weight may be removed when concrete has sufficiently set to resist damage from removal operation.

B. Other forms shall be left in place until concrete has attained strength to support its own weight and construction live loads, unless removed in sections, and each structural section immediately reshored.

C. Time Periods: Forms remain in place as shown in table below. If form removal occurs before time shown in the table, apply curing procedures previously specified.

Minimum Time Forms are to Remain in Place:

	Average Air Temperature* During Period	
Part of Structure	40 - 50 degrees F	50 degrees F
Walls, columns and sides of beam (hours)	72	24

* Air temperature near form.

D. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

E. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.04 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Field bending of reinforcement:

1. Field bending of plain reinforcement shall be performed using an approved and appropriate sized portable hydraulic device that makes ACI-approved radius bends. No other field bending method shall be permitted.

3.05 JOINTS

A. Locate and install construction joints as shown or, if not shown, locate so as not to impair strength and appearance of structures, at intervals not to exceed 50 feet. For construction joints in water-containing structures or tanks or in water-restraining structures, use watertight joints.

B. Continue reinforcement across construction joints, unless otherwise noted. Mechanical inserts with threaded studs are not accepted as substitutes for through-dowels.

C. Locate construction joints in floor system at or near middle of span in slabs, beams, or girders unless beam intersects girders at this point. Then, where not shown on Drawings, joints in girders shall be offset distances twice the width of beams, and provisions made for shear by web reinforcement across joints.

D. Provide isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces of column pedestals, foundation walls, and grade beams.

E. Contraction (Control) Joints in Slabs-on-Ground: Construct contraction (control) joints in slabs-on-ground to form panels of patterns as shown. Use saw cuts 3/16 inch by 1/4 slab depth or inserts 1/4-inch wide by 1/4 of slab depth unless otherwise noted.

F. If joint pattern is not shown, provide joints at 15 feet at most in either direction, with locations to conform to bay spacing wherever practical (at column centerlines, half-bays, third-bays).

G. Form contraction joints by inserting pre-molded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

H. Cut contraction joints in unexposed floor slabs by saw cuts as soon as practical after slab finishing when it can be safely done without dislodging aggregate.

I. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.06 INSTALLATION OF EMBEDDED ITEMS

A. Set and build into Work anchorage devices and other embedded items required for other work that are attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of attachment items.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain set elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support screed strips by use of strike-off templates or accepted compacting screeds.

C. Conduits and pipes of aluminum shall not be embedded in structural concrete unless they are effectively coated or covered to prevent aluminum-concrete reaction or electrolytic action between aluminum and steel.

3.07 PREPARATION OF FORM SURFACES

A. Clean re-used forms of concrete matrix residue, repair and patch to return forms to acceptable surface condition.

B. Coat contact surfaces of forms with form-coating compounds before placing reinforcement.

C. Thin form-coating compounds only with acceptable thinning agents, quantity, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete is placed. Apply in compliance with manufacturer's instructions.

D. Coat steel forms with non-staining, rust-preventive form oil to protect against rusting. Rust-stained steel formwork is not acceptable.

3.08 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, reinforcing steel, waterstop installation, and other embedded or cast-in items.

1. Notify other crafts to permit installation of their work.

2. Cooperate with other trades in setting their work.

3. Moisten wood forms immediately before placing concrete where form coatings are not used.

4. Apply temporary protective covering to lower 2 feet of finished walls where adjacent floor slabs are poured to guard against spattering during slab placement.

B. Comply with ACI 304R and as specified in this Section.

C. Discharge Concrete at Site within 1-1/2 hours after cement is added to water or aggregates. When air temperature exceeds 85 degrees F, the discharge time shall be less than 45 minutes. The 45-minute requirement may be waived with the use of a water reducing, retarding admixture and approval of Engineer.

D. Provide trip ticket in duplicate for each ready-mixed concrete load delivered, stating truck number, Project name, Contractor and producer, batching time, total yards of concrete and material contained therein. Show ticket to Engineer upon request. Fill in concrete discharge time and turn over to Engineer trip ticket copies at end of each day.

E. Deposit concrete continuously or in layers so that no concrete is placed on concrete which has hardened sufficiently to cause seams or planes of weakness. If section cannot be placed continuously, provide construction joints as specified. Deposit concrete as nearly as practical to its final location to avoid segregation.

F. When depositing by chute, provide equipment of size and design to ensure continuously flowing concrete. Provide discharge end of chute with baffle plate to prevent segregation. Position chute so that concrete need not flow more than 5 feet horizontally.

G. Do not drop concrete from chute end distances greater than 3 times the deposited layer thickness, nor more than 5 feet. Where distance from chute end to surface of concrete exceeds these distances, use spout and maintain lower end as near to deposit surface as practical. When operations are intermittent, discharge chutes into hoppers.

H. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24 inches to avoid inclined construction joints. Where placement involves several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Fill bottom of wall space with 2 to 4 inches of cement slurry immediately before depositing concrete in walls. Use cement slurry composed of 1 part Portland cement, 2 parts fine aggregate, and sufficient water (but not to exceed 0.45 parts) for 7-inch slump mixture.

2. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures for concrete consolidation in accordance with ACI recommended practices.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible machine effectiveness. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into concrete layers that have begun to set. At each insertion, limit duration to time necessary to consolidate concrete and complete reinforcement embedment and other embedded items without causing mix segregation. Keep vibrators away from waterstops to prevent displacement.

I. Placing Concrete Slabs: Deposit and consolidate concrete slabs in continuous operations between construction joints until panel or section placement is complete.

1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces before beginning finishing operations.

3. Maintain reinforcing in proper position during concrete placement operations.

4. Maintain waterstop in proper position during concrete placement operations.

5. Moisten soil when depositing concrete directly on granular soil.

J. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Maintain reinforcement in position on chairs during concrete placement.

3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

K. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

L. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and

patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. Trowel Finish: Apply trowel finish to monolithic slab surfaces exposed-to-view, and slab surfaces covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.

1. After floating, begin first trowel finish operation using power-driven trowels. Begin last troweling when surface produces ringing sound when trowel moves over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance.

2. Check and level surface plane to tolerances of floor flatness (FF) of 20 and floor levelness (FL) of 17 in accordance with ASTM E 1155.

3. Grind smooth surface defects that would telegraph through applied floor covering system.

B. Nonslip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps, ramps, and elsewhere as noted.

1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required finish with Engineer before application.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.

2. Construct concrete bases 4 inches high unless otherwise indicated; and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.

3. Minimum Compressive Strength: 4500 psi at 28 days.

4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.

5. For supported equipment, install anchor bolts that extend through concrete base, and anchor into structural concrete substrate.

6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.13 CONCRETE PROTECTING AND CURING

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

B. Start curing as soon as free water has disappeared from concrete surface after placing and finishing. Maintain curing as follows:

1. All concrete unless otherwise noted: 7 days.

2. High-early-strength concrete: 3 days.

C. Curing Methods: Cure concrete for water-retaining structures by moist curing. Cure concrete for other structures by curing compound, moist curing, moisture-retaining cover curing, or combinations thereof.

D. Provide Moist Curing by following methods:

1. Keep concrete surface continuously wet by covering with water.

2. Continuous water-fog spray.

3. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to cover concrete surfaces and edges, with 4 inches lap over adjacent absorptive covers.

E. Provide Moisture-Retaining Cover Curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practical width with sides and ends lapped 3 inches and sealed by waterproof tape or adhesive.

2. Immediately repair holes or tears during curing period using cover material and waterproof tape.

F. Provide Curing Compound as follows:

1. Apply specified curing compound to concrete slabs as soon as last finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain coating continuity and repair damage during curing period.

2. Transparent curing compound shall be used for structural concrete (Class A concrete).

3. Do not use membrane curing compounds on surfaces that are covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring (ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to Engineer.

G. Curing Formed Surfaces: Cure formed concrete surfaces, including beam undersides, supported slabs and other similar surfaces by moist curing with forms in place for full curing period. If form removal occurs before curing period is up, continue curing by methods specified above as applicable.

H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by application of appropriate curing method.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

B. Patching Mortar: Mi dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and

compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel reinforcement placement.

2. Steel reinforcement welding.

3. Headed bolts and studs.

4. Verification of use of required design mixture.

5. Concrete placement, including conveying and depositing.

6. Curing procedures and maintenance of curing temperature.

7. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Provide qualified personnel and employ testing laboratory, approved by Engineer, to do tests and to submit test reports.

E. Sampling Fresh Concrete: ASTM C 172, except modified for slump and air-content tests to comply with ASTM C 94.

1. Slump: ASTM C 143, one each time compression test specimens are made; additional tests when concrete consistency seems to have changed.

2. Air Content: ASTM C 231, pressure method, one each time compression test specimens made.

3. Concrete Temperature: Test hourly when air temperature is 40 degrees F and below, and when 80 degrees F and above; and each time compression test specimens are made.

4. Compression Test Specimen: ASTM C 31, four standard cylinders for each compressive strength test set, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens.

5. Compressive Strength Tests: ASTM C 39, one set for each day's pour exceeding 5 cubic yards plus additional set for each 100 cubic yards over and above first 50 cubic yards of each concrete class placed in 1 day; 1 specimen tested at 7 days,

2 specimens tested at 28 days, and 1 specimen retained in reserve for later testing if required.

F. Test Results: Report test results in writing to Engineer and Contractor within 24 hours after tests. Compressive strength test reports shall contain Project identification name and number, concrete placement date, concrete testing service name, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and break type for both 7-day tests and 28-day tests.

G. Acceptance: Concrete strength shall be considered satisfactory if averages of 3 consecutive strength test results equal or exceed specified 28-day compressive strength (f'c), and no individual strength test result falls below specified compressive strength by more than 500 psi.

H. Failure to Meet Requirements:

1. Should 7-day compressive strengths shown by test specimens fall below 65 percent of required 28-day strength (f'c), Engineer will have the right to require changes in proportions for remaining Work. Furthermore, Engineer will have the right to require additional curing, as specified in this Section, on those portions or structures represented by failed test specimens.

2. Should 28-day compressive strengths (f'c) test results fail to meet required strength, core-boring tests conforming to ASTM Standard C 42 shall be made at Contractor's expense within 60 days of that concrete placement.

I. At locations where concrete quality is deemed questionable by Engineer, core-boring tests shall also be made at Contractor's expense.

J. Concrete is acceptable if average strength of 3 cores is at least 85 percent and no single core is less than 75 percent of required minimum allowable 28-day compressive strengths (f'c). If core-boring test results fail to meet strength requirements, Engineer will have right to require strengthening or replacing those portions of structures which failed to develop specified strength.

K. Provide additional curing when ordered by Engineer because of failure to meet requirements. It shall be done at Contractor's expense, and no claim for extra compensation for additional curing will be allowed. Additional curing shall extend period of protection. Additional curing is limited to 60 days.

L. Additional Tests: Testing service shall make additional in-place concrete tests when test results suggest specified concrete strengths and other characteristics have not been attained. Testing service may conduct tests to determine adequacy by cored cylinders complying with ASTM C 42, or by other approved methods. Contractor shall pay for additional tests when unacceptable concrete is verified.

END OF SECTION

SECTION 03410 - PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Precast structural concrete.

B. Related Requirements:

1. Section 03300 "Cast-in-Place Concrete" for concrete topping and placing connection anchors in concrete. See contract drawings for concrete mix design

1.02 RELATED DOCUMENTS

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

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each precast concrete mixture. Include compressive strength and, if required, water-absorption tests.

C. Shop Drawings:

1. Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement.

2. Detail fabrication and installation of precast structural concrete units, including connections at member ends and to adjoining construction.

3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.

4. Indicate separate face and backup mixture locations and thicknesses.

5. Indicate type, size, and length of welded connections by AWS standard symbols.

6. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.

7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.

8. Include and locate openings larger than 10 inches. Where additional structural support is required, include header design.

9. Indicate location of each precast structural concrete unit by same identification mark placed on panel.

10. Indicate relationship of precast structural concrete units to adjacent materials.

11. Indicate locations, dimensions, and details of stone facings, anchors, and joint widths.

12. Indicate estimated camber for precast floor slabs with concrete toppings.

13. Indicate shim sizes and grouting sequence.

14. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

D. Delegated-Design Submittal: For precast structural concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Show precast structural concrete unit types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from precast structural concrete.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Welding certificates.

C. Material Certificates: For the following:

1. Cementitious materials.

2. Admixtures.

3. Bearing pads.

D. Material Test Reports: For aggregates, by a qualified testing agency.

E. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1. Designated as a PCI-certified plant as follows:

a. Group C, Category C3 - Prestressed Straight Strand Structural Members.

B. Installer Qualifications: An experienced precast concrete erector who has retained a "PCI-Certified Field Auditor" to conduct a field audit of a project installed by erector in

Category S1 - Simple Structural Systems and who can produce an Erectors' Post Audit Declaration, according to PCI MNL 127, "PCI Erector's Manual - Standards and Guidelines for the Erection of Precast Concrete Products."

C. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.

D. Quality-Control Standard: For manufacturing procedures, testing requirements, and quality-control recommendations for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."

E. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

2. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

1.06 COORDINATION

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Support units during shipment on nonstaining shock-absorbing material in same position as during storage.

B. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.

1. Store units with dunnage across full width of each bearing point unless otherwise indicated.

2. Place adequate dunnage of even thickness between each unit.

3. Place stored units so identification marks are clearly visible, and units can be inspected.

C. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.

D. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, registered in the Commonwealth of Kentucky to design precast structural concrete units.

B. Design Standards: Comply with ACI 318 and with design recommendations in PCI MNL120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of precast structural concrete units indicated.

C. Fire-Resistance Calculations: Where indicated, provide precast structural concrete units whose fire resistance meets prescriptive requirements of authorities having jurisdiction or has been calculated according to PCI MNL 124, "Design for Fire Resistance of Precast Prestressed Concrete," and is acceptable to authorities having jurisdiction.

D. Structural Performance: Precast structural concrete units and connections shall withstand design loads indicated within limits and under conditions indicated.

E. Structural Performance: Provide precast structural concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:

1. Dead Loads: 20 psf superimposed.

2. Live Loads: 20 psf.

3. Wind Loads: Refer to components and cladding pressures on structural drawings.

4. Maintain precast structural concrete deflections within limits of ACI 318.

   a. Thermal Movements: Allow for in-plane thermal movements resulting from annual ambient temperature changes of 120 deg F.

5. Fire-Resistance Rating: Select material and minimum thicknesses to provide indicated fire rating.

2.02 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.

1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

2.03 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A706/A706M, deformed.

2.04 PRESTRESSING TENDONS

A. Pretensioning Strand: ASTM A416/A416M, Grade 250 or Grade 270, uncoated, seven-wire, low-relaxation strand.

2.05 CONCRETE MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type III, gray, unless otherwise indicated.

1. For surfaces exposed to view in finished structure, use gray or white cement, of same type, brand, and mill source.

B. Supplementary Cementitious Materials:

1. Fly Ash: ASTM C618, Class C or F, with maximum loss on ignition of 3 percent.

2. Metakaolin: ASTM C618, Class N.

3. Silica Fume: ASTM C1240, with optional chemical and physical requirement.

4. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.

C. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C33/C33M, with coarse aggregates complying with Class 4M. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

E. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.

F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

1. Water-Reducing Admixtures: ASTM C494/C494M, Type A.

2. Retarding Admixture: ASTM C494/C494M, Type B.

3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.

4. Water-Reducing and Accelerating Admixture: ASTM C494/C494M, Type E.

5. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.

6. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.

7. Plasticizing Admixture: ASTM C1017/C1017M, Type I.

8. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

9. Corrosion-Inhibiting Admixture: ASTM C1582/C1582M.

2.06 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A36/A36M.

B. Carbon-Steel-Headed Studs: ASTM A108, Grade 1010 through 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.

C. Carbon-Steel Plate: ASTM A283/A283M, Grade C.

D. Malleable-Iron Castings: ASTM A47/A47M, Grade 32510 or Grade 35028.

E. Carbon-Steel Castings: ASTM A27/A27M, Grade 60-30.

F. High-Strength, Low-Alloy Structural Steel: ASTM A572/A572M.

G. Carbon-Steel Structural Tubing: ASTM A500/A500M, Grade B or Grade C.

H. Deformed-Steel Wire or Bar Anchors: ASTM A496/A496M or ASTM A706/A706M.

I. Carbon-Steel Bolts and Studs: ASTM A307, Grade A; carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A563; and flat, unhardened steel washers, ASTM F844.

J. High-Strength Bolts and Nuts: ASTM A325 or ASTM A490, Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A563; and hardened carbon-steel washers, ASTM F436.

1. Do not zinc coat ASTM A490 bolts.

K. Zinc-Coated Finish: For exterior steel items and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A123/A123M or ASTM A153/A153M.

1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.

2. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20.

L. Shop-Primed Finish: Prepare surfaces of nongalvanized-steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP3, and shop apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79 according to SSPC-PA 1.

M. Welding Electrodes: Comply with AWS standards.

N. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install precast structural concrete units.

2.07 BEARING PADS

A. Provide one of the following bearing pads for precast structural concrete units as recommended by precast fabricator for application:

1. Elastomeric Pads: AASHTO M251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore, Type A durometer hardness, ASTM D2240; minimum tensile strength 2250 psi, ASTM D412.

2. Random-Oriented-Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. 70 to 90 Shore, Type A durometer hardness, ASTM D2240; capable of supporting a compressive stress of 3000 psi with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.

2.08 ACCESSORIES

A. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install structural precast concrete units.

2.09 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C150/C150M, Type I, and clean, natural sand, ASTM C144 or ASTM C404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C1218/C1218M.

B. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107/C1107M, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C1218/C1218M.

C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C881/C881M, of type, grade, and class to suit requirements.

2.10 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.

1. Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

2. Limit use of fly ash to 20 percent replacement of portland cement by weight and ground granulated blast-furnace slag to 20 percent of portland cement by weight; metakaolin and silica fume to 10 percent of portland cement by weight.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 116 when tested according to ASTM C1218/C1218M.

D. Normal-Weight Concrete Mixtures: Proportion by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi.

2. Maximum Water-Cementitious Materials Ratio: 0.45.

E. Water Absorption: For structural precast concrete with an architectural finish, limit water absorption to 6 percent by weight or 14 percent by volume, tested according to ASTM C642, except for boiling requirement.

F. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

G. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.11 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.

B. Maintain molds to provide completed precast structural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

1. Edge and Corner Treatment: Uniformly chamfered.

2.12 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.

C. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.

D. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without Engineer's approval.

E. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcement exceeds limits specified in ASTM A775/A775M, repair with

patching material compatible with coating material and epoxy coat bar ends after cutting.

2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.

3. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.

4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses and specified in-place loads.

G. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.

1. Delay detensioning or post-tensioning of precast, prestressed structural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete unit.

2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.

3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.

4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.

5. Protect strand ends and anchorages with a minimum of 1-inch-thick, nonmetallic, nonshrink, grout mortar and sack rub surface. Coat or spray the inside surfaces of pocket with bonding agent before installing grout.

H. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

I. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.

J. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.

1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants." Ensure adequate bond between face and backup concrete, if used.

K. Comply with PCI MNL 116 procedures for hot- and cold-weather concrete placement.

L. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that does not show in finished structure.

M. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

N. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet Engineer's approval.

2.13 ACCESS HATCHES

A. Access hatches shall be provided for all openings in the top slabs. Each hatch shall include an extruded aluminum frame incorporating a continuous concrete anchor and shall be complete with hinges and slide bar equipped covers.

1. Each containment box hatch shall include stainless steel pump guide bar holders. Hatch frames and covers shall be constructed of aluminum and designed for a live load of 300 pounds per square foot.

2. Hatch doors shall be of aluminum checker plate with reinforcing ribs as required to meet the specified design criteria. The hatch shall be extruded aluminum channel frame, incorporating a continuous concrete anchor.

3. Shall be reinforced to withstand a live load of the H-20, uniform live load.

4. Doors shall incorporate enclosed stainless steel compression spring assists and shall close flush with the frame.

5. All hardware for hatches shall be 316 stainless steel.

6. All aluminum surfaces that will be in contact with concrete and the bottom of the hatch shall be coated with a high-build paint, applied by the hatch manufacturer, in order to protect the aluminum.

7. Hatches shall be Series H2W as manufactured by Halliday Products, Inc. or an approved equal.

2.14 FABRICATION TOLERANCES

A. Fabricate precast structural concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 116 product dimension tolerances as well as position tolerances for cast-in items.

2.15 FINISHES

A. Screed or float finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish. Hand screed at projections. Normal color variations, minor indentations, minor chips, and spalls are permitted. Major imperfections, honeycombing, or defects are not permitted.

B. Smooth, steel trowel finish unformed surfaces. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.

C. Apply roughened surface finish according to ACI 318 to precast concrete units that receive concrete topping after installation.

2.16 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate precast structural concrete fabricator's quality-control and testing methods.

1. Allow testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.

B. Testing: Test and inspect precast structural concrete according to PCI MNL 116 requirements and ASTM C1610/C1610M, ASTM C1611/C1611M, ASTM C1621/C1621M, and ASTM C1712/C1712M.

1. Test and inspect self-consolidating concrete according to PCI TR-6.

C. Strength of precast structural concrete units is considered deficient if units fail to comply with ACI 318 requirements for concrete strength.

D. If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 requirements, employ a qualified testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C42/C42M.

1. A minimum of three representative cores shall be taken from units of suspect strength, from locations directed by Engineer.

2. Test cores in an air-dry condition or, if units are wet under service conditions, test cores after immersion in water in a wet condition.

3. Strength of concrete for each series of three cores is considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.

4. Report test results in writing on same day that tests are performed, with copies to Engineer, Contractor, and precast concrete fabricator. Test reports include the following:

a. Project identification name and number.

b. Date when tests were performed.

c. Name of precast concrete fabricator.

d. Name of concrete testing agency.

e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

E. Patching: If core test results are satisfactory and precast structural concrete units comply with requirements, clean and dampen core holes and solidly fill with same precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

F. Defective Units: Discard and replace precast structural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Engineer's approval. Engineer reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Do not install precast concrete units until supporting, cast-in-place concrete has attained minimum allowable design compressive strength and until supporting steel or other structure is structurally ready to receive loads from precast concrete units.

3.02 INSTALLATION

A. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.

B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, shoring, and bracing as required to maintain position, stability, and alignment of units until permanent connections are complete.

1. Install temporary steel or plastic spacing shims or bearing pads as precast structural concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.

2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.

3. Remove projecting lifting devices and use plastic patch caps or sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.

4. For hollow-core slab voids used as electrical raceways or mechanical ducts, align voids between units and tape butt joint at end of slabs.

C. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

1. Do not permit connections to disrupt continuity of roof flashing.

D. Field cutting of precast units is not permitted without approval of Engineer.

E. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.

F. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.

1. Protect precast structural concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.

2. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil-thick coat of galvanized repair paint to galvanized surfaces according to ASTM A780/A780M.

3. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.

4. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.

G. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.

1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.

2. For slip-critical connections, use one of the following methods to assure proper bolt pretension:

a. Turn-of-Nut: According to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

b. Calibrated Wrench: According to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

c. Twist-off Tension Control Bolt: ASTM F1852.

d. Direct-Tension Control Bolt: ASTM F1852.

3. For slip-critical connections, use method and inspection procedure approved by Engineer and coordinated with inspection agency.

H. Grouting or Dry-Packing Connections and Joints: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled.

1. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces.

2. Fill joints completely without seepage to other surfaces.

3. Trowel top of grout joints on roofs smooth and uniform. Finish transitions between different surface levels not steeper than 1 to 12.

4. Place grout end cap or dam in voids at ends of hollow-core slabs.

5. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

6. Keep grouted joints damp for not less than 24 hours after initial set.

7. Caulk all joints that will be exposed to view on bottom of flat units and on bottom of flanges of tee-type units, including joints between the flat units and masonry walls adjoining or supporting the slabs.

3.03 ERECTION TOLERANCES

A. Erect precast structural concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.

B. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator and approved by Engineer.

3.04 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Erection of precast structural concrete members.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Visually inspect field welds and test according to ASTM E165 or to ASTM E709 and ASTM E1444. High-strength bolted connections are subject to inspections.

D. Testing agency will report test results promptly and in writing to Contractor and Engineer.

E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

G. Prepare test and inspection reports.

3.05 REPAIRS

A. Repair precast structural concrete units if permitted by Engineer.

1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units have not been impaired.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.

C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A780/A780M.

D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

E. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by Engineer.

3.06 CLEANING

A. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.

2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION

DIVISION 05

METALS

SECTION 05052 - BOLTS, WASHERS, ANCHORS, AND EYEBOLTS

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes materials and installation of anchor bolts, connecting bolts, washers, drilled anchors, epoxy anchors, screw anchors, eyebolts, and stainless-steel fasteners.

1.02 DESIGN CRITERIA

Structural Connections: AISC Specification for Structural Steel Buildings (July 7, 2016).

1.03 SUBMITTALS

A. Submit shop drawings in accordance with the General Conditions and Section 01330: Shop Drawings, Working Drawings and Samples.

B. Submit manufacturer's catalog data and ICBO reports for bolts, washers, and concrete anchors. Show dimensions and reference materials of construction by ASTM designation and grade.

PART 2 - MATERIALS

2.01 STAINLESS STEEL BOLTS

Stainless steel bolts shall be ASTM A 193, Grade B8 or ASTM F 593, Type 316. Nuts shall be ASTM A 194, Grade 8 or ASTM F 594, Type 316. Use ASTM A 194 nuts with ASTM A 193 bolts; use ASTM F 594 nuts with ASTM F 593 bolts. Provide washer for each nut and bolthead. Washers shall be of the same material as the nuts.

2.02 PLAIN UNHARDENED STAINLESS STEEL WASHERS

Stainless steel washers shall be Type 316. Provide clipped washers where space limitations necessitate.

2.03 DRILLED ANCHORS

Unless otherwise indicated in the drawings, drilled anchors shall be Type 316 stainless steel wedge anchors as manufactured by ITW Ramset/Redhead, Hilti, Simpson Strong-Tie or equal. Anchors shall have ICBO-approved testing.

2.04 EPOXY ANCHORS

Epoxy anchors shall be Type 316 stainless steel threaded rod adhesive anchors. Epoxy adhesive shall comply with ASTM C 881, Type IV, Grade 3, Class B or C. Adhesive shall be Hilti RE-500-V3, or equal. Epoxy anchor assemblies shall be ICBO approved.

2.05 SCREW ANCHORS

Screw anchors shall be Titan HD screw anchors by Simpson, HUS-H by Hilti, or equal.

2.06 EMBEDDED EYEBOLTS

Eyebolts shall be of the welded-eye or forged type, Type 316 stainless steel.

2.07 THREADED CARBON STEEL LIFTING EYES

Threaded carbon steel lifting eyes shall comply with ASTM A 489, Type 1, Style B.

PART 3 - EXECUTION

3.01 STORAGE OF MATERIALS

Store material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

3.02 INSTALLING CONNECTION BOLTS

A. Use stainless steel bolts to connect structural aluminum members.

B. Install washers per AISC Specification for ASD.

C. Bolt holes in structural members shall be 1/16 inch in diameter larger than bolt size. Measure cast-in-place bolt locations in the field before drilling companion holes in structural steel beam or assembly.

D. Slotted holes, if required in the drawings, shall conform to AISC Specifications, Chapter J, Section J3, Table J3.1.

E. Drive bolts accurately into the holes without damaging the thread. Protect boltheads from damage during driving. Boltheads and nuts or washers shall rest squarely against the metal. Where bolts are to be used on beveled surfaces having slopes greater than 1 in 20 with a plane normal to the bolt axis, provide beveled washers to give full bearing to the head or nut. Where self-locking nuts are not furnished, bolt threads shall be upset to prevent the nuts from backing off.

F. Bolts shall be of the length that will extend entirely through but not more than 1/4 inch beyond the nuts. Draw boltheads and nuts tight against the work. Tap boltheads with a hammer while the nut is being tightened.

3.03 INSTALLING ANCHOR BOLTS

A. Preset bolts and anchors by the use of templates. For mechanical equipment (pumps, compressors, and blowers), do not use concrete anchors set in holes drilled in the concrete after the concrete is placed.

B. For static items (storage tanks and heat exchangers), use preset anchor bolts or drilled anchors with ICBO report data.

C. After anchor bolts have been embedded, protect projecting threads by applying grease and having the nuts installed until the time of installation of the equipment or metalwork.

D. Minimum depth of embedment of drilled mechanical anchors and screw anchors shall be as recommended by the manufacturer, but no less than that shown in the drawings.

E. Minimum depth of embedment of epoxy anchors shall be as recommended by the manufacturer, but no less than that shown in the drawings.

F. Prepare holes for drilled and epoxy anchors in accordance with the anchor manufacturer's recommendations prior to installation.

END OF SECTION

SECTION 05121 - MISCELLANEOUS ALUMINUM

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes materials, fabrication, and installation of structural aluminum, stainless steel plate and members, aluminum tubing, and aluminum sheet.

1.02 DESIGN CRITERIA

Structural Connections and Framing: AISC Specification for Structural Steel Buildings July 7, 2016)

1.03 SUBMITTALS

A. Submit shop drawings in accordance with the General Conditions and Section 01340: Shop Drawings, Working Drawings, and Samples.

B. Submit placing or erection drawings that indicate locations of fabricated items. Reproductions of contract documents will not be accepted for this purpose.

PART 2 - MATERIALS

2.01 BOLTS AND WASHERS

See Section 05052: Bolts, Washers, Anchors, and Eyebolts.

2.02 HOLLOW STRUCTURAL STAINLESS STEEL TUBING

A. Stainless Steel: Conform to ASTM A554, Grade MT-316.

2.03 STAINLESS STEEL PLATE AND MEMBERS

Except where otherwise specified, stainless steel plate shall be Type 316, ASTM A240. Stainless steel pipe shall conform to ASTM A312, Grade TP316. Wrought stainless steel fittings shall conform to ASTM A403, Class WP316.

2.04 ALUMINUM SHEET

Aluminum sheet shall conform to ASTM B209, Alloy 3003, H 14 temper.

2.05 STRUCTURAL ALUMINUM

Aluminum structural members shall conform to ASTM B308, Alloy 6061-T6. Aluminum bars and rods shall conform to ASTM B221, Alloy 6061-T6.

2.06 ALUMINUM TUBING

Aluminum seamless pipe and tubing shall conform to ASTM B241, Alloy 6061-T6. Wall thickness shall be Schedule 80, per ANSI H35.2, unless otherwise shown in the drawings.

2.07 EXPANDED METAL SHEETING

Expanded metal sheet shall comply with ASTM F1267, Type II, Class 2, Grade A. Style designation shall be 1/2 No. 18.

2.08 WELDING ELECTRODES

A. Welding electrodes for structural steel shall conform to AWS A5.5. Use electrodes in the E-70 series.

B. Welding electrodes for aluminum shall be ER4043 filler metal.

C. Welding electrodes for stainless steel shall conform to AWS A 5.4. Use electrodes as follows:

Stainless Steel Material	Welding Electrode Material
Type 304	E 308
Type 304L	E 347
Type 316	E 316
Type 316L	E 318

PART 3 - EXECUTION

3.01 STORAGE OF MATERIALS

Store structural material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

3.02 FABRICATION AND ERECTION

A. Fabricate miscellaneous metal items to straight lines and true curves. Drilling and punching shall not leave burrs or deformations. Continuously weld permanent connections along the entire area of contact. Exposed work shall have a smooth finish with welds ground smooth. Joints shall have a close fit with corner joints coped or mitered and shall be in true alignment. Unless specifically indicated in the drawings, there shall be no bends, twists, or open joints in any finished member nor any projecting edges or corners at intersections. Conceal fastenings wherever possible. Built-up parts shall be free of warp. Exposed ends and edges of metal shall be slightly rounded.

B. Clean the surfaces of metalwork to be in contact with concrete of rust, dirt, grease, and other foreign substances before placing concrete.

C. Set embedded metalwork accurately in position when concrete is placed and support rigidly to prevent displacement or undue vibration during or after the placement of concrete. Unless otherwise specified, where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with dry-pack mortar in conformance with Section 03300: Concrete.

3.03 WELDING

A. Perform welding on steel by the SMAW process. Welding shall conform to the AWS D1.1-2006, except as modified in AISC Section J2.

B. Perform welding on aluminum by the gas metal arc (MIG) or gas tungsten arc (TIG) process. Welding shall conform to the AWS D1.2-2003.

C. Perform welding on stainless steel by the TIG process. All welds shall be full penetration and smooth unless otherwise indicated in the drawings. Provide inert gas on the inside of pipe during welding to reduce oxidation.

D. Provide a minimum of two passes for metal thickness in excess of 5/16-inch thickness.

E. Produce weld uniform in width and size throughout its length with each layer of weldment smooth; free of slag, cracks, pinholes, and undercuttings; and completely fused to the adjacent weld beads and base metal. Avoid irregular surface, nonuniform bead pattern, and high crown. Form fillet welds of the indicated size of uniform height and fully penetrating. Accomplish repair, chipping, and grinding of welds in manner that will not gouge, groove, or reduce the base metal thickness.

3.04 BOLTING - SEE SECTION 05052.

3.05 CONTROL OF FLAME CUTTING

Do not use a gas-cutting torch in the field for correcting fabrication errors on any member in structural framing. Use a gas-cutting torch only on minor members when the member is not under stress.

3.06 CORROSION PROTECTION OF ALUMINUM SURFACES

A. Aluminum embedded or in contact with concrete or dissimilar metal must be painted with one shop coat of primer followed by one heavy coat of aluminum pigmented asphalt paint. Allow the coating to dry before the aluminum is placed in contact with the concrete.

B. Where aluminum surfaces come in contact with dissimilar metals, except stainless steel, keep the dissimilar metallic surfaces from direct contact by use of neoprene gaskets or washers.

Aluminum & Dissimilar Metal Insulation			
Coat	Carboline	Sherwin Williams	Tnemec
Prep	SSPC-SP1 Solvent Clean		
Prime	In accordance with manufacturer's recommendations.	Macropoxy 646 @ 3.0-4.0 mils DFT	66HS @ 2.5-3.5 mils DFT
Finish	Coal Tar Epoxy 1 coat Bitumastic 300M @ 8-10	Macropoxy 646 @ 3.0-4.0 mils DFT	66HS @ 2.5-3.5 mils DFT
Total	8 to 10 mils DFT	6 to 8 mils DFT	5 to 7 mils DFT

END OF SECTION

SECTION 05510 - LADDERS, STAIRS, AND STAIR NOSINGS

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes materials, fabrication, and installation of ladders, prefabricated alternating tread stairs, stair nosings, and stair treads.

1.02 DESIGN CRITERIA

Handrails, Walkways, Ladders, and Personnel Platforms: OSHA, FBC.

1.03 SUBMITTALS

A. Submit shop drawings and signed and sealed calculations in accordance with the General Conditions and Section 01340.

B. Submit drawings of stairs, ladders, and stair nosings. Show dimensions and reference materials of construction by ASTM designation and grade.

PART 2 - MATERIALS

2.01 INCLINED ALUMINUM LADDERS WITH BUILT-IN HANDRAIL

Ladders shall be aluminum construction: Alloy 6061-T6, mill finish. Clear width of stair treads shall be 24 inches. Provide 1-1/2-inch diameter handrails. Provide 6-inch by 2-inch by 1/8-inch minimum channel stringers. Provide minimum 4-1/8-inch by 1/4-inch minimum rung able to withstand a 1,000-pound load. Provide minimum 3/16-inch thick aluminum wall and floor brackets. Provide 1/12-inch aluminum handrails. Manufacturer: O'Keefe's, Inc., Model 523-10, or equal.

2.02 ALUMINUM ABRASIVE STAIR NOSINGS

Abrasive stair nosings for concrete stairs shall be aluminum (Alloy 6061T6) angles 2-1/2 inches by 2-1/2 inches by 8 inches less than the concrete width. The walking surfaces of the nosings shall have integrally cast abrasive grit to provide antislip protection. Front edge of nosings shall be rounded. Nosings shall include concrete anchors. Nosings shall be American Abrasive Metals Company Curb Bar CB2, Barry Craft CB25A, or equal.

2.03 STAIR TREADS

Stair treads shall be of aluminum design with 1-1/4-inch by 3/16-inch bars spaced 1-3/16 inches on center. Treads shall have extruded aluminum corrugated nosings. Treads shall be as manufactured by Grating Pacific, IKG Industries, or equal.

2.04 WELDING ELECTRODES

A. Welding electrodes for structural steel shall conform to AWS A5.5. Use electrodes in the E-70 series.

B. Weling electrodes for aluminum shall be ER4043 filler metal.

C. Welding electrodes for stainless steel shall conform to AWS 5.4. Use Electrodes E308 for Type 304 stainless steel and E316 for Type 316L stainless steel.

PART 3 - EXECUTION

3.01 STORAGE OF MATERIALS

Store structural material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

3.02 INSTALLING LADDERS

Mount ladders to provide clearance in back of ladder so that the distance from the centerline of rungs, cleats, or steps to the nearest permanent object in back of the ladder shall be not less than 7 inches.

3.03 INSTALLING ANCHOR BOLTS - SEE SECTION 05052.

3.04 REPAIR OF GALVANIZED SURFACES

A. Clean damaged surfaces per SSPC SP-1 and SP-11. Coating System: Apply Z.R.C. Galvanizing Compound, RAMCO Specialty Products "Zinckit," NuWave "Galv-Match-Plus," Devcon "Cold Galvanizing," Clearco "Cold Galvanizing Spray," Tnemec Series 1 Omnithane, or equal to a minimum dry-film thickness of 3 mils. Apply per ASTM A780, Annex A2. Corrosion Protection for Aluminum Surfaces

B. Coat aluminum surfaces to be embedded or which will be in contact with concrete or masonry per Section 09900: Painting, before installation. Allow the coating to dry before the aluminum is placed in contact with the concrete.

C. Where aluminum surfaces come in contact with dissimilar metals, keep the dissimilar metallic surfaces from direct contact by use of neoprene gaskets or washers.

END OF SECTION

SECTION 05520 - HANDRAILS AND SAFETY CHAINS

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes materials, fabrication, and installation of aluminum handrail and safety chains.

1.02 DESIGN CRITERIA

Handrails, Walkways, Ladders, Personnel Platforms: OSHA, FBC.

1.03 SUBMITTALS

A. Submit shop drawings and signed and sealed calculations in accordance with the General Conditions and Section 01340: Submit Shop Drawings, Working Drawings, and Samples.

B. Submit drawings of handrail and safety chains. Show dimensions and reference materials of construction by ASTM designation and grade. Show design criteria.

C. Submit placing or erection drawings that indicate locations of handrail and safety chains. Reproductions of contract documents will not be accepted for this purpose.

PART 2 - MATERIALS

2.01 ALUMINUM HANDRAILS

A. Construct aluminum handrails of clear anodized aluminum pipe conforming to ASTM B429, Alloy 6063-T6. Handrail shall be CV Pipe Rail by Craneveyor, Wesrail as manufactured by Moultrie Manufacturing Co., or equal.

B. Railing shall be shop assembled in sections as long as practical but shall not be greater than 24-ft in length. A field splice shall be used when an assembled section is to be attached to another section. Field splices shall be used in all railing panels that cross over structure expansion joints.

1. Field splices shall use internal splice sleeves located within 8-in of railing posts. The sleeve shall be welded to the rail on one side and fastened with a set screw to the rail on other side. The field splice shall be detailed to take the differential expansion between the railing system and the supporting structure.

2. When the field splice occurs in a railing panel crossing a structure expansion joint, the sleeve shall be welded to the rail on one side and be free to slide in the rail on other side. The field splice shall be detailed to take the same movement as the structure expansion joint.

2.02 STAINLESS STEEL HANDRAIL SAFETY CHAINS

Handrail safety chains shall be Type 316 stainless steel. Chains shall be proof coil style, 3/16 inch in diameter, with at least 12 links per foot and with snaphooks at each end. Snaphooks shall be Type 316 stainless steel.

2.03 WELDING ELECTRODES

1. Welding electrodes for structural steel shall conform to AWS A5.5. Use electrodes in the E-70 series.

2. Welding electrode for aluminum shall be ER4043 filler metal.

3. Welding electrodes for stainless steel shall conform to AWS 5.4. Use Electrodes E308 for Type 304 stainless steel and E316 for Type 316L stainless steel.

PART 3 - EXECUTION

3.01 STORAGE OF MATERIALS

Store material above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion. Aluminum in contact with concrete should be coated with bituminous.

3.02 FABRICATION AND ERECTION

A. Clean the surfaces of metalwork to be in contact with concrete of rust, dirt, grease, and other foreign substances before placing concrete.

B. Set embedded metalwork accurately in position when concrete is placed and support it rigidly to prevent displacement or undue vibration during or after the placement of concrete. Unless otherwise specified, where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with dry-pack mortar in conformance with Section 03300.

3.03 WELDING

A. Perform welding on steel by the SMAW process. Welding shall conform to the AWS D1.1-2006, except as modified in AISC Section J2.

B. Perform welding on aluminum by the gas metal arc (MIG) or gas tungsten arc (TIG) process. Welding shall conform to the AWS D1.2-2003.

C. Perform welding on stainless steel by the gas tungsten arc (TIG) process. Welds shall be full penetration and smooth. Provide inert gas on the inside of pipe during welding to reduce oxidation.

D. Provide a minimum of two passes for metal thickness in excess of 5/16-inch thickness.

E. Produce weld uniform in width and size throughout its length with each layer of weldment smooth; free of slag, cracks, pinholes, and undercuttings; and completely fused to the adjacent weld beads and base metal. Avoid irregular surface, nonuniform bead pattern, and high crown. Form fillet welds of the indicated size of uniform height and fully

penetrating. Accomplish repair, chipping, and grinding of welds in manner that will not gouge, groove, or reduce the base metal thickness.

3.04 INSTALLING HANDRAILS

Provide handrail components to complete the installation for the various types of handrail.

3.05 INSTALLING SAFETY CHAINS

Provide two chains 4 inches longer than the access opening for each opening. Mount the top chain 3 feet 6 inches above the floor and mount the lower chain 2 feet above the floor.

3.06 CORROSION PROTECTION FOR ALUMINUM SURFACES

A. Refer to specs 05121 section 3.06

END OF SECTION

SECTION 05530 - GRATING

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes materials, fabrication, and installation of steel and aluminum grating, cover and floor plates.

1.02 DESIGN CRITERIA

A. Grating: Design live load of 100 psf, maximum deflection of 1/240 of span or ¼" Maximum.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with the General Conditions and Section 01340 Shop Drawings, Working Drawings, and Samples.

B. Submit drawings of grating. Show dimensions and reference materials of construction by ASTM designation and grade. Show design criteria.

C. Submit placing or erection drawings that indicate locations of fabricated items. Reproductions of contract documents will not be accepted for this purpose.

PART 2 - MATERIALS

2.01 DESIGN OF GRATING

A. Grating be as detailed in the drawings or, if not detailed, shall be designed per subsection on "Design Criteria" in Part 1. No single piece of grating shall weigh more than 80 pounds. Length of individual pieces shall not exceed one and one-half times the width, unless limited by the installation.

B. Field measure grating and cover plates for proper cutouts and size.

C. Grating shall be completely banded. For pipe and conduits (including electrical conduit) larger than 1 inch in diameter penetrating grating, cut and band grating before galvanizing.

2.02 ALUMINUM SHEET

Aluminum sheet shall conform to ASTM B209, Alloy 3003, H 14 temper.

2.03 GRATING

Grating shall be aluminum (Alloy 6061 or 6063, Temper T6, as indicated in the drawings. Main bars shall be of the thickness and of the depth indicated in the drawings.

2.04 FRAMES AND SUPPORTS FOR GRATING

Fabricated frames and supports for grating shall be aluminum or as indicated in the drawings. Corners of embedded angle frames shall be mitered and welded with the welds ground smooth.

2.05 WELDING ELECTRODES

A. Welding electrodes for structural steel shall conform to AWS A5.5. Use electrodes in the E-70 series.

B. Welding electrode for aluminum shall be ER4043 filler metal.

C. Welding electrodes for stainless steel shall conform to AWS A5.4. Use electrodes as follows:

Stainless Steel Material	Welding Electrode Material
Type 304	E 308
Type 304L	E 347
Type 316	E 316
Type 316L	E 318

PART 3 - EXECUTION

3.01 STORAGE OF MATERIALS

Store structural material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

3.02 INSTALLATION AND ERECTION

A. Clean the surfaces of metalwork to be in contact with concrete of rust, dirt, grease, and other foreign substances before placing concrete.

B. Set grating seats and frames and checkered plate frames and supports accurately in position when concrete is placed and support it rigidly to prevent displacement or undue vibration during or after the placement of concrete. Unless otherwise specified, where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with dry-pack mortar in conformance with Section 03300 Concrete.

C. Set seat angles for grating so that the grating will be flush with the floor. Maintain the grating and floor plates flush with the floor. Seat angles and anchors shall be aluminum or as indicated in the drawings.

3.03 FASTENING

Fasten grating panels to supporting members as indicated in the drawings. Saddle clips shall be the same material as the grating.

3.04 WELDING

A. Perform welding on steel by the SMAW process. Welding shall conform to AWS D1.1-2006, except as modified in AISC Section J2.

B. Perform welding on aluminum by the gas metal arc (MIG) or gas tungsten arc (TIG) process. Welding shall conform to AWS D1.2-2003.

C. Perform welding on stainless steel by the gas tungsten arc (TIG) process. Welds shall be full penetration and smooth. Provide inert gas on the inside of pipe during welding to reduce oxidation.

D. Provide a minimum of two passes for metal thickness in excess of 5/16-inch thickness.

E. Produce weld uniform in width and size throughout its length with each layer of weldment smooth; free of slag, cracks, pinholes, and undercuttings; and completely fused to the adjacent weld beads and base metal. Avoid irregular surface, nonuniform bead pattern, and high crown. Form fillet welds of the indicated size of uniform height and fully penetrating. Accomplish repair, chipping, and grinding of welds in manner that will not gouge, groove, or reduce the base metal thickness.

3.05 CORROSION PROTECTION OF ALUMINUM SURFACES

A. Refer to specs 05121 section 3.06

END OF SECTION

DIVISION 11

EQUIPMENT

SECTION 11224 - SUBMERSIBLE MIXERS INSTALLATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. The General Contractor shall install, test and place in satisfactory operation, as shown on the Plans and specified, thirty-two (32) submersible mixer(s) complete with all appurtenances, accessories and spare parts as will be required to produce a complete and workable installation. Lexington-Fayette Urban County Government will purchase the mixer packages and supply them to the Contractor for installation.

B. Mixers shall work with existing motor starter controllers.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Refer to Division 1 for supplementary requirements for guarantees, shop drawings, technical manuals, start-up, etc.

B. Section 16120 – Conductors and Cables

C. Section 16220 – Motors

1.03 SUBMITTALS

A. Testing Reports

1. Field inspection/testing reports.

B. Submit electrical/control diagrams detailing the requirements for control panels

PART 2 - MATERIALS

2.01 MANUFACTURERS

A. Manufacturer:
Submersible mixers shall be manufactured by Wilo USA LLC of Thomasville, Georgia.

B. Performance:

Performance of each mixer is presented below for information purposes only:

Minimum Propeller Diameter, inches (mm)	23.622 (600)
Number of Propeller Blades	3
Maximum Propeller Speed, rpm	254
Minimum Flow, gallons per minute (m^3/s)	6900 (0.44)

Minimum Thrust, pounds force, lbf (N)	157.3 (700)
Maximum Motor Speed, rpm	1200
Maximum Nominal Motor HP per unit	2.7
Minimum Motor Reserve at rated duty, %	38
Minimum Submergence, maximum value in feet (mm)	3.0 (900)
Rated Voltage (volts)	460
Rated Frequency (hertz)	60
Number of Phase	3

2.02 MIXER PACKAGE SCOPE OF SUPPLY

A. GENERAL

1. The mixers shall be the submersible type and shall be installed in location as shown in the plans.

2. All mating surfaces of the major castings requiring a watertight seal shall be machined and fitted with FPM (Viton) O-rings.

3. All nuts, bolts, washers, and other fastening devices supplied with the mixers shall be AISI 316 stainless steel.

B. SUBMERSIBLE MIXER

1. Mixer shall consist of housing, propeller, propeller shaft, bearings, mechanical seals, and gear reducer. A submersible motor will be mounted to the mixer.

2. Thermal switches shall be furnished to monitor stator temperatures. The stator shall be equipped with two (2) thermal switches. Thermal switches shall automatically de-energize the motor when its temperature exceeds a preset limit as recommended by the manufacturer.

C. POWER AND CONTROL CABLES

1. Power and control cables shall be furnished in lengths to run un-spliced from the mixer to the control panel or disconnect as shown on the Contract Drawings and as specified herein. Cables shall terminate with conductor sleeves that bundle the entire group of strands of each phase to improve termination at the pump control panel. The sleeves shall be provided to confirm that all strands of each conductor is terminated properly.

D. The removal/mounting system for each mixer shall consist of the following:

1. Guide Rail System:
   a. A guide rail system shall be used to mount each mixer during operation and to guide the units during installation and removal for service. The system shall consist of a

bottom assembly, mixer support assembly, 4-inch by 4-inch guide pipe, upper support and positioning device. The system to be fixed at the bottom of the tank in a pivot which shall allow horizontal rotation of the mast through not less than 120 degrees. All guides and brackets shall be constructed of AISI 316 stainless steel. The mast bearings shall be constructed of Hostaform (POM). Power/control cable holders shall be provided every five feet.

b. The bottom assembly shall be bolted to the floor of the tank, and provide support for the guide pipe. It shall also include a hole to accept the guide pipe bottom plug. The bottom console and guide pipe shall be constructed of AISI 316Ti stainless steel.

c. The assembly shall be positioned in such a manner so as to prevent the mixer blade tips from hitting the basin floor. The mixer support shall be constructed of AISI 316Ti stainless steel.

d. The upper guide holder assembly shall secure the system to the tank edge or platform. It shall also provide the lateral support for the guide pipe. The assembly shall contain a location to secure the electrical motor cable holder.

2. Special Fastening Parts

a. Each mixer shall be provided with Special Fastening Parts. The special fastening parts shall consist of a cable lifting post, a cable with a thimble, cable clamps, and fastening material. Cable shall be 6mm x 12m 316SS.

b. The cable lifting post is used to secure the cable when the mixer has been lowered. The cable lifting post must be fastened in the immediate vicinity of the hoist.

3. Hoist (Crane) Assembly

a. A hoist system shall be used for lifting and lowering of the mixer on the guide rail during installation and maintenance. The system shall be capable of 360 degree-rotation. Each hoist assembly shall be rated at a minimum of 500 pounds. All crane and receiving boxes shall be constructed of AISI 304 stainless steel. The sleeves and the bearings in the receiving box shall be constructed of Nylon (PA). Hoist shall come complete with a 304SS hand winch that will accept 6mm x 12m 316SS cable provided with each mixer.

b. Hoist shall be portable so it can be moved from mixer to mixer. Permanent base sockets shall be provided at each mixer. A total of four (4) hoists and 32 hoist base sockets shall be provided by WILO USA LLC

2.03 LOCAL CONTROL PANEL

A. Existing Control Panels will be reused and modified by Division 16 contractor.

2.04 JUNCTION BOX

A. The existing junction boxes will be replaced and provided by the Division 16 contractor per the electrical drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Contractor shall install the mixers in the locations shown on the drawings per the manufacturer's installation instructions and in consultation with the manufacturer.

B. The Contractor shall field measure all guide rail locations and trim the provided guide rails to the appropriate size. All adjustment to the guide rails shall be done in a manner to provide a clean square cut.

3.02 STORAGE/MAINTENANCE

A. The contractor shall be responsible to exercise the mixers in storage at the 6-month storage period and every three (3) months thereafter. Exercise the mixers by rotating the props by hand twelve (12) complete revolutions to lubricate the bearings and seals.

3.03 FIELD QUALITY CONTROL

A. The contractor shall provide the services of the manufacturer's factory trained service technician to inspect the installation, assist in the successful start-up of the mixers, and instruct the Owner in proper operation and maintenance of the equipment for a period of not less than three (3) eight, (8) hour days.

END OF SECTION

11241 - PROGRESSING CAVITY METERING PUMPS

PART 1 GENERAL

1.01 DESCRIPTION

A. SCOPE: This section specifies positive displacement progressing cavity pumps, complete with electric motors, and all specified appurtenances, as shown on the plans and specified herein.

B. TYPE: The pumping units shall be of the positive displacement, progressing cavity type designed for pumping the liquids, as specified.

C. PERFORMANCE AND DESIGN REQUIREMENTS:

1. Pumps shall be specifically designed and selected for continuous duty pumping of the liquids as specified:

Liquid	Sodium Aluminate Solution
Percent Concentration	38%
Specific Gravity	1.454
Viscosity	260 cps
pH	14.0
Temperature	68 °F

2. The pumps shall be of the compact, close-coupled design. The gear reducer (if required) shall be sized for a minimum service factor of 1.5 and designed with a thrust load capability of 150 percent of the actual thrust load.

3. The pumps, along with associated drive appurtenances, shall be mounted on common fabricated steel base plates.

4. Manufacturers must currently have installations for the same liquids and of the same model pump unit, in service for a minimum of three years.

D. OPERATING CONDITIONS: The progressing cavity pumps shall have the following operating characteristics:

Equipment Service	Rated Capacity, gph	Discharge Pressure psi	Maximum/ minimum pump speed, rpm	Suction and discharge port size, NPT – in	Minimum motor hp	Drive
Feed Pump #1 High Flow Low Flow	16 1	100	600	1" - ½"	0.5	AC Motor Fixed Reduction VFD
Feed Pump #2 High Flow Low Flow	16 1	100	600	1" - ½"	0.5	AC Motor Fixed Reduction VFD
Feed Pump #3 High Flow Low Flow	90 16	100	200	1 ½" – 1 ¼"	1.0	AC Motor Fixed Reduction VFD
Feed Pump #4 High Flow Low Flow	90 16	100	200	1 ½" – 1 ¼"	1.0	AC Motor Fixed Reduction VFD

E. Power Supply to all pumps shall be 3-phase, 460V, 3 phase, 60 Hz.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Refer to Division 1 for supplementary requirements for guarantees, shop drawings, technical manuals, start-up, etc.

B. Section 16220 – Motors

1.03 REFERENCES

A. This section contains references to the following documents. They are part of this section as specified and modified. In case of conflict between the requirements of the section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
AGMA 6010-E-88	Spur, Helical, Herringbone, and Bevel Enclosed Drive
AGMA 6019-E-89	Gear Motors Using Spur, Helical, Herringbone, Straight Bevel, or Spiral Bevel Gears
AGMA 6023-A88	Design Manual for Enclosed Epicyclic Gear Drives

1.04 ENVIRONMENTAL CONDITIONS

A. Pumps to be provided under this section will be installed in the Nitrification Blower Building basement, which is conditioned space.

1.05 SUBMITTALS

A. The following information shall be provided in accordance with Section 01300: Submittals.

1. Manufacturer's data including materials of construction and equipment weight.
2. Predicted performance curves developed for the specific application. Performance curves shall plot speed, capacity, head, and horsepower required for the specified operating range.
3. Motor data.
4. Universal joint warranty.
5. Pump Warranty.
6. Drive Train Warranty.
7. A copy of this specification section with addenda updates, and all referenced sections with addenda updates, with each paragraph check marked to show specification compliance or marked to show deviations.
8. Installation instructions.

B. Operations and Maintenance Manual: Provide operating and maintenance manuals in accordance with the applicable provisions of Section 01780.

C. Installation certification Form.

D. Training certification Form.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Progressing cavity pumps shall be **seepex, Inc.** Series MD for the smaller feed pumps 1 and 2 and Series BN for the larger feed pumps 3 and 4. Seepex, Inc. Is the Design Basis, any alternate equipment submitted must meet requirements of the specification. Contractor is responsible for all changes to design related to providing alternate equipment. Changes shall be made at no expense to the owner.

2.02 MATERIALS

	Material	
Component	**Feed Pumps 1 and 2**	**Feed Pumps 3 and 4**
Rotor	AISI 316 SS	Tool Steel - Duktil Coated
Stator	Viton	Buna N
Pump Body	HDPE	Cast iron, outside coated with

	Material	
Component	**Feed Pumps 1 and 2**	**Feed Pumps 3 and 4**
		epoxy or enamel coating
Shaft	AISI 316 SS	
Mechanical Seal	Burgmann MG1- $G_{60}Q_1Q_1VGG$	Single, elastomer bellows Material code Q1Q1VGG

2.03 EQUIPMENT

A. ROTOR AND STATOR: Each pump shall be a minimum two-stage design employing a convoluted rotor operating in a similarly convoluted stator. The convolutions shall be configured to form a cavity between the rotor and stator, which shall progress from the pump's inlet to discharge port with the operation of the rotor. The fit between the rotor and stator at the point of contact shall compress the stator material sufficiently to form a seal and to prevent leakage from the discharge back to the inlet end of the pumping chamber. The stator shall be molded with a seal integral to the stator elastomer preventing the metal stator tube and the bonding agent from the elastomer from contacting the pumped liquid. Gaskets or "O" rings may not be used to form this seal.

1. Stators for the Feed pumps 1 and 2 shall have Viton elastomer. The pump rotors shall be constructed of AISI 316 SS.

2. Stators for feed pumps 3 and 4 shall have Buna elastomer. The sludge pump rotors shall be constructed of tool steel. Additionally, the sludge pump rotors shall have a chromium nitride coating (Duktil) with a minimum thickness of (.010"). Hard chrome plating or ceramic coatings are not acceptable due to the ease at which this coating will crack and the lack of diffusion into the rotor base metal.

B. ROTOR AND DRIVE TRAIN: The rotor drive train shall be warranted for three (3) years from acceptance and shall consist of the following:

1. Feed Pumps 1 and 2: Each pump rotor shall be driven through a positively sealed and lubricated pin joint. The pin shall be constructed of high speed steel, air hardened to 60-65 HRc. The joint shall be grease lubricated with a high temperature (450 °F), PTFE filled synthetic grease, covered with Viton sleeve and positively sealed with hose clamps constructed of 304 SS. The shaft under the mechanical seal shall be constructed of 316 SS.

2. Feed Pumps 3 and 4: Each pump rotor shall be driven through a positively sealed and lubricated pin joint. The pin joint shall have replaceable bushings, constructed of air-hardened tool steel of 57-60 HRc, in the rotor head and coupling rod. The pin shall be constructed of high speed steel, air hardened to 60-65 HRc. The joint shall be grease lubricated with a high temperature (450 °F), PTFE filled synthetic grease, covered with Buna N sleeve and positively sealed with hose clamps constructed of 304 stainless steel. A stainless steel shell shall cover the rotor side universal joint assembly to protect the elastomer sleeve from being damaged by tramp metals or glass. The universal joints shall carry a separate warranty of 10,000 operating hours. This warranty shall be unconditional in regards to damage or wear.

C. CASING:

1. Feed Pumps 1 and 2: NPT connections shall be provided at both the inlet and discharge ports. Casings shall be constructed of high density polyethylene (HDPE).

2. Feed Pumps 3 and 4: A 150-pound (ANSI B16.5) flanged connection shall be provided at both the inlet and discharge ports. The suction and discharge casings shall each be provided with a 3/8-inch (or larger) tap to permit installation of pressure instruments.

D. SHAFT SEALS:

1. Feed Pumps 1 and 2: Shaft shall be sealed using a single-acting mechanical seal constructed of Viton elastomers, silicon carbide faces, and 316 SS metal parts. The shaft shall be solid through the mechanical seal area, but of a two part design which allows the mechanical seal and all other wetted rotating parts to be removed from the pump without disassembly of the pump or gear motor (if required) bearings. Bearings shall be located in the motor or gearmotor as required and shall be designed to adequately withstand all radial and thrust loads imposed by the pump at the service conditions.
2. Feed Pumps 3 and 4: Shaft shall be sealed using a single internal mechanical seal as specified in Section 2.02. The shaft shall be solid through the sealing area, but of a two part design which allows the rotating unit to be removed from the pump without disassembly of the gearmotor bearings. Seal materials shall be solid silicon carbide faces with 316 stainless steel metal parts and fluoroelastomers (FKM).

E. BEARINGS:

1. Feed Pumps 1 and 2: Bearings shall be located in the motor or gearmotor as required and shall be designed to adequately withstand all radial and thrust loads imposed by the pump at the service conditions.

2. Feed Pumps 3 and 4: Each pump shall be provided with oil lubricated thrust and radial bearings, located in the gearmotor, designed for all loads imposed by the specified service.

3. All motor bearings shall be insulated with a B10 life of 100,000 hours.

F. MOTOR AND DRIVE UNIT:

1. Gear motors or gear reducers (if required) shall be designed in accordance with AGMA 6019-E (Class II). Unless otherwise noted, motors shall be energy-efficient motors in accordance with Section 16220 Motors.

2. All pumps shall be provided with inverter duty motors to be controlled by Variable Frequency Drives (VFDs). and control panels are to be new, refer to drawing E-sheets for ladder logic control diagram. The pump controller must use Rockwell Powerflex 755 VFD's with Ethernet TCP/IP Modbus communication. Refer to E-sheets for additional requirements. The pump supplier shall be responsible for the provision of the fixed reduction between the motor and pump as well as the pump controller. The reduction ratio shall be that required to operate the pump at its maximum operating speed when the motor is operating at its nominal rated full speed in accordance with the schedule in paragraph 1.01 D. Units may be operated at 90 Hz at the maximum speed. The supplier shall configure the

existing pump controller settings to insure proper pump and piping protection against clogs and high pressure.

3. Where motor requirements conflict with Division 16, this specification shall govern.

2.04 ACCESSORIES:

A. RUN DRY PROTECTION

1. The stator shall be fitted with a sensor sleeve and thermistor sensor. The new controller will monitor the sensor. The vendor's local representative shall configure the VFD settings for appropriate sensor monitoring and shutdown. The controller shall monitor the stator temperature and activate a shutdown and alarm sequence if the stator temperature reaches the adjustable limit on the controller.

B. OVER PRESSURE PROTECTION: (For Feed Pumps 3 and 4 only.) Each pump unit shall be supplied with a silicone-filled isolation ring with a dual mounted gauge and single point pressure switch. The pressure ranges for the switch and gauge shall be selected specifically for each specified service. The isolation ring shall be mounted between ANSI flanges, be sized according to the discharge pipe as shown on the plans, and be constructed with a carbon steel body and fittings with a Buna sleeve. The switch shall be SPDT, NEMA 4.

2.05 SPARE PARTS

A. One set of special tools shall be provided to service the pumps. In addition, the following shall be provided for each pump size:

1 – stator assembly (with TSE sensor sleeve as required)
1 – rotor
1 – set universal joint assemblies
1 – mechanical seal
1- VFD for each size used
2- Pressure sensor
2- Thermistor sensor
2- Pressure switch

PART 3 EXECUTION

3.01 INSTALLATION

A. The pumps shall be installed as specified and in accordance with manufacturer's written recommendations. The installation and initial operation of all components shall be certified by the manufacturer.

3.02 MANUFACTURER'S FIELD REPRESENTATIVE

A. The manufacturer shall provide the services of a factory trained service technician to inspect the installation, configure the existing VFD, terminate sensors and devices, assist in the successful start-up of the pumps, and instruct the Owner in proper operation and maintenance of the equipment for a period of not less than two (2) eight (8) hour days.

3.02 TESTING

A. After completion of installation, the pumps shall be completely tested to demonstrate compliance with operating requirements as specified.

END OF SECTION

DIVISION 13

SPECIAL CONSTRUCTION

SECTION 13122 – CUSTOM ALUMINUM ENCLOSURES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Provide two (2) manufactured insulated aluminum enclosures of the dimensions shown on the drawings.

1.02 QUALITY ASSURANCE

A. Qualifications: The enclosure manufacturer shall be a company specializing in the manufacture of aluminum enclosures with at least 5 years of successful experience designing and selling enclosures to various customers in different climatic regions.

1.03 SUBMITTALS

A. Shop Drawings

1. Submit dimensioned drawings of each enclosure showing location of access panel.

2. Information on the performance and properties of the insulation.

3. Submit under provisions of 01300 Submittals.

1.04 STORAGE AND HANDLING

A. Store products in shipping containers and maintain in dry place until installation.

1.05 ACCEPTABLE MANUFACTURERS

A. **Safe-T-Cover™** or Engineer approved equal.

1.06 REFERENCES

A. ASTM B209.

PART 2 PRODUCTS

2.01 GENERAL

A. Enclosures shall be custom made to match the sizes and configurations shown on the drawings. Enclosure will be mounted to concrete on two sides.

2.02 MATERIALS OF FABRICATION

A. Material of fabrication shall be 5052-H32 marine grade aluminum (.050/18 gauge), mill finish and shall meet ASTM B209.

B. Insulation shall be 1.5" (9.0 "R" value) minimum thickness polyisocyanurate foam laminated to a glass fiber reinforced facer (each side). The insulation shall have the following properties:

1. Dimensional Stability-Less than 2% linear change, ASTM D-2126;
2. Compressive Strength-20PSI, ASTM D-1621;
3. Water Absorption-Less than 1% by volume, ASTM C-209;
4. Moisture Vapor Transmission-Less than one (1) perm, ASTM E-96;
5. Product Density-Nominal 2.0 lbs. per cubic foot, ASTM D-1622;
6. Flame Spread=25, ASTM E-84;
7. Service Temperature= -100°F to +250°F maximum.
8. The insulation shall be of uniform thickness.

2.03 ROOF & WALLS

A. The roof and walls of the enclosure shall be constructed of 5052-H32 (.050/18 gauge) marine grade aluminum, mill finish, ASTM B209 outside with insulation 1 1/2" (9.0 "R" value) thick in the walls and roof.

B. The enclosure shall have completely removable access panels on the sides with folding T handle in the middle for removal.

C. Roof will be hinged with a full length stainless steel piano hinge and secured in the closed position with interior latches. Hinged roof shall extend half way down the front.

D. The enclosure shall have a fully insulated drain panel designed to remain closed except when discharging water. Clear opening drain panel area shall be the width of the front of the enclosure and 4" high.

E. Drain flap shall have a stainless steel hinge and a stainless steel light strength spring as a positive means of closure so that it will not be activated by wind.

F. The drain flap shall be constructed of the same materials that is used in the walls and roof of the enclosure.

2.04 MOUNTING HARDWARE

A. Mounting hardware shall be designed and furnished by the enclosure manufacturer and shall be constructed of 316 stainless steel.

B. All masonry fasteners shall be 316 stainless steel metal hit anchors.

C. All necessary drill bits shall be furnished.

D. All mounting brackets shall be on the inside of the enclosure. The enclosure shall be mounted in such a way that removal will be by removal of interior mounting brackets.

PART 3 EXECUTION

3.01 INSTALLATION

A. Enclosure shall be mounted on a concrete pad and concrete wall.

B. Enclosure shall be assembled and mounted to concrete pad according to manufacturer's instructions.

C. Where Aluminum is in contact with concrete provide a gasket or paint with bituminous coating per section 05121 3.06.

END OF SECTION

SECTION 13645 - ONLINE NUTRIENT PROCESS MONITORNG SYSTEM WITH SAMPLE FILTRATION

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The CONTRACTOR shall furnish and install two (2) on-line nutrient analysis systems for the detection of ammonia, nitrate, nitrite and ortho phosphate from a total of eight (8) sample points.

B. Each on-line nutrient analysis system consists of one (1) ChemScan Model UV-6101 nutrient analyzer, four (4) sample filtration accessories, and four (4) sample pumps. The systems shall be furnished by a single supplier who shall be responsible for proper operation and interfacing of the equipment.

C. Each ChemScan Model UV-6101 nutrient analyzer including NEMA-4 electronics module enclosure, main power connection, control circuit board, network communications board and associated software for instrument control, internal memory with lithium battery backup, light source module, spectrograph module with 256 element array detector, external keypad and cabinet mounted display. Flow cell module consisting of injection type flow cell, reagent injectors, internal manifold including auto zero and clean functions, calibration sample port and four (4) sample lines, internal analyzer pump for zero and clean solutions, RS-232 serial port and NEMA-3R enclosure. Multiple analyzers for each parameter or sample point are not acceptable.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Refer to Division 1 for supplementary requirements for guarantees, shop drawings, technical manuals, start-up, etc.

B. Section 16120 - Conductors and Cables

C. Section 16220 – Motors

1.03 SUBMITTALS

A. Shop Drawings: Submit shop drawings in accordance with Section 01300: Submittals. At a minimum, shop drawings shall include the following:

1. Cutsheets and dimensional drawings for sample pumps, including weight of pump and accessories.

2. Sample Pumps motor data.

3. Sample Pump Curves.

4. Cutsheet on portable hoist used for removal of submersible sample pumps.

5. Electrical and Control schematics, wiring diagrams.

6. Installation instructions for process analyzer, filter assemblies, and sample pumps.

7. Short-term and Long-term storage and handling instructions for all supplied equipment.

8. Cutsheets for nutrient analyzer and sample filtration accessories.

9. Layout drawings of inside of analyzer panel including Electronics Module and Flow-Cell Module.

1.04 QUALIFICATIONS

A. Detection ranges and accuracy for each parameter must be verified through the availability of data from tests of at least four months duration at a municipal wastewater treatment facility in North America. Comparison samples from test sites shall have been extracted a minimum of 60 times during the test period and independently analyzed in accordance with a standard laboratory analysis method. The following calculations from the test shall be submitted: average absolute error, variance and standard deviation. In addition, references from a minimum of five municipal wastewater treatment sites in North America using the same analytical method for a period not less than 5 years shall be furnished for each parameter.

1.05 PERFORMANCE

A. The analyzer shall be capable of detecting nitrite, nitrate, ammonia and ortho-phosphate from each sample location shown in the table in below. Demonstrated accuracy for all parameters in wastewater will be ±5 % or better.

Sample Location	Nitrate (mg/l as N)	Nitrite (mg/l as N)	Ammonia (mg/l as N)	Ortho-phosphate (mg/L as P)
Analyzer I, BPR Influent	0.1 – 20	0.1 – 5	0.1 – 20	0.1 – 10
Analyzer I, BPR Mid	0.1 – 20	0.1 – 5	0.1 – 20	0.1 – 10
Analyzer I, BPR Effluent	0.1 – 20	0.1 – 5	0.1 – 20	0.1 – 10
Analyzer I, Return Activated Sludge	0.1 – 20	0.1 – 5	0.1 – 20	0.1 – 10
Analyzer II, 1st Stage Aeration Mid	0.1 – 20	0.1 – 5	0.1 – 20	0.1 – 10
Analyzer II, 1st Stage Aeration Effluent	0.1 – 20	0.1 – 5	0.1 – 20	0.1 – 10
Analyzer II, 2nd Stage Aeration Mid	0.1 – 20	0.1 – 5	0.1 – 20	0.1 – 10
Analyzer II, 2nd Stage Aeration Effluent	0.1 – 20	0.1 – 5	0.1 – 20	0.1 – 10

B. Demonstrated accuracy must be based on field performance for a minimum of 30 days, with a minimum of 20 samples over this period following calibration by manufacturer's personnel. Accuracy shall be measured using the average absolute error, defined as the sum of the absolute differences between the laboratory value for a sample and the equivalent on-line analysis value at the time of sample extraction, divided by the number of samples.

PART 2 - PRODUCTS

2.01 SAMPLING REQUIREMENTS

A. The analyzer shall be capable of measuring all parameters from a single sample point within 7 minutes or less, not including sample flush time. The total time required to measure all parameters at two designated sample points, including any time required to flush sample lines and accumulate fresh filtrate for analysis shall be 15 minutes or less. The analyzer system shall be capable of enabling or disabling parameter selections at each sample point and enabling or disabling analysis of any of the sample points through operator-initiated commands on the controller screen without the need for external software modifications.

B. Flow-Through Cyclic (FTC) Sample Filtration System: The analyzer system manufacturer shall supply two (2) ChemScan UV-6101 analyzers, each with four (4) ChemScan Wall Mounted Type-II Flow Through Cyclic Filter Systems, each consisting of 1.5-inch sample inlet and outlet couplings, manual bypass valves, and cyclic contact chamber with quick disconnect coupling. Filter systems are wall mounted. Two (2) spare filters Type-II Filter with cleaning chambers shall be provided. Twelve (12) filters in total for two analyzer systems.

C. Sample Pumps. All sample pumps shall be supplied by the analyzer system supplier.

1. The analyzer manufacturer shall provide six (6) submersible grinder pumps, 2.7 HP, 460 VAC, 3-phase, with MP style mounting, including lower discharge / guide rail fitting, upper guide rail fitting and stainless-steel lifting cable with shackles, 30-foot submersible power cable standard. Pump guide rails (3/4" nominal I.D. Sch. 40 Type 316 SS pipe in site-specific lengths), one portable davit crane (Halliday model 36C30AC60AA with 24" – 36" reach, 30' of ¼" SST cable with 310 lbs capacity), one set of lifting hardware per pump (chain fitting kit, hardware connection assembly, and hook safety assembly), six (6) davit crane bases shall be provided. Pumps shall be provided with moisture sensors and relays.

2. Submersible sample pumps and motors shall be explosion proof. The motor shall bear the FM (Factory Mutual) explosion-proof label certifying its use in a Class 1, Division 1, Groups C & D hazardous location.

3. Contractor to provide all anchor bolts. Anchor bolts shall be 316 stainless steel. Anchor bolt sizing to be provided by pump manufacturer.

4. Two (2) dry-pit chopper pumps for RAS sample location and Sample Point 3: BPR Effluent Channel. Dry-pit chopper pump shall be model ChopX3-A, motor frame 213T, manufactured by Hayward Gordon.

   a. Casing: The pump casing will be constructed of ASTM A48 Cast Iron. Flanged suction and discharge connections shall conform to the requirements of ANSI B16.1, Class 125. Casings with 4" or larger discharge diameter shall have an inspection port with removable cover to allow access to the casing passage. An inspection port shall also be provided in the suction spool piece to allow access to the front of the impeller and cutter bars. The casing backplate shall have spiral cutting groove on the surface that is in close clearance to the rear of the impeller. The casing shall be a clamp type design, with integrally cast feet to allow removal of the power frame for maintenance without disturbing the suction or discharge piping.

   b. Impeller: The pump impeller shall be an open type with or sharpened vane edges incorporated into the rear of the impeller which provides cutting action against the backplate spiral groove, preventing fouling behind the impeller. Primary chopping/conditioning of materials shall be accomplished by the action of the sharpened leading edges of the impeller blades moving across the cutter bar at the intake openings with a set clearance between the impeller and cutter bar of .010" to .015" on pumps with less than 14" diameter impellers or .020" to .030" on pumps with 14" diameter or larger impellers. Impeller shall be constructed of cast alloy steel, case hardened to minimum Rockwell C 60 and shall be dynamically balanced. The impeller shall be keyed to the shaft and the axial clearance at the front and rear of the impeller shall be externally adjustable.

   c. Cutter Bar: The casing will be fitted with a replaceable, externally-adjustable suction plate with integral cutter bars constructed of cast alloy steel case hardened to minimum Rockwell C 60. The surface of the suction plate facing the impeller shall have multiple radial cutting slots to prevent binding of material between it and the

impeller vanes. Pumps with 15" or larger impeller diameters shall have separately replaceable cutter bars independent of the main suction cover.

d. Deflector Nut: The impeller shall be secured to the shaft using a deflector nut made from 410 Stainless Steel hardened to 400 BHN, designed protrude in front of the cutter bars and deflect stringy materials and prevent binding.

e. Upper Cutter: The area behind the impeller shall be protected from fouling by the cutting and expulsion action of sharpened vane edges sweeping across spiral grooves in the casing backplate.

D. Reagent Requirements

1. Zeroing (distilled or D.I. water) and cleaning solutions shall not need replenishment more than once every two months. Reagents for analysis of ammonia and phosphate once every 15 minutes shall not require replenishment more often than once a month.

2.02 SOFTWARE REQUIREMENTS

A. Calibration File Library Storage

1. The analyzer shall be capable of maintaining all necessary calibration data for each analyte plus control instructions for system operation in a nonvolatile memory within the analyzer.

2. In the event of a power loss to the analyzer, all calibration files and operating instructions shall be held intact. The analyzer shall automatically resume operation upon restoration of power.

B. Correction Due To Interfering Substances

1. The analyzer shall provide for the elimination of interference due to background substances present during its analyses. Multiple wavelength ultraviolet absorbance spectrometry using a minimum of 15 wavelengths that allows the elimination of interfering substances shall be used as the measurement method.

C. Reference Wavelength Adjustment Capability

1. During each new light absorbance reading, the analyzer shall compensate for turbidity variations in the sample.

D. Internal Data Logging Capability

1. The analyzer shall contain an internal memory capable of retaining a record of analytical values with the corresponding date and time for each analyte measurement. This memory shall be battery protected to avoid loss in the event of a power interruption. The memory shall be capable of being accessed through a serial port. At least 750 sets of measurements shall be retained in memory.

2. Software to transfer data log files to an interrogation and logging system shall be provided.

E. Security Code Capability

1. The analyzer shall contain the capability of denying operational command or menu access using a security code. The analyzer shall also contain the capability for security codes to be changed by an authorized operator.

F. Calibration Algorithm Construction and Backup

1. Calibrations for the calculation of measurements for each analyte and range specified will be site specific and constructed from field and laboratory data. A backup copy of the calibration algorithm shall be provided on a flash drive.

G. Field Calibration File Collection

1. The analyzer shall have a dedicated sample port for the introduction of calibration and test samples. A manual signal shall be available for initiation by an operator to record absorbance signatures in parallel with the extraction of a calibration sample.

2. Software to extract absorbance log files from memory shall be provided.

H. Zero Adjustment

1. The analyzer shall have the capability of being automatically zeroed using deionized water as the zero standard. The analyzer shall be programmed to automatically initiate zeroing after a specified number of measurements. The analyzer shall automatically zero the instrument using the deionized water standard, automatically check intensity values, signal the need for physical cleaning if intensity values fall below a predetermined standard for reliable analyzer operation, automatically clean the flow cell using a cleaning solution and automatically return the analyzer to on-line operation.

2. The previous 50 auto zero and clean operations shall be logged in internal memory.

3. Software to extract zero log files from memory shall be provided.

I. Slope/Intercept Adjustment

1. The analyzer shall have the capability for operators to enter calculated slope and intercept adjustments for each analyte calibration, based on laboratory analysis of comparison samples.

2. Software to calculate slope and intercept adjustments shall be provided.

2.03 COMMUNICATIONS CAPABILITY

A. Operator Interface

1. The analyzer shall be provided with a 7" (16:9) ChemScan UV-Series Graphic User Interface (HMI) with the ability to display and select menu choices, operational commands and diagnostic information necessary for operation and control of the analyzer. The HMI shall include the following features:

a. TFT, LCD, Touchscreen HMI

b. 800 x 480 (WVGA) resolution

c. Viewing area Size: 154.08 x 85.92 mm

d. Front face rating: IP65/66, NEMA 4X

e. Rear side rating: IP20, NEMA1

f. Display backlight Illumination: White LED

g. Enhanced maintenance and troubleshooting videos.

h. Auto fault detection and Auto recovery.

2. The analyzer shall also display operating status and the most recent analysis results for each parameter.

B. Data Communications

1. The analyzer system shall contain the ability to communicate using dedicated Ethernet TCP/IP for each parameter and sample line.

C. Serial Data Communications

1. The analyzer shall also be provided with an RS-232 serial communications port for laptop access for personnel to update or reload analyzer's software.

2.04 EQUIPMENT

A. Electronics Module

1. Enclosure

a. The light source and detection system shall be housed in an electronics enclosure rated NEMA 4 or better polyurethane enamel-coated steel. All steel enclosure materials exposed to the atmosphere shall be protected using coatings suitable for use in a wastewater environment.

b. The enclosure shall be secured with a lock and key that are different from the lock and key used to secure the flow cell enclosure.

2. Keypad and Display

a. An externally mounted display shall be provided. The display shall be back illuminated for observation in low ambient light levels.

b. A keypad shall be provided to enter all operator-selected variables and menu options necessary for routine operation of the analyzer.

3. Temperature Control

a. The analyzer's upper electronics enclosure shall contain an internal heater capable of temperature measurement and control at ambient temperatures of 4-95 F.

4. Power Connection

a. The electronics module shall contain a terminal block for connection to 110 v, 60 Hz power. Power consumption of the analyzer and analyzer's communication accessory shall be a maximum of 4 amps.

B. Flow-Cell Module

1. A flow-cell enclosure shall be furnished, using the same materials of construction and coating systems as the electronics enclosure. The flow-cell enclosure shall be rated NEMA 3R or better. The enclosure shall be secured with a lock and key.

2. Flow Cell

a. Sample flow cell surfaces in contact with the sample flow shall be constructed of corrosion resistant materials. Optical windows in contact with the sample flow shall be quartz.

b. The flow cell shall be sealed to prevent leakage of the sample but shall permit periodic disassembly for physical cleaning of optical surfaces in contact with the sample flow.

3. A data communication enclosure rated NEMA 4 or better shall be furnished. The standard material shall be fiberglass NEMA 4X. The enclosure shall house the communication control.

4. Power Connection

a. The enclosure shall receive power for the communication module via a connectorized watertight cable from the analyzer. No AC power connection shall be required.

PART 3 – EXECUTION

3.01 MANUFACTURER'S SERVICE REPRESENTATIVE

A. Manufacturer shall assist the Contractor during installation including observation, guidance, and instruction of manufacturer's recommended procedures for assembly, erection, installation, and application. Manufacturer shall setup, configure, calibrate, test and make system fully functional with Contractor's assistance.

B. Minimum service to be performed by the manufacturer are as follows:

On-Site Service by the Manufacturer	Number of trips	Days per trip	Total Days
On-Site installation assistance, configuration, setup and calibration	3	4	12
Operation and Maintenance Training	1	2	2
		Total	14

3.02 INSTALLATION AND TESTING

A. All equipment shall be installed in accordance with the manufacturer's recommendations and instructions. Field technician shall configure system and test the equipment performing the services outlined in 3.01, Paragraph B.

END OF SECTION

DIVISION 15

MECHANICAL

SECTION 15011 - PIPE HANGERS AND SUPPORTS FOR PROCESS PIPING

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Furnish all labor, materials, equipment and incidentals and install pipe hangers, supports, concrete inserts, and anchor bolts including all metallic hanging and supporting devices for supporting exposed piping.

B. Related Work Described Elsewhere:

1. Metal fabrications are included in Division 5.
2. Pipe and fittings are included in respective sections of Division 15.

C. General Design (Not Applicable)

1.02 QUALITY ASSURANCE

A. Hangers and supports shall be of approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions. The minimum working factor of safety for pipe supports shall be five (5) times the ultimate tensile strength of the material, assuming 10 feet of water filled pipe being supported.

B. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, the Contractor shall submit a certification stating that such requirements have been complied with.

1.03 SUBMITTALS

A. Materials and Shop Drawings:

1. Submit to the Engineer for approval, as provided in the General Requirements and Section 01300: Submittals, shop drawings of all items to be furnished under this Section.

2. Submit to the Engineer, for approval, samples of all materials specified herein.

1.04 PRODUCT DELIVERY STORAGE AND HANDLING

A. The equipment provided under this section shall be shipped, handled and stored in accordance with the Manufacturer's written instructions, and in accordance with Section 01550: Site Access and Storage.

1.05 WARRANTY AND GUARANTEES

A. Provide equipment warranty in accordance with Section 01782: Warranties and Bonds.

PART 2 PRODUCTS

2.01 GENERAL

A. All pipe and tubing shall be supported as required to prevent significant stresses in the pipe or tubing material, valves, and fittings and to support and cure the pipe in the intended position and alignment. All supports shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe, and personnel contact. All pipe supports shall be approved prior to installation.

B. The Contractor shall select and design all piping support systems within the specified spans and component requirements. Structural design and selection of support system components shall withstand the dead loads imposed by the weight of the pipes filled with water, plus any insulation. Commercial pipe supports and hangers shall have a minimum safety factor of 5.

C. No attempt has been made to show all required pipe supports in all locations, either on the Drawings or in the details. The absence of pipe supports and details on any drawings shall not relieve the Contractor of the responsibility for providing them throughout the plant.

D. All support anchoring devices, including anchor bolts, inserts and other devices used to anchor the support onto a concrete base, roof, wall or structural steel works, shall be of the proper size, strength and spacing to withstand the shear and pullout loads imposed by loading and spacing on each particular support.

E. All materials used in manufacturing hangers and supports shall be capable of meeting the respective ASTM Standard Specifications with regard to tests and physical and chemical properties, and be in accordance with MSS SP-58.

F. Hangers and supports shall be spaced in accordance with ANSI B31.1.0 except that the maximum unsupported span shall not exceed 10 feet unless otherwise specified herein.

G. Unless otherwise specified herein, pipe hangers and supports shall be as manufactured by ITT Grinnel Co., Inc., Carpenter and Patterson, Inc., or equal. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product, and shall not be considered as proprietary. Any item comparable in type, style, quality, design and performance will be considered for approval.

2.02 MATERIALS AND EQUIPMENT

A. Pipe Hangers and Supports for Metal Pipe:

1. Suspended single pipes shall be supported by hangers suspended by steel rods from galvanized concrete inserts, beam clamps, or ceiling mounting bolts as follows:

a. Hangers

Pipe Size, Inches	Grinnel Fig. No.
Less than 1/2	138R
1/2 through 1	97C
1-1/4 through 4	104
6 through 12	590
14 through 30	171

b. Hanger rods shall be rolled steel machine threaded with load ratings conforming to ASTM Specifications and the strength of the rod shall be based on root diameter. Hanger rods shall have the following minimum diameters:

Pipe Size, Inches	Min. Rod Diameter, In.
Less than 2-1/2	3/8
2-1/2 to 3	1/2
4	5/8
6	3/4
8 to 12	7/8
14 to 18	1

c. Where applicable, structural attachments shall be beam clamps. Beam clamps, for rod sizes 1/2-inch through 3/4-inch shall be equal to Grinnel Fig. No. 229, and for rod sizes 7/8-inch through 1-1/4 inches shall be equal to Grinnel Fig. No. 228, or equal.

d. Concrete inserts for pipe hangers shall be; continuous metal inserts designed to be used in ceilings, walls or floors, spot inserts for individual pipe hangers, or ceiling mounting bolts for individual pipe hangers and shall be as manufactured by Unistrut Corp., Wayne, Michigan; Carpenter and Patterson, Inc., Laconia, New Hampshire; Richmond or equal and shall be as follows:

   i. Continuous concrete inserts shall be used where applicable and/or as shown on the Drawings and shall be used for hanger rod sizes up to and including 3/4-inch diameter. Inserts to be used where supports are parallel to the main slab reinforcement shall be Series P3200 by Unistrut Corp., Fig 1480 Type 2 by Carpenter and Patterson, Inc., or equal. Inserts to be used where supports are perpendicular to the main slab reinforcement shall be Series P3300 by Unistrut Corp., Fig. 1480 Type I by Carpenter and Patterson, Inc. or equal.

   ii. Spot concrete inserts shall be used where applicable and shall be used for hanger sizes up to and including 7/8-inch diameter. Inserts shall be Fig. 650 by Carpenter and Patterson, Inc. for hanger rod sizes 1/2-inch through and including 3/4-inch, and Fig. 266 by Carpenter and Patterson Inc., for 7/8-inch hanger rods.

   iii. Ceiling mounting bolts shall be used where applicable and be for hanger rod sizes I-inch through and including 1-1/4 inches and shall be Fig. 104M as manufactured by Carpenter and Patterson, Inc., or equal.

e. All pipe hangers shall be capable of vertical adjustment under load and after erection. Turnbuckles, as required and where applied, shall be equal to Grinnel Fig. No. 230.

2. Wall or column supported pipes shall be supported by welded steel brackets equal to Grinnel Fig. 194, 195 and 199 as required, for pipe sizes up to and including 20-inch diameter. Additional wall bearing plates shall be provided where required.

   a. Where the pipe is located above the bracket, the pipe shall be supported by an anchor chair and U-bolt assembly supported by the bracket for pipes 4 inches and larger and by a U-bolt for pipes smaller than 4 inches. Anchor chairs shall be equal to Carpenter Patterson Fig. No. 127. U-bolts shall be equal to Grinnel Fig. No. 120 and 137.

   b. Where the pipe is located below the bracket, the pipes shall be supported by pipe hangers suspended by steel rods from the bracket. Hangers and steel rods shall be as specified above.

3. Floor supported pipes 3-inches and larger in diameter shall be supported by either cast-in-place concrete supports or adjustable pipe saddle supports as directed by the Engineer. In general, concrete supports shall be used when lateral displacement of the pipes is probable (unless lateral support is provided), and adjustable pipe saddle type supports shall be used where lateral displacement of pipes is not probable.

   a. Each concrete support shall conform to the details shown on the Drawings. Concrete shall be poured after the pipe is in place with temporary supports. Concrete piers shall conform accurately to the bottom 1/3 to 1/2 of the pipe. Top edges and vertical corners of each concrete support shall have 1-inch bevels. Each pipe shall be secured on each concrete support by a wrought iron or steel anchor strap anchored to the concrete with cast-in-place bolts or with expansion bolts. Where directed by the Engineer, vertical reinforcement bars shall be grouted into drilled holes in the concrete floor to prevent overturning or lateral displacement of the concrete support. Unless otherwise approved by the Engineer, maximum support height shall be five (5) feet.

   b. Concrete piers used to support base elbows and tees shall be similar to that specified above. Piers may be square or rectangular.

   c. Each adjustable pipe saddle support shall be screwed or welded to the corresponding size 150 pound companion flanges or slip-on welding flanges respectively. Supporting pipe shall be of Schedule 40 steel pipe construction. Each flange shall be secured to the concrete floor by a minimum of two (2) expansion bolts per flange. Adjustable saddle supports shall be equal to Grinnel Fig. No. 264. Where used under base fittings, a suitable flange shall be substituted for the saddle.

4. Vertical piping shall be supported as follows:

   a. Where pipes change from horizontal to vertical, the pipes shall be supported on the horizontal runs within 2 feet of the change in direction by pipe supports as previously specified herein.

   b. For vertical runs exceeding 15 feet, pipes shall be supported by approved pipe collars, clamps, brackets, or wall rests at all points required to insure a rigid installation.

   c. Where vertical piping passes through a steel floor sleeve, the pipe shall be supported by a friction type pipe clamp which is supported by the pipe sleeve. Pipe clamps shall be equal to Grinnel Fig. 262.

5. Anchor bolts shall be equal to Kwik-Bolt as manufactured by the McCullock Industries, Minneapolis, Minnesota, or Wej-it manufactured by Wej-it Expansion Products, Inc., Bloomfield, Colorado.

6. All rods, hangers, inserts, brackets, and components shall be furnished with galvanized finish.

B. Pipe Hangers and Supports for Plastic Pipe:

   1. Single plastic pipes shall be supported by pipe supports as previously specified herein.

   2. Multiple, suspended, horizontal plastic pipe runs, where possible, and rubber hose shall be supported by ladder type cable trays such as the Electray Ladder by Husky-Burndy, the Globetray by the Metal Products Division of United States Gypsum, or equal. Ladder

shall be of mild steel construction. Rung spacing shall be approximately 18 inches for plastic pipe and 12 inches for rubber hose. Tray width shall be approximately 6-inch for single runs of rubber hose and 12 inches for double runs of rubber hose. Ladder type cable trays shall be furnished complete with all hanger rods, rod couplings, concrete inserts, hanger clips, etc. required for a complete support system. Individual plastic pipes shall be secured to the rungs of the cable tray by strap clamps or fasteners equal to Globe Model M-CAC, Husky-Burndy Model SCR or approved equal. Spacing between clamps shall not exceed 9 feet. The cable trays shall provide continuous support along the length of the pipe.

3. Individual clamps, hangers, and supports in contact with plastic pipe shall provide firm support but not so firm as to prevent longitudinal movement due to thermal expansion and contraction.

C. Pipe Supports for Small Diameter PVC and Steel Pipe:

1. Small diameter Schedule 80 PVC piping 3-inches in diameter and smaller, and steel piping 2-inches in diameter and smaller shall be supported with "SUSPORT" system arrangements as manufactured by Universal Suspension Systems Inc. of Gillette, New Jersey or an equal approved by the Engineer. Clamping halves for the pipe support shall be manufactured of molded polypropylene and shall support and fit closely for 360° around the pipe. To support piping carrying non-corrosive fluids or gases and located in noncorrosive, indoor environments, all hardware for the "SUSPORT" system shall be nickel chrome plated carbon steel. To support piping carrying corrosive fluids or gases, piping located in corrosive environments or piping located outdoors, all hardware for the system shall be manufactured of Type 304 stainless steel.

2. In some cases, to adequately support small diameter PVC or steel piping, a metal frame support structure may be required for support of the "SUSPORT" system specified above. Where required, metal frame support structures shall be constructed using channels, fittings, brackets, hardware and other accessories as manufactured by B-Line Systems, Inc. of Highland, Illinois, or an equal approved by the Engineer. If located in indoor, non-corrosive environments, the materials for the frame structure shall be carbon steel with an epoxy coating applied by a cathodic, electro-deposition process which is equal to "Dura-a-Green" by B-Line Systems, Inc. For corrosive or outdoor environments, the materials for the frame structure be Type 316 stainless steel unless otherwise noted on the Drawings. Hardware used to construct the frame support structure shall be cadmium plated for carbon steel supports or Type 316 stainless steel for stainless steel supports.

3. Pipe supports for small diameter PVC and steel piling shall be located wherever necessary in the opinion of the Engineer to adequately support the pipe, however, they shall have a maximum spacing as specified below for straight pipe runs. Adequate supports shall especially be used adjacent to valves and fittings in pipelines. The following table is based on spacing requirements for Schedule 80 PVC or Standard Weight (Schedule 40) steel pipe carrying a fluid with a Specific Gravity of 1.0 at a temperature not exceeding 120°F. Support spacing for PVC or steel piping carrying fluids with Specific Gravities or temperatures exceeding those stated above shall be approved by the Engineer.

Nominal Pipe Diameter, Inches	Support Spacing, Feet PVC Pipe	Steel Pipe
1/2"	3.5	4.5
3/4"	4.0	5.0
1"	4.5	5.5
1-1/4"	5.0	6.5
1-1/2"	5.0	7.5
2"	5.5	8.0
2-1/2"	5.5	-
3"	6.0	-

D. Chemical Trays and Supports for Small Diameter Process Pipe:

1. Chemical tray systems are defined to include, but are not limited to straight sections of ladder type cable trays, bends, tees, elbows, drop-outs, supports and accessories. Maufacturers shall be regularly engaged in manufacture of chemical trays and fittings of types and capacities required and shall have products that have been in satisfactory use in similar service for not less than 5 years. Chemical tray systems shall be manufacturered by Cooper B-Line, Inc., T.J. Coper Allied, or an approved equal.

2. Straight section, fitting side rails, rungs and splice plates shall be extruded from Aluminum Association Alloy 6063. All fabricated parts shall be made from Aluminum Association Alloy 5052

3. Ladder chemical trays shall consist of two longitudinal members (side rails) with transverse members (rungs) mechanically fastened to the side rails. Rungs shall be spaced nine (9) inches on center. Rung spacing in radiused fittings shall be industry standard 9" and measured at the center of the tray's width. Each rung must be capable of supporting a 200 lb. concentrated load at the center of the cable tray span and width, with a safety factor of 1.5. Rungs shall be capable of easy removal, reinstallation, or replacement if necessary.

4. Chemical tray loading depth shall be 4-inches.

5. Straight sections shall be supplied in standard 12-foot lengths.

6. Chemical tray widths shall be 12, 18, and 24-inches as required or shown on drawings.

7. All fittings must have a minimum radius of 24-inches.

8. Install cable trays as indicated: Installation shall be in accordance with equipment manufacturer's instructions, and with recognized industry practices.

9. Provide sufficient space encompassing chemical trays to permit access for installing and maintaining cables.

10. Cable tray fitting supports shall be located such that they meet the strength requirements of straight sections. Install fitting supports in accordance with manufacturer's instructions.

2.03 ACCESSORIES (NOT USED)

2.04 SPARE PARTS (NOT USED)

2.05 QUALITY CONTROL

A. Contractor shall follow Manufacturer's and Supplier's recommended product quality control specifics as required for this project.

PART 3EXECUTION

3.01 PREPARATION

A. Prior to prime coating, all pipe hangers and supports shall be thoroughly clean, dry and free from all mill-scale, rust, grease, dirt, paint and other foreign substances to the satisfaction of the Engineer.

B. All submerged pipe supports shall be prime coated with Koppers 654 Epoxy Primer or approved equal. All other pipe supports shall be prime coated with Rustinhibitive Primer No. 621 as manufactured by Koppers Company, Inc., Pittsburgh, Pa., or equal.

C. Finish coating shall be compatible with the prime coating used and shall be applied by the Contractor.

3.02 INSTALLATION

A. All pipes, horizontal and vertical, shall be rigidly supported from the building structure by approved supports. Supports shall be provided at changes in direction and elsewhere as shown in the Drawings or specified herein. No piping shall be supported from other piping or from metal stairs, ladders, and walkways, unless it is so indicated on the Drawings, or specifically directed or authorized by the Engineer.

B. All pipe supports shall be designed with liberal strength and stiffness to support the respective pipes under the maximum combination of peak loading conditions to include pipe weight, liquid weight, liquid movement, and pressure forces, thermal expansion and contraction, vibrations, and all probable externally applied forces. Prior to installation, all pipe supports shall be approved by the Engineer.

C. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split type couplings, and sleeve type couplings and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connecting pipes.

D. Pipe supports shall be provided as follows:

1. Cast iron and ductile iron shall be supported at a maximum support spacing of 10 feet, 0-inches with minimum of one support per pipe section at the joints.

2. All vertical pipes shall be supported at each floor or at intervals of at least 15 feet by approved pipe collars, clamps brackets or wall rests, and at all points necessary to insure rigid construction.

E. Effects of thermal expansion and contraction of the pipe shall be accounted for in pipe support selection and installation.

F. Inserts for pipe hangers and supports shall be installed on forms before concrete is poured. Before setting these items, all Drawings and figures shall be checked which have a direct bearing on the pipe location. Responsibility for the proper location of pipe supports is included under this Section.

G. Continuous metal inserts shall be embedded flush with the concrete surface.

H. Standard Pipe Supports:

1. Horizontal Suspended Piping:

   a. Single Pipes: Adjustable swivel-ring, splint-ring, or clevis hangers.
   b. Grouped Pipes: Trapeze hanger systems.
   c. Furnish galvanized steel protection shield and oversized hangers for all insulated pipe.
   d. Furnish precut sections of rigid insulation with vapor barrier at hangers for all insulated pipe.

2. Horizontal Piping Supported From Walls:

   a. Single Pipes: Wall brackets or wall clips attached to wall with anchors. Clips attached to wall mounted framing also acceptable.
   b. Stacked Piping:
      1) Wall mounted framing system and clips acceptable for piping smaller than 3-inch minimal diameter.
      2) Piping clamps which resist axial movement of pipe through support not acceptable.
   c. Wall mounted piping clips not acceptable for insulated piping.

3. Horizontal Piping Supported From Floors:

   a. Stanchion Type:

      1) Pedestal type; adjustable with stanchion, saddle, and anchoring flange.

      2) Use yoke saddles for piping whose centerline elevation is 18 inches or greater above the floor and for all exterior installations.

      3) Provide neoprene waffle isolation pad under anchoring flanges, adjacent to equipment or where otherwise required to provide vibration isolation.

   b. Floor Mounted Channel Supports:

      1) Use for piping smaller than 3-inch nominal diameter running along floors and in trenches at piping elevations lower than can be accommodated using pedestal pipe supports.

      2) Attach channel framing to floors with anchor bolts.

3) Attach pipe to channel with clips or pipe clamps.

c. Concrete Cradles: Use for piping larger than 3-inch along floor and in trenches at piping elevations lower than can be accommodated using stanchion type.

4. Vertical Pipe: Support with wall brackets and base elbow or riser clamps on floor penetrations.

5. Standard Attachments:

   a. To Concrete Ceilings: Concrete inserts.
   b. To Steel Beams: I-beam clamp or welded attachments.
   c. To Wooden Beams: Lag screws and angle clips to members not less than 2-1/2 inches thick.
   d. To Concrete Walls: Concrete inserts or brackets or clip angles with anchor bolts.

6. Existing Walls and Ceilings: Install as specified for new construction, unless shown otherwise.

3.03 INSPECTION AND TESTING (NOT USED)

3.04 START-UP AND INSTRUCTION (NOT USED)

END OF SECTION

SECTION 15015 - IDENTIFICATION FOR PROCESS PIPING AND VALVES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work included under this Section consists of providing an identification system for piping systems and related equipment.

1.02 QUALITY ASSURANCE

A. Standards: ANSI Standard A13.1, Scheme for the Identification of Piping Systems.

1.03 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Submit manufacturer's descriptive literature, illustrations, specifications, and other pertinent data.

C. Schedules:

1. Provide a typewritten list of all tagged valves giving tag color, shape, letter code and number, the valve size, type, use, and general location.

2. Provide a complete list of materials to be furnished and surfaces on which they will be used.

D. Samples:

1. Provide a sample of each type valve tag supplied.

2. Provide manufacturer's color charts for color selection by Engineer.

1.04 PRODUCTS DELIVERY, STORAGE, AND HANDLING

A. Delivery Of Materials: Except for locally mixed custom colors, deliver sealed containers with labels legible and intact.

B. Storage Of Materials:

1. Store only acceptable project materials on project site.

2. Store in suitable location.

3. Restrict storage to paint materials and related equipment.

4. Comply with health and fire regulations.

1.05 JOB CONDITIONS

A. Environmental Requirements:

1. Comply with manufacturer's recommendations as to environmental conditions

under which coatings and coating systems can be applied.

2. Do not apply finish in areas where dust is being generated.

B. Protection: Cover or otherwise protect finished work of other trades and surfaces not to be painted.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials selected for coating systems for each type surface shall be the product of a single manufacturer.

B. Aboveground piping that is not submerged shall be identified by painted on (stenciled) letters. Provide flow arrows indicating the direction of flow next to the label. self-adhesive pipe markers equal to those manufactured by W. H. Brady Company are also acceptable.

1. Labels shall be of wording and color shown below.

Service	Label	Color
Sample to Chemscan Unit	CHEMSCAN SAMPLE	Black
Sodium Aluminate	SODIUM ALUMINATE	Black

2. Lettering shall be:

a) 2 1/4-inches high for pipes 3 inches diameter and larger.

b) 1 1/8-inches high for pipes less than 3 inches diameter.

3. Flow arrows shall be:

a) 2 1/4-inches by 6 inches for pipes 3 inches diameter and larger.

b) 1 1/8-inches by 3 inches for pipes less than 3 inches diameter.

C. Aboveground Valve Identifications: A coded and numbered tag attached with stainless steel chain and/or "S" hooks shall be provided on all valves.

1. Tag Types: Tags for valves on pipe shall be stainless steel or anodized aluminum. Colors for aluminum tags shall, where possible, match the color code of the pipe line on which installed. Square tags shall be used to indicate normally closed valves and round tags shall indicate normally open valves.

2. Coding: In addition to the color coding, each tag shall be stamped or engraved with wording or abbreviations to indicate the valve service and number. All color and letter coding shall be approved by the Engineer.

PART 3 - EXECUTION

3.01 COLOR CODING FOR PIPES AND EQUIPMENT

A. General Notes and Guidelines:

1. Pipelines, equipment, or other items which are not listed here shall be assigned a color by the Owner and shall be treated as an integral part of the Contract. Color coding shall consist of color code painting and identification of all exposed conduits, through lines and pipelines for the transport of gases, liquids, or semi-liquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and any operating accessories which are integral to a whole functional mechanical pipe and electrical conduit systems.

2. All moving parts, drive assemblies, and covers for moving parts which are potential hazards shall be Safety Orange.

3. All safety equipment shall be painted in accordance with OSHA standards.

4. All inline equipment and appurtenances not assigned another color shall be painted the same base color as the piping. The pipe system shall be painted with the pipe color up to, but not including, the flanges attached to pumps and mechanical equipment assigned another color.

5. All pipe hangers and pipe support floor standards shall be painted, unless specified otherwise due to material of construction.

B. All hangers and pipe support floor and accessories stands shall be painted to match their piping. The system shall be painted up to, but not including, the face of flanges or the flexible conduit connected to electrical equipment. Structural members used solely for pipe hangers or supports shall be painted to match their piping. Where the contact of dissimilar metals may cause electrolysis and where aluminum will contact concrete, mortar or plaster, the contact surface of the metals shall be coated with Bituminous paint.

C. All systems which are an integral part of the equipment, that is originating from the equipment and returning to the same piece of equipment, shall be painted between and up to, but not including, the face of flanges or connections on the equipment.

D. All insulated surfaces, unless otherwise specified, shall be given one coat of glue sizing, one prime coat and one finish coat.

E. System code lettering and arrows shall conform to the requirements of ANSI A 13.1 marked on piping as follows:

1. Labels shall be placed no more than 20 feet apart with at least one label on every straight run and additional markers at turns and where pipe passes through walls.

2. An arrow indicating direction of flow shall be placed adjacent to each marker.

3.02 FABRICATED EQUIPMENT

A. Unless otherwise indicated or specifically approved, all fabricated equipment shall be shop primed and finished.

B. The Contractor shall be responsible for and take whatever steps are necessary to properly protect the shop prime and finish coats against damage from weather or any other cause.

C. Where specified in other sections of these specifications for mechanical equipment, the Contractor shall apply field coat or coats of paint. If shop finish coat is unsatisfactory due to poor adhesion or other problems with primer or finish coats, coatings shall be removed and replaced by sandblasting, priming and finishing in accordance with this Section.

D. Wherever fabricated equipment is required to be sandblasted, the Contractor shall protect all motors, drives, bearings, gears, etc., from the entry of grit. Any equipment found to contain grit shall be promptly and thoroughly cleaned. Equipment contaminated by grit in critical areas, such as bearings, gears, seals, etc., shall be replaced at no cost to the Owner.

END OF SECTION

SECTION 15061 - DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Ductile iron pipe and fittings.
2. Accessories.

B. Related Requirements:

1. Section 15085 - Water Pipeline Testing

1.02 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings.
2. ASME B31.3 - Process Piping Design.

B. ASTM International:

1. ASTM A48 - Standard Specification for Gray Iron Castings.

C. American Water Works Association:

1. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings.
3. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C150/A21.50 - Thickness Design of Ductile-Iron Pipe.
5. AWWA C153/A21.53 - Ductile-Iron Compact Fittings.
6. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.

D. The Society for Protective Coatings:

1. SSPC-SP 6/NACE No. 3 - Commercial Blast Cleaning.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01300.

B. Supplier shall indicate layout of piping systems, including equipment, critical dimensions, sizes, and materials lists.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Submit Coating Manufacturer's Technical Representative's Report.

1.04 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's packaging, including handling instructions.

B. Inspection: Accept piping and appurtenances on-Site. Inspect for damage.

C. Store piping and appurtenances according to manufacturer's instructions.

D. Protect piping and appurtenances from oxidation by storing off the ground.

1.06 INSPECTION

A. The Design Engineer reserves the right to inspect materials, production, or testing of pipe at the manufacturer's plant.

PART 2 PRODUCTS

2.01 DUCTILE IRON PIPE AND FITTINGS

A. This specification covers 3" through 64" ductile-iron pipe, centrifugally cast, for water or other liquids, with flanged joints. All pipe furnished shall be in conformance with ANSI/AWWA Standard C151/A21.51.91, or latest revision thereof. Flanged joints shall be in conformance with ANSI/AWWA C110/A21.10 or ANSI/AWWA C115/A21.15.

1. General Requirements:

a. All pipe shall conform to the following pressure classes, based upon a working pressure of 150 pounds per square inch:

3" through 12"	350 psi
16" and 20"	250 psi
24"	200 psi
30" through 64"	150 psi

b. All ductile iron pipes shall have an interior lining applied in accordance with ANSI/AWWA C104/A21.4 cement mortar lining.

c. Exterior Coating for Exposed Piping: Piping Located above ground or in vaults or structures shall be coated in the field by the Contractor. Coating shall be prime coat of two part cross-linked epoxy primer Tnemec series 69 Hi-Build Epoxoline II at 4.0 mils DFT followed by a coat of Tnemec Series 69 Hi-Build Epoxoline II at 5.0 mils DFT.

d. Each length of pipe furnished shall bear identification markings in conformance with Sec. 51.10 of AWWA Standard C151.

e. The manufacturer shall take adequate measures during pipe production to assure compliance with AWWA C151 by performing quality-control tests and maintaining results of those tests as outlined in Sec 51.14 of that Standard.

2. Fittings: For use on ductile iron flanged joint, unless shown otherwise on Drawings or Standard Details.

   a. Size, dimensions, and tolerances: AWWA C110 or AWWA C153.

   b. Unless shown otherwise, furnish fittings 3 inch through 24 inch diameter having minimum pressure rating of 350 psi, and furnish fittings larger than 24 inch diameter having minimum pressure rating of 250 psi.

   c. Coatings: Manufacturer shall provide patch kits for minor repair of coating during installation.

      1) Exterior: Field applied. Not by pipe Manufacturer.

      2) Interior: Lined with double thickness cement and seal coated: AWWA C104 and C111.

   d. Approved manufacturers:

      1) American Cast Iron Pipe Co.
      2) Clow Water Systems Company, (Division of McWane Incorporated).
      3) Griffin Pipe Products Co.
      4) Tyler Pipe Industries, Inc.
      5) Union Foundry Company
      6) United States Pipe and Foundry Co.
      7) C&B Piping

3. Flange hardware shall be 316 Stainless Steel.

B. Flange Gaskets: Gaskets shall be Toruseal by American or equal in accordance with ANSI/AWWA C111/A21.11.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field dimensions are as indicated on Drawings and Shop Drawings.

3.02 PREPARATION

A. Thoroughly clean pipe and fittings before installation.

B. Surface Preparation:

1. Touch up shop-primed surfaces with primer as specified in Section 09900 - Painting.

2. Solvent-clean surfaces that are not shop primed.

3.03 INSTALLATION

A. Exposed Service:

1. Run piping straight along alignment indicated on Drawings and procedure submitted with the approved Shop Drawings with minimum number of joints.

2. Install according to ASME B31.3.

3. Fittings:

a. Clean gasket seats thoroughly, and wipe gaskets clean prior to installation.

b. Install fittings according to manufacturer's instructions.

c. Tighten bolts progressively, drawing up bolts on opposite sides until bolts are uniformly tight; use torque wrench to tighten bolts to manufacturer's recommendations.

4. Provide required upstream and downstream clearances from devices as indicated.

B. Make taps to ductile iron piping only with service saddle, tapping boss of a fitting or valve body, or equipment casting.

C. Install piping with sufficient slopes for venting or drainage of liquids and condensate to low points.

D. Finish primed surfaces.

E. Installation: All pipe shall be installed in accordance with the drawings and procedures submitted with the shop drawings. The interior of the pipe, fittings and couplings shall be kept clean and free from contamination during installation. All pipes shall be carefully placed and supported at the proper lines and grades and where practical shall be sloped to permit complete drainage. Piping runs shown on the plans shall be followed as closely as possible. If relocation is required, they shall be approved by the Design Engineer.

F. Installation: All pipe, fittings, couplings, and appurtenant items shall be in proper alignment. Assembly and installation shall not result in placing any undo alignment strains or stresses on any flanges or couplings. When connecting flanged joints care shall be taken in bolting together joints to avoid placing restraint on the opposite end of the piece, which would prevent pressure from being evenly and uniformly applied to the flanged gasket. The pipe or fitting must be free to move in any direction during the installation of bolts. Bolts shall be gradually tightened in a crisscross pattern, to ensure a uniform rate of gasket compression around the entire flange.

G. Connections to Existing Piping. Connections between new work and existing piping shall be made suitable fittings for the conditions encountered. Each connection with an existing pipe shall be made at a time and under conditions which will least interfere with service to customers and as authorized by the Design Engineer.

3.04 FIELD QUALITY CONTROL

A. Inspect for damage to pipe lining or coating, or other defects that may be detrimental as determined by the Design Engineer. Repair damaged piping or provide new undamaged pipe.

B. Pressure Testing per Specification Section 15085 Water Pipeline Testing.

C. After installation, inspect for proper supports and interferences.

3.05 CLEANING

A. Keep pipe interior clean as installation progresses.

B. Clean pipe interior of soil, grit, loose mortar, and other debris after pipe installation.

END OF SECTION

SECTION 15063 - POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS, SCHEDULE TYPE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Furnish all labor, materials, equipment and incidentals required, and install and test in the locations as shown on the Drawings, the polyvinyl chloride piping, fittings and appurtenances specified herein.

2. Schedule 80 PVC piping shall be used on all small diameter PVC piping systems (4 inches and smaller in diameter) which includes, but are not limited to, process analyzer sample piping, non-potable water, sodium aluminate carrier piping.

3. All plastic pipe and fittings shall conform to this specification section whether provided as a part of an equipment "package" or purchased separately by the contractor.

B. Related Work Described Elsewhere:

1. Section 15085 – Pressure Testing of Piping
2. Section 15015 – Identification for Process Piping and Valves
3. Section 15011 – Pipe Hangers and Supports for Process Piping

1.02 REFERENCES

A. ASTM Internation (ASTM):

1. D 1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
2. D 1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
3. D 2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
4. D 2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
5. D 2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
6. D 2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
7. F 645 - Standard Guide for Selection, Design and Installation of Thermoplastic Water-Pressure Piping Systems.

1.03 QUALITY ASSURANCE

A. All PVC pipe shall be products of well-established reputable firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

1.04 SUBMITTALS

A. Submittals shall be in accordance with Section 01300.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled, shipped and stored in accordance with Section 01550: Site Access and Storage.

1.06 WARRANTY AND GUARANTEES

A. Provide equipment warranty in accordance with Section 01782: Warranties and Bonds.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. PVC Pipe:

1. Process pipe shall be made of polyvinyl chloride, Schedule 80 pipe, conforming to ASTM D1785 unless otherwise noted on the drawings. Schedule 80 pipe shall have solvent welded joints. Threaded connections are permissible when connecting to valves or other equipment where solvent weld connections are not an option. In no cases is connection of PVC female threads to metal male threads allowable. Female threads shall be special reinforced with stainless steel collars. Male threads shall be reinforced with stainless steel insert.

2. When polyvinyl chloride, Schedule 40 pipe is called out on the Drawings it shall conform to ASTM D1785. Schedule 40 pipe shall have solvent welded joints. In no cases is connection of PVC female threads to metal male threads allowable. Schedule 40 pipe includes vents and chemical containment conduits.

B. Fittings:

1. Fittings for Schedule 80 pipe 4 inches and smaller in diameter shall be socket type, solvent welded in conformance with ASTM D 2467. When permitted, threaded joints shall be in conformance with ASTM D 2464. Solvent welded and threaded joints shall be watertight. Female threads shall be special reinforced with stainless steel collars. Male threads shall be reinforced with stainless steel insert.

2. Fittings for Schedule 80 pipe greater than 4 inches in diameter shall be socket type, solvent welded in conformance with ASTM D 2467. Fittings shall be a 1-piece injection molded design. Use of low pressure fabricated PVC fittings will not be permitted.

C. Solvent Cement:

1. PVC solvent cement shall be in compliance with ASTM D 2564.

2. Solvent cement shall be specified by compatibility based on pipe service and size. Large diameter joints shall be solvent welded with slow setting solvent cement.

3. Manufacturer to provide certification with submittal.

D. Flanges:

1. Slip-on flanges shall be provided to connect to flanged valves, fittings, or equipment. Flanges shall match the connecting flanges on the adjacent fitting, valve or piece of equipment and must meet the test pressure of the piping system as specified in Section 15085.

2. Flange hardware (bolts, nuts, and washers) for PVC flanges shall be Type 316 stainless steel in accordance with ASTM F593 and F594, respectively. The length such that, after installation, bolts will project 1/8 to 3/8 inch beyond the outer face of the nut. Flat Washers shall be of the same material as the bolts.

3. Flange gaskets shall be nitrile for process sample service and sodium aluminate service.

2.03 QUALITY CONTROL

A. Contractor shall follow Manufacturer's and Supplier's recommended product quality control specifics as required for project.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install PVC pipe where shown on the Drawings and in strict accordance with the manufacturer's technical data and printed instructions.

B. Joints for Schedule 80 PVC pipe and fittings shall be solvent welded, flanged, or threaded. All joints shall be made watertight. All pipe cutting, threading and jointing procedures for solvent welded and threaded PVC pipe joints shall be in strict accordance with the pipe and fittings manufacturer's printed installation instructions. Thread lubricant for threaded joints shall be Teflon tape only. In making solvent welded connections, clean dirt and moisture from pipe and fittings, bevel pipe ends slightly with emery cloth, if necessary and apply solvent cement of proper grade.

C. Installation of valves and fittings shall be strictly in accordance with the manufacturer's instructions. Particular care shall be taken not to over-stress threaded connections at sleeves. In making solvent weld connections the solvent shall not be spilled on valves or allowed to run from joints.

D. Field Painting:

1. Pipe normally exposed to sunlight shall be painted as follows:

a. Surface preparation: Solvent clean. If recommended by manufacturer, lightly abrade surface with medium grade sand paper. Remove dust by wiping with clean rags.

b. Coating systems:

i. Prime Coat: Two component Epoxy, Tnemec Series 66 Hi-Build Epoxoline at 3.0 mils DFT.

ii. Finish Coat: Tnemec Series 73 Endurashield at 3.0 mils DFT.

E. Joining:

1. Join pipe in strict accordance with manufacturer's instructions for joining pipe. Pay special attention to proper methods for solvent welding pipe, especially with larger pipe diameters.

2. Clean each pipe length, coupling and fitting of all debris and dirt before installation.

3. Do not use pipe length if there are any cuts, abrasions, or defects on the surface of the pipe.

4. Provide and use coupling pullers for joining the pipe when required.

5. Shove home each length of pipe against the pipe previously laid and hold securely in position.

6. Do not pull or cramp joints.

F. Fabrication:

1. Cutting:

a. Use a hand saw or pipe cutter with blades (not rollers).

b. Examine all cut ends for possible cracks caused by cutting.

2. Connecting:

a. Solvent weld connections as recommended by the manufacturer.

b. Connect pipe and fittings only when temperature is above the minimum recommended by the manufacturer.

c. Threaded adapters shall be connected only with plastic male into metal female. Do not thread metal threads into plastic female threads.

d. Flange pipe with appropriate adaptors for to connect to flanged valves, tank nozzles and equipment.

3.02 INSPECTION AND TESTING

A. All PVC piping shall be hydrostatically pressure tested and flushed in accordance with the requirements in Section 15085: Pressure Testing of Piping.

END OF SECTION

SECTION 15066 - STAINLESS STEEL PIPE AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish all labor, materials, equipment and incidentals required and install all stainless steel pipe and fittings shown on the Drawings and/or specified herein for the following applications:

1. Process Analyzer Sample Piping inside basins, channel, and heated enclosures and sample piping through walls

1.02 QUALITY ASSURANCE

A. All stainless steel pipe, fittings and appurtenances shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of the items to be furnished. The stainless steel pipe, fittings and appurtenances shall be fabricated and installed in accordance with the best practices and methods and shall comply with these Specifications.

1.03 SUBMITTALS

A. Materials and Shop Drawings:

1. Submit shop drawings in accordance with the general conditions, Section 01300.

2. Submit materials list showing material of pipe and fittings with ASTM reference and grade.

3. Piping Layouts showing locations of field connections (split-type grooved couplings or flanges).

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. The equipment provided under this section shall be shipped, handled and stored in accordance with the manufacturer's written instructions, and in accordance with Section 01550 – Site Access and Storage.

1.05 WARRANTY AND GUARANTEES

A. Provide equipment warranty in accordance with Section 01782 - Warranties and Bonds.

PART 2 – PRODUCTS

2.01 MATERIAL COMPATIBILITY

A. Gaskets, O-rings, and other resilient sealing items shall be suitable for the intended services. Such sealing materials shall not contain asbestos and shall meet all applicable regulatory agency requirements.

2.02 STAINLESS STEEL PIPING AND FITTINGS

A. All stainless steel pipe and fittings shall be fabricated from Type 316L extra low carbon grade austenitic stainless steel.

1. Pipe shall conform to ASTM A312/ A312M and be seamless to dimension and round within specified tolerances.

2. Fittings shall conform to ASTM A-403 in accordance with ANSI B16.9.

3. Ends of pipe and fittings shall be true and perpendicular to the longitudinal axis with the edges deburred.

4. Pipes shall be straight within maximum of 1/8-inch deviation over 10 feet.

5. Longitudinal seams on pipe and fittings shall be welded by the GTAW, PAW, FCAW, SAW, or the SMAW methods. Welding rod or wire shall be of same composition or superior to the pipe and fittings material.

6. Weld deposit at the seams shall have a slight crown on both sides of the weld and no cracks or crevices shall be allowed. Excessive weld deposits, slag, weld spatter and projections into interior of pipe shall be removed by grinding. The interior welds shall be smooth, even and shall not have an internal bead higher than 1/16 inch.

7. All pieces shall be marked with gauge and type of stainless steel.

8. Pipe and fittings shall be immersed in pickling solution in manufacturer's plant and scrubbed and washed until discoloration and possible iron, picked up from manufacturing process, is removed. After cleaning the pipe and fittings shall be passivated.

B. Stainless steel pipe and fittings shall be Schedule 10S.

C. Fittings:

1. Fittings shall be butt weld type per ASTM A-403 and manufactured in accordance with ANSI B16.9. All fittings shall be of the same pressure rating and grade material as the pipe.

D. Joints:

1. Joints shall be butt-welded, same material as the pipe, conforming to ANSI B16.11, except where flanges are required to connect to valves.

2. Pipe shall be shop welded in as large of pieces as possible. All field connections shall be made using split-type grooved couplings or flanges. No field welding is allowed.

E. Flanges:

1. Provide weld-neck flanges conforming to ANSI B16.5 to connect to flanged valves, fittings, or equipment. Flanges shall be Class 150 per ANSI B16.5 unless specified otherwise. Material for flanges shall conform to ASTM A 182, Grade F316L. Flanges shall match the connecting flanges on the adjacent fitting, valve or piece of equipment. Slip-on flanges and Vanstone angle-type face rings with backing flanges are also acceptable in lieu of weld-neck flanges. In exposed applications, lightweight galvanized

ductile iron backing flanges shall be used. Type 316L stainless steel backing flanges shall be used in submerged applications.

2. Determine the pressure class of flange and blind flanges based on the test pressure specified in Section 15085: Pressure Testing of Piping.

3. Where a raised face steel flange connects to a flat face flange, remove the raised face on the steel flange.

4. Bolts and nuts for flanges shall be of Type 316 stainless steel. Provide washer for each nut. Washers shall be of the same material as the nuts.

F. Split-type Grooved Couplings

1. Construction: Cast Type 316 Stainless Steel, ASTM A 351 Grade CF8M w/ Nitrile or Fluoroelastomer gasket material.

2. The pipe ends shall be roll grooved to the coupling manufacturer's specifications for piping size 6-inches and under.

3. Finish: Smooth Electropolished

4. Acceptable manufacturers:

a. Victaulic Company of America – Style 475 with pipe diameters of 1inch through 4 inches.

5. Nuts/Bolts: 316 Stainless Steel

G. All welding shall be performed by an AWS certified welder and shall be tested for verification of weld.

H. Gaskets for stainless steel pipe shall be Red SBR rubber.

2.03 QUALITY CONTROL

A. Contractor shall follow Manufacturer's and Supplier's recommended product quality control specifics as required for project.

B. Piping subcontractor shall submit a list of welders who will work on this project along with a welder's current certification (less than one year old) and two sample weld coupons. Only approved welders will be allowed to work on the Project.

C. Welds should be made as rapidly as possible, with the least amount of generated heat.

D. All shop welds shall be visually inspected by the fabricator's quality control division. Each weld shall be marked with an inspection stamp, certifying that the weld is acceptable.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Stainless steel piping shall be installed true to alignment and rigidly supported.

B. After installation, completed pipe lines shall be washed clean with steam or hot water to remove any foreign material picked up during transportation.

C. Joint welding shall be in accordance with the American Welding Society Standards. The strength of the weld shall develop the strength of the pipe. All field welds shall be treated with pickling paste, scrubbed, and washed with stainless wire brushes until clean.

D. When installing threaded piping, ream, clean and remove burrs from threads. Install pipe without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment.

E. Fabrication, Assembly and Erection of Welded Piping:

1. Beveled ends for butt-welding shall conform to ANSI B16.25. Remove slag by chipping or grinding. Surfaces shall be free of paint, oil, rust, scale, slag, and other material detrimental to welding.

2. Fabrication shall comply with ANSI B31.3, Chapter V. The minimum number of passes for welded joints shall be as follows:

Steel Cylinder Thickness (inch)	Minimum Number of Passes for Welds
Less than 0.1875	1
0.1874 through 0.25	2
Greater than 0.25	3
Welds shall be full circumferential	

3. Use the shielded metal arc welding (SMAW) or the tungsten inert gas (TIG) process for welding. Use the SMAW process for any pipe. Use the TIG process only on pipe having a maximum thickness of Schedule 10S.

4. Welding preparation shall comply with ANSI B31.3, Paragraph 327.3. Limitations on imperfections in welds shall conform to the requirements in ANSI B31.3, Tables 327.4.1A and 327.4.1a, and Paragraph 327.4 for visual examination. Identify welds in accordance with ANSI B31.3, Paragraph 327.4.

5. Clean each layer of deposited weld metal prior to depositing the next layer of weld metal, including the final pass, by a power-driven wire brush on the same material.

6. Welding electrodes shall comply with AWS A5.4. Bare wire shall comply with AWS AS.9.

7. Contractor shall install the stainless steel piping system with no field welds. Split-type grooved couplings and flanged connections shall be used to make field connections. All installed stainless steel pipe shall be closed to the atmosphere after connections of pipe, valves or equipment with an inert gas purge and bagged ends. Provide temporary enclosures as required to complete the piping installation in a clean environment. This area shall remain clean and dust free. If the area is not maintained adequately, the fabrication and welding work will not be accepted.

8. Mark each weld completed in the field and at the manufacturing facility with symbol identifying welder and date of weld.

F. Painting:

1. Exposed stainless steel piping is not required to be painted.

2. Fitting flanges and other non-stainless steel appurtenances shall be final painted with two-part epoxy polyamide primer Tnemec Series 140-1255 Pota-Pox Plus at 4.0 mils DFT followed by two component cross linked epoxy Tnemec Series 140 Pota-Pox Plus with two coats at 5 mils DFT per coat.

3.02 INSPECTION AND TESTING

A. All stainless steel pipe shall be pressure tested in accordance with Section 15085 – Pressure Testing of Piping.

END OF SECTION

SECTION 15076 - DOUBLE WALL CONTAINMENT PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Furnish all labor, materials, equipment and incidentals required, and install and test the double wall containment piping, fittings and appurtenances specified herein.

2. Double wall containment piping systems are required for the sodium aluminate feed piping. The double wall containment piping shall be used when the piping is in contact with the ground, located outside the containment area, or any other location indicated on the drawings.

B. Related Work Described Elsewhere:

1. Section 15011 – Pipe Hangers and Supports for Process Piping

2. Section 15015 – Identification for Process Piping and Valves

3. Section 15085 – Water Pipeline Testing

C. General Design:

1. Double wall containment piping shall be installed in the locations as shown on the Drawings. All plastic pipe and fittings shall conform to this specification section whether provided as a part of an equipment "package" or purchased separately by the Contractor.

2. Double wall containment pipe for sodium aluminate shall be made of Schedule 80 PVC with PVC tubing conforming to this specification.

1.02 QUALITY ASSURANCE

A. All Schedule 80 PVC and PVC tubing double containment piping including fittings and appurtenances shall be furnished by a manufacturer who is fully experienced, reputable, and qualified in the manufacture of the items to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications.

B. Solvent welder shall be qualified in accordance with Chapter VII of the ASME B31.3-93 Code, Part 9, Paragraph A328.

C. Piping shall be marked with nominal size, type, class, schedule or pressure rating, manufacturer and all markings required by applicable ASTM and AWWA standards.

D. PVC Schedule Type Piping shall be Schedule 80 unless otherwise indicated on the Drawings. Pipe and fittings shall be extruded from Type I, Grade I, Class 12454-B material in accordance with ASTM D 1784.

1.03 SUBMITTALS

A. Materials and Shop Drawings:

1. Shop drawings shall be submitted to the Engineer for approval in accordance with the General Requirements and Section 01300 and shall include dimensioning and the technical specification for all piping to be furnished.

B. Additional Information:

1. Submit to the Engineer, for approval, samples of all materials specified herein, along with the manufacturer's Certificates of Inspection, descriptive literature, illustrations, specifications, installation instructions and related information.

C. Operating Instructions (Not Applicable)

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. PVC containment pipe shall be delivered to the site in unbroken bundles or reels for tubing packaged in such manner as to provide protection against damage. When possible, pipe should be stored at the job site in the unit packages until ready for use. Packaged units shall be handled using a fork lift or a spreader bar with fabric straps. Packaged units shall not be stacked at the job site higher than two units high.

B. When it is necessary to store PVC containment pipe for more than 30 days, exposure to direct sunlight shall be prevented by covering the pipe with an opaque material. Adequate air circulation above and around the pipe shall be provided as required to prevent excessive heat accumulation. Carrier pipe and tubing shall not be stored close to heat sources or hot objects such as heaters, fires, boilers or engine exhaust. Pipe gaskets shall be protected from excessive exposure to heat, direct sunlight, ozone, oil and grease. The interior and all sealing surfaces of pipe, fittings and other appurtenances shall be kept clean and free of dirt and foreign matter.

C. Care shall be taken in handling and laying pipe and fittings to avoid severe impact blows, crushing, abrasion damage, gouging or cutting. Pipe shall be lowered, not dropped, from trucks or into trenches. All cracked, damaged or defective pipe and fittings, or any length of pipe having a gouge, scratch or other permanent indentation of more than 10 percent of the wall thickness in depth, shall be rejected and removed at once from the work and replaced with new acceptable pipe at no additional cost to the Owner.

1.05 WARRANTY AND GUARANTEES

A. Provide equipment warranty in accordance with Section 01782: Warranties and Bonds.

PART 2 - PRODUCTS

2.01 GENERAL

A. All double wall containment piping system components shall be pre-engineered, factory fabricated, tested, and assembled such that field assembly is minimized to primarily that of straight joints.

2.02 MATERIALS AND EQUIPMENT

A. PVC Tubing

1. Materials:

a. Provide PVC tubing with nylon braid reinforcement embedded in the wall of the tubing with smooth inside bore and smooth outside.

b. Minimum operating pressure shall be 200 psi for tubing 3/4 inch and smaller, 150 psi for 1 inch, 100 psi for 1-1/4 and 1-1/2 inches, and 75 psi for 2 inches. Burst pressure shall be at least 4.0 times the specified operating pressure.

c. Products: Kuriyama "Kuri-Tech Clearbraid K3130 Series BF Heavy Wall PVC Food and Beverage Hose", Ryan-Herco "Herco-Braid Heavy Duty Food Grade Clear PVC Tubing".

2. Fittings:

a. Join tubing to pipe with a single-barb male adapter fitting. Secure tubing to the fitting with a stainless steel hose clamp. Connect tubing sections by means of single or multi-barb thermoplastic couplings with titanium hose clamps. Use single barb PVC fittings for ½ inch tubing and smaller and multiple barb PVC fittings for larger tubing.

B. PVC Containment Piping:

1. Materials:

a. Pipe shall be made of polyvinyl chloride, Schedule 80, conforming to ASTM D1784-92.

2. Fittings:

a. Fittings for Schedule 80 pipe shall be socket type, solvent welded in conformance with ASTM D2467. Solvent welded joints shall be watertight.

3. Solvent Cement:

a. PVC solvent cement shall be in compliance with ASTM D2564.

2.03 ACCESSORIES

A. Centering Devices

1. Centering and support carrier pipe within the containment pipe with centering devices. Locate not less than every 9 feet or within 24 inches of the termination of the containment pipe on all fabricated pieces.

2. Install centering devices such that the system maintains free drainage.

2.04 SPARE PARTS

A. All special tools, solvents, lubricants, and cements required for normal installation shall be furnished with the pipe.

2.05 QUALITY CONTROL

A. Contractor shall follow Manufacturer's and Supplier's recommended product quality control specifics as required for project.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:

1. Install double wall containment pipe where shown on the Drawings and in strict accordance with the manufacturer's technical data and printed instructions.

2. All piping shall have sufficient number of unions to allow convenient removal and shall be as approved by the Engineer.

3. All valves and equipment shall be supported independently from the pipe. Anchor valves such that the turning moment resulting from their operation will not be transmitted to the pipe.

B. Installation of PVC Piping, Schedule Type:

1. Joints for double wall containment pipe and fittings shall be solvent welded. All joints shall be made watertight. All pipe cutting and jointing procedures for solvent welded pipe joints shall be in strict accordance with the pipe and fittings manufacturer's printed installation instructions. In making solvent welded connections, clean dirt and moisture from pipe and fittings, bevel pipe ends slightly with emery cloth, if necessary and apply solvent cement of proper grade.

2. Installation of valves and fittings shall be strictly in accordance with the manufacturer's instructions. In making solvent weld connections the solvent shall not be spilled on valves or allowed to run from joints.

C. Installation of Flexible Non-Metallic Tubing and Fittings:

1. Install small bore flexible tubing in accordance with manufacturer's printed instructions, in neat straight lines, supported at close enough intervals to avoid sagging, and in continuous runs wherever possible.

2. Bundle tubing in groups of parallel tubes within protective sheath.

3. Tubes within protective sheath may be color coded, but protect tubing other than black outside the sheath by wrapping with black plastic electrician's tape.

4. For buried tubing in chemical service, tubing shall be installed in Schedule 80 PVC carrier pipe to serve as double containment. Requirements are as follows:

   i. Carrier pipe shall utilize long radius elbows to facilitate pulling of tubing.

ii. Carrier pipe system shall run through H-20 precast vault structures in the yard, watertight (cast with waterstops), and no smaller than 4-feet by 4-feet by 4-feet deep, unless otherwise shown on the drawings, with an H-20 rated access hatch.

iv. Drain valves for each carrier pipe shall also be installed in the vault and at low points to allow for draining of accumulated chemicals.

v. Tubing shall be coiled at each break in the carrier pipe including changes in direction to account for expansion and contraction. Coil radius shall be kept larger than the tubing manufacturer's recommended minimum radius.

D. Field Painting:

1. Pipe normally exposed to view shall be painted and marked as specified in Section 15015 – Identification for Process Piping and Valves.

2. Outdoor above grade PVC piping shall be painted with a UV resistant coating.

3.02 INSPECTION AND TESTING

A. All PVC piping shall be hydrostatically pressure tested and flushed in accordance with the requirements in Section 15085 – Water Pipeline Testing.

B. Following installation and testing:

1. Flush clean the carrier and primary piping system.

2. Purge the annular space and primary tubing of moisture with clean, dry air.

END OF SECTION

SECTION 15085 - PRESSURE TESTING OF PIPING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section covers field pipeline cleaning and hydrostatic pressure and leakage testing of all piping and valves installed under this Contract. The term "piping" shall be used in this Section to refer to piping systems, pipelines, or sections thereof.

1.02 GENERAL REQUIREMENTS

A. The Contractor shall furnish all labor, materials, equipment, and incidentals to perform flushing, cleaning, pressure, and/or leakage testing of all pipeline segments and appurtenant piping in accordance with the Contract Documents.

B. The Contractor shall be responsible for coordinating testing and providing adequate and safe access to all pipeline segments.

C. The Owner shall be present during testing and shall be notified of the time and place of testing at least three (3) days prior to commencement of testing. All testing shall be performed to the satisfaction of Owner and in accordance with all governing standards and regulations.

D. The Owner shall furnish non-potable plant water for filling, de-pressurizing and testing the process analyzer sample piping. The Owner will furnish initial potable water for the testing of the sodium aluminate piping. Should the first test fail to pass, all additional potable water required for subsequent tests shall be furnished at the Contractor's expense. The Contractor shall be responsible for getting the non-potable plant water and the potable water from the closest source large enough to the pipe being tested.

E. Unless otherwise permitted, during testing, the water shall be kept out of the remainder of the piping not being tested.

F. Flushing and testing water may be disposed of into the closest process channel, process basin or floor drain. Flushing water shall be passed through a strainer with 1/8" opening prior to disposal to remove any debris from the assembly of the piping.

G. Sodium aluminate piping shall be blown out with air after testing to dry the inside of the piping.

1.03 RELATED WORK

A. Section 01300 – Submittals

B. Division 15 – Mechanical

1.04 SUBMITTALS

A. A testing schedule, including proposed plans for water source and conveyance, control, and disposal shall be submitted in accordance with Section 01300 - Submittals in writing for acceptance a minimum of 10 work days before each test is to start. The schedule shall indicate the proposed time and sequence of testing of the piping.

B. Written pressure, and leakage test procedures, required pipeline appurtenances, and testing personnel qualifications. The test procedures shall establish the limits of the piping to be

tested, the positions of all valves during testing, the locations of temporary bulkheads, and all procedures to be followed in performing the testing.

C. Certified test reports documenting the results of the hydrostatic pressure and leakage tests.

D. Gauges calibration reports.

PART 2 PRODUCTS

2.01 GENERAL

A. Shop welded segments of stainless steel piping shall be leak tested in the shop. Completed piping assemblies shall be tested in the field.

2.02 TEST EQUIPMENT

A. All necessary connections between the piping to be tested and the water source, together with pumping equipment pressure gauges, backflow prevention and all other equipment, materials, and facilities required to perform the specified tests, shall be furnished by the Contractor. All required blind flanges, valves, bulkheads, bracing, and other sectionalizing devices shall also be provided. The Contractor shall use temporary bulkheads, which shall be removed upon completion of testing. The removal of the temporary bulkheads shall be performed in a manner to minimize damage to the cement mortar lining and tape coating systems. The Contractor may use an air gauge and a skip method of cutting to remove the temporary bulkheads or any other bulkhead removal method as recommended by the pipe manufacturer. Vents shall be provided in test bulkheads where necessary to expel air from the piping to be tested. No materials shall be used which would be injurious to the construction or its future function.

B. Test pressures shall be applied by means of a force pump sized to produce and maintain the required pressure without interruption during the test.

C. Pressure gauges shall be accurately calibrated and shall be subject to review and acceptance by the Owner.

D. Pressure gauges shall be ANSI/ASME B40.1, Grade 1A and shall meet or exceed the test pressures specified in this Section. Pressure gauges shall be calibrated to an accuracy of plus or minus 1 percent minimum over the entire range of the gauge. The gauges shall be laboratory bench tested for accuracy just prior to field testing.

E. Permanent gauge connections shall be installed at each location where test gauges are connected to the piping during the required tests. Field drilling and tapping of pipe walls will not be permitted. Upon completion of testing, each gauge connection shall be fitted with a removable plug or cap acceptable to the Owner.

F. Permanent or temporary fill and vent connections shall be installed as needed for the required test. Drilling and tapping of pipe walls will not be permitted. Upon successful completion of testing, each permanent fill and vent connection shall be fitted with the permanent fill or vent piping, and each temporary fill and vent connection, if used, shall be fitted with a permanent sealed plug or cap acceptable to the Owner.

PART 3 EXECUTION

3.01 GENERAL

A. Unless otherwise acceptable or indicated in the Contract Documents, during testing of the pipeline, all valves shall be in the open position and temporary bulkheads shall be provided so that the test pressures are not applied to existing or new closed valves and hydrants, or to existing lines, or to any portion of lines installed under this Contract that have already been put into service.

B. Prior to testing, place temporary bulkheads in the pipe and fill the line slowly with water. Care shall be taken to ensure that all air release valves and vents are properly installed and in the open position during the filling. Hand operated vent valves shall not be closed until an uninterrupted stream of water is flowing from each valve. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the air valves. Filling shall be at a reasonable velocity and all the air within the pipeline shall be properly purged. In no case shall the filling rate result in a flow velocity of more than 0.5 foot per second as measured using the full cross-sectional area of the pipe.

C. Piping shall be adequately anchored and supported before the test pressure is applied.

D. During filling and testing, the Contractor shall monitor the pipeline alignment for signs of leaks. If leaks are found, the testing shall be halted until the leaks are repaired. Water damage due to testing operations shall be corrected at the Contractor's expense including leakage, runoff and erosion to areas outside of the pipeline easement or leakage that may cause damage to installed facilities. The Contractor shall maintain equipment on site, including earthmoving equipment, to mitigate and repair any damage from leaks.

E. Contractor shall furnish all necessary equipment and make tests at no additional cost to the Owner.

F. Test Pressure:

Pipe Service	Working Pressure	Test Pressure
Process Analyzer Sample	40 psi	60 psi
Sodium Aluminate	100 psi	150 psi

3.02 PIPELINE CLEANING

A. The Contractor is required to keep the pipe interior free of all debris. The Contractor shall completely clean the interior of the pipe of all sand, dirt, mortar splatter and any other debris following completion of pipe laying, grouting of joints and any necessary interior repairs prior to testing the completed pipeline.

B. Process Analyzer sample pipelines shall be flushed with non-potable water prior to testing and sodium aluminate pipelines shall be flushed with potable water prior to testing. Flushing velocity shall be a minimum of 2.5 fps. Flushing shall continue until clean water flows from the pipe. However, the Contractor shall endeavor to use the minimum amount of flushing water required to complete the work.

3.03 HYDROSTATIC PRESSURE AND LEAKAGE TESTS

A. Hydrostatic Pressure Test

1. Loss of pressure during the test shall not exceed 0 psi in a 4-hour period. Any test results that do not meet these requirements shall constitute a failure of the pressure test.

2. Duration of test shall be not less than four (4) hours.

3. Visually inspect pipeline for leaks while pipe is pressurized.

4. If pressure test fails, modifications to the piping shall be made and the test repeated until the piping process.

B. Valve Pressure Test. Pressure test valves, as installed in the field, and adjust valves as necessary for drip-tight performance. Valves shall be tested with pressure equal to the pressure class of the valve or pipeline hydrostatic test pressure, whichever is less. Test pressure shall be applied to each side independently, and the valve tested for drip-tight performance with zero pressure on the other side of the valve. Provisions satisfactory to the Owner shall be made for verifying "0" leakage within the duration of the test. Test duration shall be two (2) hours plus any additional time required by the Owner for examination. If pressure class of valve is less than the pipeline hydrostatic test pressure at the valve location, the valve shall then be opened for the pipeline hydrostatic test.

3.04 ALLOWABLE LEAKAGE

A. During hydrostatic test, no visible leakage will be allowed.

B. Pipelines that fail to pass the specified leakage test will be considered defective Work, and the Contractor shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall retest the pipeline.

END OF SECTION

SECTION 15100 - VALVES AND APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Furnish all labor, materials, equipment and incidentals required to install complete and ready for operation all valves and appurtenances as shown on the Drawings as specified herein.

2. The equipment shall include, but not be limited to the following:

   a. Ball Valves
   b. Plug Valves
   c. Check Valves
   d. Pressure Relief Valve
   e. Backpressure Sustaining Valve
   f. Valve Operators
   g. Expansion Joints

B. Related Work Described Elsewhere:

1. Section 15011 – Pipe Hangers and Supports for Process Piping
2. Section 15015 – Identification for Process Piping and Valves
3. Section 15085 – Pressure Testing of Piping
4. Division 16: Electrical
5. Division 17: Instrumentation

C. General Design:

1. All of the equipment and materials specified herein are intended to be standard for use in controlling the flow of water, air, chemicals, etc., depending on the applications.

1.02 QUALITY ASSURANCE

A. All of the types of valves and appurtenances shall be products of well established reputable firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

1.03 SUBMITTALS

A. Complete shop drawings of all valves and appurtenances shall be submitted to the Engineer for approval in accordance with the requirements of Section 01300 and the General Requirements. In addition, valve manufacturer shall certify in writing that valve design and materials of construction are suitable for the intended service.

B. Quality Control Submittals:

1. Tests and inspection data

2. Manufacturer's Certificate of Proper Installation

3. Operation and Maintenance Manual

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled, shipped and stored in accordance with Section 01500: Site Access and Storage.

1.05 WARRANTY AND GUARANTEES

A. Provide equipment warranty in accordance with Sections 01782: Warranties and Bonds.

1.06 SPARE PARTS

A. Provide one (1) replacement set of valve stem packing or seals as applicable for every five valves supplied. No less than one (1) set shall be provided for each type and model of valve supplied.

B. Provide one (1) full set of gaskets as applicable for each valve supplied.

C. Special tools, if required for normal operation and maintenance shall be supplied with the equipment.

PART 2 - PRODUCTS

2.01 GENERAL

A. Valves shall include operator, actuator, handwheel, chain wheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and accessories as required for a complete and operable installation.

B. All valves and appurtenances shall be of the size shown on the Drawings and all equipment of the same type shall be from one manufacturer.

C. All valves and appurtenances shall have the name of the manufacturer and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

D. Unless specified otherwise, all hardware on the valve and actuator including bolts, washers, and nuts shall be Type 316 stainless steel for valves with stainless steel or thermoplastic body materials.

E. Factory Finishing:

1. Epoxy Lining and Coating:

a. In accordance with AWWA C550 unless otherwise specified.

b. Either two-part liquid material or heat-activated (fusion) material except only heat-activated material if specified as "fusion" or "fusion bonded" epoxy.

c. Minimum 7-mil dry film thickness except where limited by valve operating tolerances.

2. Exposed Valves:

a. Safety isolation valves and lockout valves with handles, handwheels, or chain wheels "safety yellow."

3. Stainless Steel Valves:

a. Pickling & Passivation shall be provided for all stainless steel valves to provide a bright, uniform finish of the valve body interior and exterior surfaces, including the valve trim, and hardware.

2.02 MATERIALS AND EQUIPMENT

A. Ball Valve

1. BV1:

a. Valve: Ball valves for sodium aluminate service shall be manufactured of Grade I, Type I, PVC with floating Teflon seats. Seals shall be EPDM. Valve shall be provided with True-Union ends and shall be of Trunnion design. Ball valve shall be full bore.

b. Operator: Handle

c. Pressure: 150 psi @ 73°F

d. Service: Sodium Aluminate

e. Plast-O-Matic MBV

2. BV2:

a. Valve: Ball valves shall be 2-piece body ball valves with full ports and flanged end connections. Valves shall be manufactured of CF8M stainless steel body and wetted internals conforming to ASTM A351 Grade CF8M and ANSI B16 with a solid 316 stainless steel ball and stem. RPTFE seat and seal.

b. Operator: Lever

c. Pressure: 275 psi

d. Service: Mixed Liquor

e. Apollo 87A-200 Series

B. Check Valves:

1. CV1:

a. Valve: Ball check valve shall be manufactured of Type I, Grade 1 PVC with Viton or EPDM seals, depending on service, and shall incorporate a single disc design suitable for horizontal or vertical applications. Valves shall have a top entry bonnet for maintenance purposes. Valves shall be flat faced flanged end type conforming to ANSI B16.5 bolt pattern for 150 lb flanges.

b. Pressure: 150 psi @ 70°F

c. Service: Sample (Mixed Liquor, RAS)

d. Acceptable Manufacturers: Asahi/America, Hayward

2. CV2:

a. Valve: Ball check valve shall be manufactured of Type I, Grade 1 PVC with Viton seals, and designed for horizontal or vertical installation with equal effectiveness. Valves shall be provided with double true unions.

b. Pressure: 150 psi @ 73°F

c. Service: Sodium Aluminate

d. Acceptable Manufacturers: Asahi/America, Hayward True Check

C. Plug Valves:

1. General:

a. Plug valves shall be the non-lubricated eccentric type for use in wastewater service with flanged or mechanical joint ends as specified herein. Valves shall open by turning to the left (counter-clockwise), when viewed from the stem. Port area of the valves shall be a minimum of 100 percent of full pipe area. Valves shall be capable of providing drip-tight shutoff to the full valve rating with the pressure in either direction.

b. Plug valves shall be tested in accordance with AWWA C517. Each valve shall be performance tested in accordance with 5.2 and shall be given leakage test and hydrostatic test as described in paragraph 5.3 and 5.4. The leakage test shall be applied to the face of the plug tending to unseat the valve. The leakage test shall be performed at valve rating pressure as specified in B above. The manufacturer shall furnish certified copies of reports covering proof of design testing as described in Section 5.5.

c. All interior ferrous surfaces of the valve that will have contact with wastewater shall be coated with a factory applied, thermally bonded epoxy coating in accordance with AWWA C550, latest revision. Surfaces shall be clean, dry and free from rust, oil, grease before coating. Exterior surfaces of valve shall be coated as specified hereinafter.

d. Valve joints. All plug valves installed above-ground, in valve vaults or on flanged piping shall have flanged ends. Flanges shall comply with facing, drilling and thickness of ANSI Standards for Class 125 dimensions. Nuts and bolts for flanged connections shall be Type 316 stainless steel.

2. PV1:

a. Valve: Valve bodies shall be constructed of high strength cast iron conforming to ASTM A126, Class B, latest revision. Valve bodies shall be cast with raised eccentric seats. Seats shall be 1/8" thick welded overlay of not less than 95% pure nickel. Seat shall be at least 1/2" wide, 1/8" thick through entire width and raised. The raised surface shall be completely covered with nickel to insure that the resilient plug face contacts only the nickel seat. Valves shall be furnished with resilient faced ductile iron plugs and Chloroprene, or Buna-N facing, suitable for use with wastewater. Valves shall be furnished with replaceable, permanently lubricated, stainless steel, sleeve-type bearings in the upper and lower plug stem journals. Valves shall be bolted bonnet design. Valves shaft seals shall be designed so that they can be repacked without removing the bonnet and the packing shall be adjustable. Packing material shall be Buna-Vee type packing. All exposed valve nuts, bolts, springs, washers and the like shall be Type 316 stainless steel. Valves shall be 100% port.

b. Operator: 4" and below – Lever, 6" and above – Weatherproof Handwheel

c. Pressure Rating: ANSI B16.1-1967: 175 psi

d. Service: Mixed Liquor, RAS

e. Manufacturers:

1) DeZurik
2) Milliken
3) Valmatic

D. Pressure Relief Valves:

1. PRV1:

1) Valve: The valve shall operate such that if upstream pressure increases greater than valve setting, the valve will open.

Valve shall be of the Angle-pattern design and manufactured of PVC with Teflon wetted diaphragm, with adjustable relief pressure and locking nut. Spring-loaded, with pressure adjustable over range up to 150 psig.

2) Valve Body: PVC

3) Control spring: The valve spring shall be elastomer-coated and isolated from the process flow.

4) Control spring housing: PVC

5) Pressure: 150 psi

6) Service: Sodium Aluminate

10) Pulsafeeder, Inc., Prominent Fluid Controls, Milton Roy Co

E. Backpressure Valve, BPV:

1. BPV1:

a. Valve: The back pressure sustaining valve shall throttle to maintain a pre-set pressure on the downstream side of the valve. If upstream pressure drops below valve setting, the valve will close. Turning clockwise on the sustaining pilot handwheel will increase the setting and turning counterclockwise will decrease the setting. Backpressure valve shall be of the in-line pattern design and manufactured of PVC with Teflon wetted diaphragm, stainless steel spring, and HDPE adjusting screw. Valve shall be supplied with 316 stainless steel hardware.

b. Operator: Adjusting screw

c. Pressure: 150 psi

d. Service: Sodium Aluminate

e. Plast-O-Matic, Blacoh, or Simtech

F. V-Port Ball Valves:

1. VBV:

a. Valve: Accuracy for valve, actuator and positioner assembly shall be 3.0% or better with a resolution of 100 or more discrete positions over 90° range of operation. Each valve, actuator and positioner shall be assembled, adjusted, and tested as a unit by the valve manufacturer. Valve body, stem and ball shall be constructed of PVC. V-Port ball V notch shall be 30 degrees. Valve seats shall be self lubricated TFE. O-rings shall be EPDM. The valve body shall be flanged class 150.

b. Operator: Handle

c. Pressure: 150 ps.

d. Service – Sample (Mixed Liquor and RAS)

e. Design Criteria for Valve
Flow Range: 20 – 40 gpm

Sample Points 3,8 Normal Operating Pressure: 5 to 7 psi
Sample Points 3,8 Pressure Loss through Valve: 4 to 6 psi
Sample Points 1,2,4,5,6,7 Normal Operating Pressure: 18 to 36 psi
Sample Points 1,2,4,5,6,7 Pressure Loss through Valve: 17 to 35 psi

g. Valtorc V-Ball Valves, Series 700

G. Valve Operators:

1. General:

a. Size all operators to operate the valve at 150% of the valve's full-rated pressure.

b. Valve operators, handwheels or levers shall open by turning counter-clockwise.

c. Non-buried (exposed) valve operators shall be furnished with chainwheel operators, geared operators, extension stems, floor stands, and other elements to permit operation from the normal operating level. Valves located in process piping trenches, vaults, clearwells, wetwells, sumps and similar confined spaces shall be furnished with all necessary appurtenances to allow valve operation from the finished floor or above-grade level.

d. Ferrous materials of construction may be used on valve operators where permitted within the specifications. Operators for valves used in corrosive services (e.g. process valves made of stainless steel or thermoplastic construction) shall be fully protected from corrosion due to leaks, sprays, and fumes from the process water and from high humidity, condensation, and moist/damp environmental conditions. Fusion bonded epoxy coating systems shall be used to encapsulate all ferrous components from such conditions. Components subject to wear from mechanical operation shall be stainless steel of suitable grade to resist corrosion from the environment. Soley using galvanized treatment of ferrous materials is not considered acceptable to meeting these requirements.

2. Manual Operators:

a. Manual operators include handwheel, chainwheel, lever and handle type operators. When the maximum force to operate a valve under full operating head exceeds 40 pounds, gear reduction operators shall be provided.

b. Lever Operator:

i. Lever shall be fabricated steel. They shall include a set screw and grease lubricated.

ii. Operator shall be capable of being locked in any position and shall be provided within adjustable memory stop.

c. Handwheel:

ii. All operators shall be geared and shall have a weatherproof case iron housing or pedestal with a bronze operating nut. An effective gear ratio of at least 2:1 is required.

iii. Operator shall include position indicator and self-locking feature to prevent the disc or plug from creeping.

iv. Gear operators shall be totally enclosed and lubricated. Operators shall be grease lubricated and provided with grease fittings.

v. Handwheel operators supplied with floorstands and benchstands shall be self-locking at any position of stem travel. Cranks and handwheels shall be cast iron and hot dip galvanized after fabrication. Cranks shall be no less than 12-inches long and shall be keyed to the operating nut. Handwheels shall not have a diameter greater than 30-inches.

vi. Self-locking gear shall be a one-piece design of gear bronze material (ASTM B 427), accurately machine cut. The sector gear shall be hardened alloy steel (ASTM A 322), grade G41500 or ASTM-A 148, Grade 105-85, with thread ground and polished. The reduction gearing shall run in a proper lubricant.

c. Chainwheel:

i. Where valve location is not accessible from a standing position at a walkway or slab floor, Chainwheel operators shall be provided. Gearboxes shall be as specified for handwheel operators above, only with a chainwheel and chain guide assembly.

ii. Chain shall be type 304 stainless steel for ferrous valves, and type 316 stainless steel for stainless steel and thermoplastic valves and for valves located in chemical or corrosive process areas.

H. Valve Tags:

1. Each valve operator shall be provided with a 1-1/2-inch minimum diameter stainless steel tag. Each tag shall bear the valve number shown on the Drawings. The tags shall be attached to the operator with stainless steel key rings so that ring and tag cannot be removed. The numbers and letters shall be of block type, with 1/4-inch high numbers and letters stamped thereon.

2.04 QUALITY CONTROL

A. Contractor shall follow Manufacturer's and Supplier's recommended product quality control specifics as required for this project.

PART 3 - EXECUTION

3.01 PREPARATION

A. All exterior surfaces of iron body valves shall be clean, dry and free from rust and grease before coating.

B. For above-ground service, the exterior ferrous parts of all valves shall be coated as follows:

1. Prior to shipment from the factory, valves shall be coated with a thermally bonded epoxy coating in accordance with AWWA C550, latest revision, or shall be shop painted with one coat, 1.5 mils dry film thickness, of a combination lead and chromate primer with rust-inhibitive pigments and synthetic resins.

2. Following installation in the field, valves shall be painted with one coat, 1.5 mils dry film thickness, of a combination lead and chromate primer with rust-inhibitive pigments and synthetic resins. Valves shall be finish painted with two coats, 1.5 mils dry film thickness each coat, of a medium to long oil alkyd resin coating. Field applied coatings shall be as manufactured by the Carboline or an equal approved by the Engineer. The color of the finish coats shall be coordinated with the OWNER prior to painting.

C. All exterior surfaces of stainless steel valves shall be clean, dry and free from rust and surface contaminants. Stainless steel castings shall be of a smooth, bright, pitt-free appearance. Fabricated stainless steel valve bodies shall be pickled and passivated following the fabrication process to remove surface contaminants.

3.02 INSTALLATION

A. All valves and appurtenances shall be installed in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Engineer before they are installed.

B. After installation, all valves and appurtenances shall be tested at least 2 hours at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, it shall be repaired to the satisfaction of the Engineer.

C. Flanged joints shall be made with bright finish Type 316 stainless steel bolts, nuts and washers.

D. Valve Orientation:

1. Install operating stem vertical when valve is installed in horizontal runs of pipe having centerline elevations 4 feet inches or less above finished floor, unless otherwise shown.

2. Install operating stem horizontal in horizontal runs of pipe having centerline elevations between 4 feet 6 inches and 6 feet 9 inches above finish floor, unless otherwise shown.

3. If no plug valve seat position is shown, locate as follows:

a. Horizontal Flow: The flow shall produce an "unseating" pressure, and the plug shall open into the top half of valve.

b. Vertical Flow: Install seat in the highest portion of the valve.

E. Locate valve to provide accessibility for control and maintenance.

3.03 INSPECTION AND TESTING

A. Completed pipe shall be subjected to hydrostatic pressure test for 4 hours at full working pressure. All leaks shall be repaired and lines retested as approved by the Engineer. Prior to testing, the gravity pipelines shall be supported in an approved manner to prevent movement during tests.

END OF SECTION

DIVISION 16

ELECTRICAL

SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 REQUIREMENT

A. Contractors bidding work under this Contract shall read and understand Division Zero and Division 1 - General Requirements. If any discrepancies are discovered between the Basic Electrical Materials and Methods and General Requirements, the above mentioned documents shall overrule this section. The Basic Electrical Materials and Methods are intended as a supplement to the above mentioned documents.

B. The Contractor shall bid as outlined in the above mentioned Specifications and shall be governed by any alternates or unit prices called for in the form of proposal.

C. Each Contractor bidding on the work included in these Specifications shall view the building site and carefully examine the contract Drawings and Specifications, so that he/she may fully understand what is to be done, and to document existing conditions.

1.02 SCOPE OF WORK

A. Work included in this section of the Specifications shall include the furnishing of all labor, material, tools, approvals, concrete cores, wall penetrations, sealing of penetrations, excavation, backfill, and other equipment necessary to install the electrical system as shown on the Contract Drawings and as specified herein.

B. It also includes installation and connection of all electrical utilization equipment included in this Contract but furnished by other contractors or suppliers.

C. It is the general intent that all motors shall be furnished with the particular object of equipment it drives, except where a new motor is to be provided for an item of existing equipment (a replacement motor), then it shall be provided under this Division of the Specifications.

D. The Contractor is responsible to coordinate and provide all control and instrumentation configurations and to READ all manuals and shop drawings to support.

E. The Contractor shall furnish and install all conduit, wire, disconnect switches and miscellaneous material to make all electrical connections to all items of utilization equipment or wiring devices except as otherwise specified.

F. Equipment connections shall be made with flexible or rigid conduit as required. Controllers for motors, disconnect switches, and all control, protective and signal devices for motor circuits, except where such apparatus is furnished mounted and connected integrally with the motor driven equipment, shall be installed, connected and left in operating condition. The number and size of conductors between motors and control or protective apparatus shall be as required to obtain the operation described in these Specifications, and/or by the Contract Documents, and/or as shown in manufacturer furnished, Engineer reviewed Shop Drawings.

G. All devices and items of electrical equipment, including those shown on the Contract Drawings but not specifically mentioned in the Specifications or those mentioned in the Specifications but not shown on the Contract Drawings, are to be furnished under this section of the specifications. Any such device or item of equipment, if not defined in quality, shall be equal to similar Equipment and/or devices specified herein.

H. All devices and items of equipment mentioned in this section of the Specifications whether electrical or not or whether furnished under this or other Division of the Specifications,

shall be installed under this Division of the Specifications, unless specifically indicated otherwise.

I. Where wiring diagrams are not shown on the Contract Drawings, they are to be provided by the supplier of the equipment served and such diagrams shall be adhered to except as herein modified.

J. The following is a list of items that may not be defined clearly on the Contract Drawings or in other parts of these Specifications. The list is meant to be an aid to the Contractor and is not necessarily a complete list of all work to be performed under this Contract:

1. Connect all motors and accessories furnished by equipment suppliers.

2. Furnish, install, and connect all motor controls.

3. Furnish, install, and connect power and signal lines to all instrumentation equipment, monitoring, control and accessories.

4. Furnish, install, and connect all electrical conduit, duct and cables.

5. Furnish, install, and connect all telephone boxes, outlets, etc.

6. Furnish, install, and connect all power distribution equipment.

7. Furnish and install standby power equipment.

8. Install all loose ship controls, control panels, instrumentation, cables, sensors, etc. provided by equipment vendors specified under Divisions 11, 13, 15, and 17.

1.03 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE INFORMATION

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted per Section 01300.

B. Shop Drawings shall be submitted on the following materials specified in this Division:

1. Conduit - all types and sizes, including liquid-tight flexible.

2. Boxes - all types and sizes.

3. Coal tar epoxy paint.

4. Wiring devices.

5. Device plates.

6. Metal framing system (Strut type channel).

7. Conduit fittings, expansion joints, support hardware.

8. Motor control equipment - including individually mounted items.

9. Power distribution equipment - including individually mounted items.

10. Adjustable speed equipment and accessories.

11. Miscellaneous spare parts and hardware.

12. Wire - all types and sizes.

13. Wire markers, signs and labels.

14. Lightning/Surge Suppression Devices (SPD's)

15. Motors.

16. Transformers.

C. The Engineer reserves the right to make modifications to motor control and power distribution equipment ratings after Shop Drawing review, if the Shop Drawings are submitted prematurely (prematurely meaning submitted before all utilization equipment has been reviewed and accepted). Cost of modifications shall be the Contractor's responsibility.

1.04 SYMBOLS AND ABBREVIATIONS

A. The symbols and abbreviations general follow standard electrical and architectural practice, however, exceptions to this shall be as shown on the Contract Drawings.

1.05 COORDINATION WITH OTHER TRADES

A. The Contractor shall coordinate the electrical work with that of other trades to ensure proper final location of all electrical equipment and/or connections. The Contractor shall verify door swings to see that light switches are located properly.

1.06 CODES

A. The minimum standard for all work shall be the latest revision of the Kentucky Building Code (KBC), and the National Electrical Code (NEC). Whenever and wherever state and/or local laws or ordinances and/or regulations and/or the Engineer's design require a higher standard that the current NEC or KBC, then these laws and/or regulations and/or the design shall be followed.

B. Following is a list of other applicable Standards or Codes:

1.	Kentucky Building Code	KBC
2.	National Electrical Code	NEC
3.	National Electrical Safety Code	NESC
4.	Underwriters Laboratories, Inc.	UL
5.	Factory Mutual System	FM
6.	National Fire Protection Association	NFPA
7.	National Electrical Manufacturers Association	NEMA
8.	Occupational Safety and Health Administration	OSHA
9.	Insulated Cable Engineers Association, Inc.	ICEA
10.	Illuminating Engineering Society of North America	IES
11.	Instrument Society of America	ISA

12.	Institute of Electrical and Electronic Engineers, Inc.	IEEE
13.	Certified Ballast Manufacturers Association	CBM
14.	American National Standards Institute, Inc.	ANSI
15.	Anti-Friction Bearing Manufacturers Association, Inc.	AFBMA
16.	Joint Industry Council	JIC
17.	American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.	ASHRAE
18.	Federal Communications Commission	FCC
19.	American Society for Testing and Materials	ASTM
20.	American Wood Preservers Association	AWPA
21.	Rural Electrification Association	REA

1.07 INSPECTIONS AND PERMITS

A. Inspection of the electrical system on all construction projects is required. If the local government has appointed a state licensed inspector, the Contractor shall be required to use that person to perform the inspections. If a locally mandated inspector does not exist, the Contractor shall select and hire a state licensed inspector, who has jurisdiction before any work is concealed. The Contractor shall notify the electrical inspector in writing, immediately upon notice to proceed, and a copy of the notice shall be submitted to the Engineer.

B. At the time of completion of the project, there shall be furnished to the Owner a certificate of compliance, from the agency having jurisdiction pursuant to all electrical work performed. The Engineer shall also receive a photostatic copy.

C. All costs incurred by the Contractor to execute the above mentioned requirements shall be paid by the Contractor at no extra cost to the Owner.

D. All permits necessary for the complete electrical system shall be obtained by the Contractor from the authorities governing such work. For further information, see Division 1.

1.08 STORAGE

A. All work, equipment, and materials shall be protected against dirt, water, or other injury during the period of construction.

B. Sensitive electrical equipment such as motor starters, controls, and panelboards, delivered to the job site, shall be protected against injury or corrosion due to atmospheric conditions or physical damage by other means. Protection is interpreted to mean that equipment shall be stored under roof, in a structure properly heated in cold weather and ventilated in hot weather. Provision shall be made to control the humidity in the storage area to 50 percent relative. The stored equipment shall be inspected periodically, and if it is found that the protection is inadequate, further protective measures shall be employed. Electrical equipment other than boxes and conduit shall not be installed until the structure is under roof with doors and windows installed.

1.09 MATERIALS

A. All materials used shall be new and at least meet the minimum standards as established by the NEC and/or National Electrical Manufacturers Association (NEMA). All materials shall be UL listed for the application, where a listing exists. Additional requirements are found in Division 1. All equipment shall meet applicable FCC requirements and restrictions.

B. The material and equipment described herein has been specified according to a particular trade name or make to set quality standards. However, each Contractor has the right to substitute other material and equipment in lieu of that specified, other than those specifically mentioned at matching or for standardization, providing such material and equipment meets all of the requirements of those specified and is accepted, in writing by the Engineer.

C. The reuse of salvaged electrical equipment and/or wiring will not be permitted unless specified herein or indicated on the Contract Drawings.

D. All salvaged or abandoned electrical materials shall become the property of the Contractor and shall be removed from the job site upon completion of the project, unless otherwise noted on the Contract Drawings or specified herein.

1.10 ERRORS, CORRECTIONS, AND/OR OMISSIONS

A. Should a piece of utilization equipment be supplied of a different size or horsepower than shown on the Contract Drawings, the Contractor shall be responsible for installing the proper size wiring, conduit, starters, circuit breakers, etc., for proper operation of that unit and the complete electrical system at no extra cost to the Owner.

B. It is the intent of these Specifications to provide for an electrical system installation complete in every respect, to operate in the manner and under conditions as shown in these Specifications and on the Contract Drawings. When drawings and plans conflict and there is insufficient time to request clarification for bids, contractor shall follow the specifications for bid purposes and if awarded the contract shall initiate an RFI for further clarification prior to construction. Further requirements on this subject may be found in the General Requirements, Division 1.

C. Necessary changes or revisions in electrical work to meet any code or power company requirement shall be made by the Contractor without additional charge.

1.11 GUARANTEES AND WARRANTIES

A. The Contractor shall guarantee all work including equipment, materials, and workmanship. This guarantee shall be against all defects of any of the above and shall run for a period of 1 year from the date of acceptance of the work, concurrent with the one year guarantee period designated for the general construction contract under which electrical work is performed. Date of acceptance shall be considered to be the date on which all "punch list" items are completed ("punch list" is defined to be the written listing of work that is incomplete or deficient that must be finished or replaced/repaired before the Contractor receives final payment).

B. Repair and maintenance for the guarantee period is the responsibility of the Contractor and shall include all repairs and maintenance other than that which is considered as routine. (That is oiling, greasing, etc.) The Engineer shall be the judge of what shall be considered as routine maintenance.

C. Lamps shall bear the manufacturer's warranty.

1.12 TESTING

A. After the wiring system is complete, and at such time as the Engineer may direct, the Contractor shall conduct an operating test for acceptance. The equipment shall be demonstrated to operate in accordance with the requirements of these Specifications and the Contract Drawings. The test shall be performed in the presence of the Engineer or his authorized representative. The Contractor shall furnish all instruments and personnel required for the tests, as well as the necessary electrical power.

B. Before energizing the system, the Contractor shall check all connections and set all relays and instruments for proper operation. He shall obtain all necessary clearances, approvals, and instructions from the equipment manufacturers prior to placing power on the equipment.

C. Tests may be performed by the Engineer to determine integrity of insulation on wiring circuits selected by the Engineer at random.

1.13 CLEANUP

A. Cleanup shall be completed as soon as possible after the electrical installation is complete. All outlets, switches, starters, motor control centers, disconnect switches and other electrical equipment shall be free of shipping tags, stickers, etc. All painted equipment shall be left free of scratches or other blemishes, such as splattered or blistered paint, etc. All light fixture diffusers shall be clean and the interior of all motor controls, etc., shall be free of dust, dirt, wire strippings, etc. Surplus material, rubbish and equipment resulting from the work shall be removed from the job site by the Contractor upon completion of the work.

B. During construction, cover all Owner equipment and furnishings subject to mechanical damage or contamination in any way.

1.14 CUTTING AND PATCHING

A. Cutting and patching shall be held to an absolute minimum and such work shall be done only under the direction of the Engineer or Owner.. The Contractor shall be responsible for and shall pay for all openings that may be required in the floors or walls, and he shall be responsible for putting said surfaces back in their original condition. Every attempt shall be made to avoid cutting reinforcing steel bars when an opening is required in a reinforced concrete wall or floor slab. All penetrations shall be sealed.

1.15 EXCAVATION AND BACKFILL

A. Excavation

1. Excavation for conduits shall be of sufficient width to allow for proper jointing and alignment of the type conduit used. Conduit shall be laid in straight lines between pull boxes and/or structures unless otherwise notes on the Contract Drawings. The cost of solid rock excavation shall be included in the lump sum bid with no extra pay allowed (unclassified).

B. Encasement/Backfill

1. All buried conduits shall be concrete encased. Backfill over the ductbank may contain rocks but must be mixed with sufficient earth to fill all voids.

1.16 SLEEVES, CHASES AND OPENINGS

A. Sleeves shall be required at all points where exposed conduits pass through new concrete walls, slabs, or masonry walls. Sleeves that must be installed below grade or where subject to high water conditions must be installed watertight.

B. Wiring chases shall be provided where shown on the Contract Drawings. The Contractor shall have the option of installing chases below surface mounted panelboards provided all structural requirements are met.

C. It is the Contractor's responsibility to leave openings to allow installation of the complete, operational electrical system. Openings required but not left shall be cut as outlined under cutting and patching. The Contractor shall coordinate all holes and other openings with necessary diameters for proper firestopping.

1.17 TEMPORARY ELECTRICAL POWER

A. The Contractor shall be responsible for providing temporary electrical power as required during the course of construction and shall remove the temporary service equipment when no longer required. Temporary power is also addressed in Division 1.

1.18 OVERCURRENT PROTECTION

A. Circuit breakers or fused switches shall be the size and type as written herein and shown on the Contract Drawings. Any additional overcurrent protection required to maintain an equipment listing by an authority having jurisdiction shall be installed by the Contractor at no extra cost to the Owner.

B. The Contractor shall submit to the Engineer actual nameplate data from motors shipped to the site, stating motor identification as well as characteristics. Overload relay thermal unit selection tables shall accompany the motor data. The Engineer will select thermal unit sizes from this data for use by the Contractor in ordering proper thermal units.

1.19 TRAINING

A. All manufacturers supplying equipment for this division shall provide the Owner's operations staff with training in the operation and maintenance on the equipment being furnished. The training shall be conducted at the project site by a qualified representative of the manufacturer.

B. The cost of this training shall be included in the bid price.

C. The required training shall consist of both classroom and hands-on situation. Classroom training shall include instruction on how the equipment works, its relationship to all accessories and other related units, detailed review of shop drawings, detailed presentation of written O & M instructions, troubleshooting and record-keeping recommendations. Hands-on-training shall include a review of the manufacturer's O & M instructions, check out of each operator to identifying key elements of the equipment, tear down as appropriate, calibration, adjustment, greasing and oiling points, and operating manipulations of all electrical and mechanical controls.

D. The training shall be scheduled through the Contractor with the Owner. The timing of the training shall closely coincide with startup of the equipment, but no training shall be conducted until the equipment is operational.

E. The minimum number of hours to be provided by manufacturers supplying equipment on this project shall be in accordance with the following table:

Item	Training Hours	
	Classroom	Hands-on
Instrumentation and Control Systems	1	1

F. At least 60 days prior to the training the manufacturer shall submit through the Contractor to the Engineer an outline of the training proposed for the Engineer's review and concurrence.

G. The Owner reserves the right to videotape all training sessions.

1.20 MAINTAINING CONTINUOUS ELECTRICAL SYSTEM AND SERVICE

A. Existing service(s) continuity shall be maintained at all times. In no way shall the installation and/or alteration of the electrical work interfere with or stop the normal operation of the existing facilities, except where prior arrangements have been made

B. When additions and taps to existing service(s) require electrical outages of duration in excess of a few minutes, arrangements shall be made in advance for such outages. All outages shall be held to an acceptable minimum with none exceeding 8 hours continuous duration. If necessary, cuts shall be performed on premium time. If performed at night, requiring a general outage, the Contractor shall furnish an auxiliary source of light and power as required. Under no circumstances shall an electrical outage of any duration be initiated until the Owner and Engineer have concurred, and as far as possible in advance.

C. See Section 01520 for additional requirements.

1.21 GROUNDING AND BONDING

A. All metallic conduit, cabinets, equipment, and devices shall be grounded with a pulled ground wire in accordance with the latest issue of the National Electrical Code. All supporting framework and other metal or metal clad equipment or materials which are in contact with electrical conduit, cable and/or enclosures, shall be properly grounded to meet the code requirements. Conduit shall not be used as the grounding system, all raceways shall have pulled grounds installed.

1.22 RELATED SPECIFICATION DIVISIONS

A. The following divisions contain Specifications on utilization equipment, equipment accessories, and procedures related to execution of the electrical work, and are included here for the Contractor's information. Bids shall still be based on complete Contract Documents.

Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract
Division 1 - General Requirements
Division 11 - Equipment
Division 13 - Special Construction
Division 15 – Mechanical
Division 17 - Instrumentation

1.23 CONTRACTOR LICENSING

A. The Contractor performing the electrical work on this project shall be locally licensed, if required by local law or ordinance. If the Contractor has passed the State test, it may not be necessary to meet local testing requirements. It shall be the Contractor's responsibility to investigate these requirements and comply with same.

1.24 ANCHORING/MOUNTING

A. Electrical conduits and/or equipment shall be rigidly supported. Anchors used shall be stainless steel metallic expansion type, or if appropriate to prevent spalling concrete, epoxy set type. Plastic or explosive type anchors are prohibited.

B. All supports shall be consistent with the latest edition of the KBC and ASCE 7.

1.25 ELECTRICAL COMPONENT MOUNTING HEIGHTS

A. Unless otherwise indicated, mounting height for components shall be as defined herein. In cases of conflicts with architectural or structural aspects, the components may be relocated. If an indicated height conflicts with a code requirement, the code shall govern.

B. Mounting heights are given from finished floor elevation to the centerline of the component, unless otherwise noted.

	Component	Height	Comments
1.	Wall type light switch	4'-0"	To top of box
2.	Low wall outlet	16"	To bottom
3.	Medium height wall outlet	4'-0"	
4.	Medium height telephone outlet	4'-0"	
5.	High wall outlet or fixture	7'-0"	
6.	Wall type buzzers, horns, etc.	8'-0" Max.	Top 2" below ceiling
7.	Push-button or control stations	4'-0"	
8.	Top of panelboards or control panels	6'-6"	Maximum (except for handicapped areas)
9.	Top of telephone back boards	6'-6"	Maximum
10.	Top of switch handle on motor control center	6'-6"	Maximum
11.	Top of local motor controller	6'-0"	Maximum
12.	Top of local disconnect switch	6'-0"	Maximum
13.	Wall mount exterior light fixtures	8'-0"	or as shown
14.	Wall mount emergency light fixtures	6'-6"	Maximum to test button
15.	Wall thermostats	4'-0"	To top of thermostat

In situations where there appears to be a conflict with Americans with Disabilities Act (ADA) legislation, utilize the ADA requirements herein.

1.26 HAZARDOUS AREA CLASSIFICATIONS

The following table identifies the applicable hazardous areas for this project, and the classifications for each. All equipment used in these areas shall be UL listed for the application, and all wiring methods shall be in accordance with Chapter 5 of the National Electrical Code. All conduits to these spaces from non-hazardous areas shall be properly sealed.

Location	Area Classification	Extent of Hazardous Area
Open Flow Channels Outdoor	Class I, Division 1, Group D	18" Above Water Surface

1.27 RECEIPTS

A. Some sections of the Specifications call for equipment, materials, accessories, etc. to be provided and "turned over to the Owner" or like requirements. The Contractor shall obtain a receipt for each item turned over, signed by the Owner or his representative. A copy of this receipt shall be transmitted to the Engineer.

B. When a question arises concerning whether items have been turned over to the Owner, and there is no signed receipt, it may be assumed that the items were not provided.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 16070 - SUPPORTING DEVICES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. All electric equipment shall be rigidly mounted and installed using supporting devices as indicated on the Contract Drawings, as required by the work, and described herein.

1.02 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE INFORMATION

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted per Section 01300.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. "Kindorf," "Unistrut," or equal.

2.02 MATERIALS

A. All mounting brackets and strut shall be aluminum or 316 stainless steel. Fasteners, including nuts, bolts, washers and all associated hardware, used to mount equipment shall be 316 stainless steel.

B. Aluminum support members shall not be installed in direct contact with concrete. Stainless steel or non-metallic "spacers" shall be used to prevent contact of aluminum with concrete.

PART 3 - EXECUTION

3.01 ANCHORING CABINETRY

A. All free-standing equipment shall be anchored to its foundation using stainless steel expansion bolts of the size and number recommended by the equipment manufacturer.

3.02 RACEWAYS AND BOXES

A. All conduits, boxes, devices and wall mount cabinets shall be supports on aluminum or stainless-steel strut. Use only stainless steel threaded rod, fasteners and anchors.

END OF SECTION

SECTION 16075 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 EQUIPMENT LABELING

A. All starters, feeder units in panelboards, switchboards, disconnects, instruments, etc. shall be marked to indicate the motor, outlet, circuit they control, or variable monitored. Marking is to be done with engraved laminated nameplates and shall bear the designation shown on the Contract Drawings where this information is given. Nameplates shall be fastened to equipment with stainless steel screws, minimum of one each side. In no way shall the installation of mounting screws void the NEMA enclosure rating of the equipment in which they are installed. If there are more than one identical unit, they shall be given consecutive numbers or other descriptions as designated by the Engineer. Nameplate background color shall be white, with black engraved letters, unless otherwise noted. When re-using existing devices, replace existing name plates.

B. Branch circuits in panels shall be typed on a card suitable for the card frame furnished with the panel. The card shall bear the panel designation listed on the Contract Drawings where this information is given, as well as indicate what each circuit controls.

C. Motor control centers, individual wall mounted starters, panelboards, and disconnect switch shall be labeled with vinyl self-adhesive signs that warn of "High Voltage" (state the specific voltage). Other major equipment such as transformers, transfer switches, pump control panels, etc., shall be labeled as such. The type of labels to be used shall have orange as the basic color to conform with OSHA requirements, letters shall be black. The labels shall be of proper size to fit flatly on the surface of the enclosure to make for a neat appearance and not interfere with the operating function of the device it is attached to. These labels shall be as manufactured by the Brady Identification Systems Division, Safety Sign Company, or equal.

D. Furnish and install "Authorized Personnel Only" signs by doors into all power distribution equipment rooms/buildings. Furnish and install other signs as indicated on the Contract Drawings.

1.02 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE INFORMATION

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted per Section 01300.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 16120 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. All wire and cable shall conform to the latest requirements of the NEC and shall meet all ASTM/UL specifications. Wire and cable shall be new; shall have size, grade of insulation, voltage rating and manufacturer's name permanently marked on the outer covering at regular intervals. Complete descriptive literature shall be submitted to the Engineer for review and acceptance prior to installation.

B. Building wire #12 - #1 shall be applied based on a 60 degree Celsius temperature rise. Building wire larger than #1 may be applied at its 75 degree Celsius temperature rise.

1.02 DELIVERY, STORAGE AND HANDLING

A. Wire and cable shall be suitably protected from weather and damage during storage and handling and shall be in first class condition when installed.

1.03 RELATED WORK

A. The following Sections of this Specification Division contain requirements which are considered to be covered by applicable requirements of this section:

Section 16710 – Communication Systems.

1.04 TESTING

A. All testing shall be performed by a NETA certified company hired and paid for by the Division 16 contractor.

B. Submit qualifications of company and the on-site personnel who will be performing the testing. Personnel must have 5 years' experience in testing of electrical and fiber optic cables and terminations.

1.05 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE INFORMATION

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted per Section 01300.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Building Wire (type "RHW"-2-cu.) – "Southwire," "Collyer," "American," "Carol," or equal.

B. Control Wire (type "RHW"-2-cu) – "Southwire," "Collyer," "American," "Carol," or equal.

C. Control Cables (Twisted pairs, Shielded) 600V max. – "Belden," "Eaton-Dekoron," "Okonite," or equal.

D. Instrumentation Cables (Twisted pairs, Shielded) 600V mx. – "Eaton-Dekoron," "Manhatton," "American," "Belden," "Okonite," or equal.

E. Cat 5e, 6, 6a Cables – Must be manufactured in the United States, Canada or Europe.

F. Fiber Optic Cables - Must be manufactured in the United States, Canada or Europe.

2.02 MATERIALS

A. General

1. In general, all conductors shall be 98 percent conductive, annealed copper unless otherwise noted on the Contract Drawings.

2. Conductors shall be type RHW-2 insulation. Conductor size shall be AWG (American Wire Gauge) Standard. Minimum conductor size shall be AWG number 12 except branch circuits in excess of 75 feet from panel to first outlet not smaller than no. 10 AWG. Minimum voltage rating shall be 600 volts. Conductors for small power may be solid (i.e. lighting, receptacles, motors), but conductors for control work shall be stranded.

3. **Conductor exterior insulation up to size 1/0 shall be color coded from the factory. Tape or field applied marking will NOT be an acceptable substitution.**

4. Conductors with high temperature rated insulations and special construction shall be used where required in connecting to light fixtures or appliances that have special requirements.

B. VFD Cable

1. The cable shall be 600V/1000V rated, with stranded tinned copper conductors, shielded, suitable for use with Variable Frequency Drives.

2. The insulation shall be rated for 90 degrees Celsius Wet/Dry operating temperature.

3. Accessories (terminations) shall have ratings that are at least equal to those of the cable.

4. All cables shall be round.

5. Cable shall be suitable for use in wet/dry locations, indoors and outdoors, in cable trays, in conduits, trenches, and in underground ducts and direct burial.

6. The conductor shall be annealed stranded tinned copper per ASTM B3, B8, and B33.

7. The insulation thickness shall have a minimum average wall thickness of 30 mils. The insulation material must be XLPE with an RHW-2 listing per UL 44. Each insulated conductor shall be identified in accordance with ICEA Method 4 color coding.

8. The insulated conductors are to be cabled together with a minimum of one ground wire. The ground wire(s) are to have a minimum circular mil area equivalent to one circuit conductor. Fillers shall be included as necessary to make the cable round.

9. The cabled assembly shall be shielded using one of two methods:

   a. Applying helically two 2-mil copper tapes. The shield shall provide 100% coverage over the assembly.

   b. Applying an 80% minimum coverage tinned copper braid shield used in conjunction with an Aluminum Foil shield tape.

10. All cables shall have a continuous overall outer sheath of Polyvinyl Chloride (PVC), suitable for 90 degree Celsius use.

11. The jacket shall be resistant to abrasion, rated for direct burial, sunlight resistant, and flame resistant in accordance with UL 1277.

12. The following permanent legend shall be clearly embossed or printed at approximately 2 foot intervals on the outer jacket for the entire length of the cable:

    a. Manufacturer's name and or Trade Mark.

    b. Number of conductors and size (-- AWG).

    c. Type of insulation (XLPE) or NEC Listed Conductor Type (XHHW-2).

    d. Voltage rating.

    e. TC-ER rating.

    f. 1000V Flexible Motor Supply Cable rating.

    g. Sequential footing marking at 2 foot intervals.

13. Only one continuous (without splices) length of cable shall be shipped on a reel. Both ends shall be waterproof sealed, secured, protected from damage, and both ends shall be available for testing.

PART 3 - EXECUTION

3.01 INSTALLATION/APPLICATION/ERECTION

A. General

1. Conductors shall be continuous from outlet to outlet and no splices shall be made except accessible in junction or outlet boxes. Wire connectors of insulating material or solderless pressure connectors, properly taped, shall be used for all splices in wiring, wherever possible.

2. Conductors shall be color coded in accordance with the following schedule:

	480/277V 3 Phase	208/240V 3 Phase	120/240, Single Phase
Phase A	Brown	Black	Black
Phase B	Orange	Red	Red
Phase C	Yellow	Blue	
Neutral (Grounded)	White or Light Gray	White or Light Gray	White or Light Gray
3-Way Tracers			Blue
Grounding	Green	Green	Green
Remote Energized			Yellow

3. Conductors shall be pulled into raceways in strict accordance with manufacturer's recommendations.

4. Ample slack conductors shall be allowed at each terminal point, and pull or junction box, to permit installation with ease and without crowding.

5. All conductors terminating at terminal blocks shall be identified with numbers and/or letters identical to circuit or control identification.

6. No conductors shall be drawn into conduits until all work which may cause wire or cable damage is completed. Wire pulling shall be accomplished utilizing machinery and accessories intended for the purpose.

7. All connections and splices shall be made in accordance with conductor manufacturer's recommendations, and as written herein.

9. Unless otherwise specifically indicated, neutrals may not be shared.

C. Control Cable

1. Control cable shall be the size and have the number of conductors shown on the control system drawings. Control cable shall be used for motor controls and monitoring only. Color coding shall be ICEA, Method 1. Control cables between buildings shall be underground in conduit of the size shown in the control system schematic. Cabling shall provide a minimum of 25 percent spare conductors. Voltage rating shall be 600 volts.

D. Instrument Cable

1. General

a. All signal lines should be constructed of individually twisted pairs (6 to 10 twists per foot), including thermocouple extension leads. Cables should be made of twisted pairs, with all lays and pairs twisted in the same direction for maximum flexibility.

b. Wire size is #16 AWG minimum.

c. Stranded tinned copper conductor shall be used for all wiring other than thermocouple extension leads.

d. Insulation resistance at 68 degrees Fahrenheit between conductors and between conductors and ground should be at least 500 megohms per 1,000 feet.

e. Multi-pair cable should be jacketed with poly-vinyl-chloride, polyethylene or Teflon at least 0.045" thick. Voltage rating shall be 600 volts.

2. Signal Wiring

a. Low level analog (less than 500 millivolt d-c). Use twisted pairs which may be cabled with other pairs carrying similar voltage levels. Foil wraps or equivalent shielding is required for each cable with the shield insulated from ground.

b. High level analog (greater than 500 millivolts d-c). Use twisted pairs which may be cabled with other pairs carrying similar voltage levels and current levels less than 100 ma. Shielding is required.

c. Analog outputs (normally 4-20 mA). Same as b.

d. Contact inputs - use twisted pairs and run in separate conduit.

e. Contact outputs - same as d.

f. Pulse inputs - same as d.

3. Signal and Shield Grounding

a. All shields must be grounded at one point only as close as possible to the signal source.

b. Thermocouples may be grounded or ungrounded.

c. Analog signals, if grounded, should be grounded as near the signal source as possible.

d. Resistance bulbs should not be grounded.

4. Signal and Wiring Separation

a. Analog signals shall be run in a separate conduit from contact or pulse signals.

b. A minimum separation of 12 inches between analog signal leads and a-c power leads should be maintained. For a-c power leads carrying 100 amps or greater, a 24-inch separation should be maintained. Parallel runs should be limited to less than 500 feet. Perpendicular runs may be as close as 6 inches.

E. Submersible pump Power Cable

1. Power cables for submersible pumps shall be of the extra hard usage type suitable for submerged duty and able to withstand common corrosive agents found in water and wastewater. They shall be provided with high grade non-magnetic stainless-steel relief cable grips installed at the pump end and high grade non-magnetic stainless-steel support cable grips anchored to the wet well structure where they enter the wet well. The strain relief and support cable grips shall be as manufactured by Kellems, Slater/Flexcor, or equal. Non-metallic corrosion resistant grips may be used in lieu of stainless steel if available for the cable size

2. Cables shall be terminated to the termination box or control cabinet with a PXSS2K-US Class I Division II connector with a metric to NPT thread adapter. A rubber seal shall be installed complying with the manufacture's requirements. The end of the gland shall be potted per manufacturer instructions and allowed to dry before wire terminations for 24 hours at an ambient temperature of not less than 50°F, unless noted otherwise in manufacturer's installation instructions.

F. Ethernet Cables

1. Ethernet cables shall be **shielded** Category 6 rated.

2. Ethernet cables inside VFD cabinets shall be Category 6 rated and **shielded**.

3. For connections to plant SCADA systems and equipment in supervisory control centers and operator workstations, motor controls centers, switchboards and control panels, etc., provide 4-pair **shielded** twisted pair cabling meeting EIA/TIA Cat 6. Provide with BLUE jacket.

4. Industrial Ethernet cable shall be 24 AWG, shielded with polyolefin insulation, aluminum foil polyester shield and PVC outer jacket rated for WET location.

G. Fiber Optic Cable Systems

1. Fiber optic communications cable shall be 4 strand OM2.

2. Provide riser rated, loose tube, gel-free, TrayOptic as manufactured by Belden. The cable shall be UL listed OFNR. Cable shall be suitable for indoor and outdoor applications including installation in underground ducts and direct burial.

3. Individual fibers shall be ISO 9314 (FDDI) specifications for local area network applications at 100Mbps with 62.5um diameter glass core, a 125um diameter glass cladding and a 245um diameter UV cured acrylate primary buffer. The fibers shall be Gigabit Ethernet grade.
4. Terminate and test all fibers per TIA -568-C.0 Tier 1 bidirectional testing AND Tier 2 testing. Test is the presence of plant operator and provide signed witness test sheets in O&M documents.

5. For connection to network, provide end connectors from cable manufacturer. The connector ferrule shall be ceramic or glass-in-ceramic, metallic or equivalent. Provide heat shrink tubing section where cable is broken out to protect jacketing. Provide and terminate all fibers of all cables. Coordinate connector types with network equipment provided.

H. Devicenet cable

1. 4 conductor shielded cable with PVC jacket. Conductors shall be tinned copper, 600volt class 1 as manufactured by Belden or equal. Conductor sizes shall be as determined by the contractor for the final devicenet system layout using thick, middle and thin gauge conductors.

3.02 FIELD QUALITY CONTROL

A. Testing

1. All testing shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

a. Witness Shop Tests

1) Not required.

b. Shop Test

1) Cable and wiring shall be tested in accordance with the applicable ICEA Standards. Wire and cable shall be physically and electrically tested in accordance with the manufacturer's standards.

2) Fiber optic cables shall be tested in accordance with TIA/TIB Standards.

c. Field Tests

1) Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and NETA acceptance testing specifications.

2) After installation, all wires and cables shall be tested for continuity. Testing for continuity shall be "test light" or "buzzer" style.

3) After installation, all wires and cables shall be tested for insulation levels. Insulation resistance between conductors of the same circuit and between conductor and ground shall be tested. Testing for insulation levels shall be as follows:

   - For 600V power and control cable, apply 1,000 VDC from a Megohmmeter for one (1) minute for all 600V wires and cables installed in lighting, control, power, indication, alarm and motor feeder circuits. Resistance shall be no less than 100 Megohms.

   - 600V instrumentation signal cable shall be tested from conductor to conductor, conductor to shield, and conductor to ground using a Simpson No. 260 volt-ohmmeter or approved equal. The resistance value shall be 200 Megohms or greater.

4) Fiber optic cables shall be tested in accordance with TIA/TIB 140. Tests shall include both the OLTS and OTDR test without exception. OTDR will NOT be optional, it must be performed in addition to OLTS.
   - Inspect each fiber with a fiber optic microscope with at least 200x magnification. Submit equipment to be used at least 4 weeks prior to beginning fiber work.
   - If under microscope review the fiber end is dirty, cracked or pitted, the connector must be replaced.
   - Use only static dissipative fiber optic cleaning fluids to clean ends.
   - Use OLTS to measure total end to end loss of each installed fiber. Optically measure each fiber run.
   - Use OTDR to measure the loss in each connector, each splice and check for macro-bends in cable.
   - Acceptable losses shall be as published by TIA-standards.

2. Low voltage wires and cables shall be tested before being connected to motors, devices or terminal blocks.

3. Voltage tests shall be made successively between each conductor of a circuit and all other conductors of the circuit grounded.

4. Fiber optic cables shall be tested prior to connector installation and after connector installation.

5. If tests reveal defects or deficiencies, the Contractor shall make the necessary repairs or shall replace the cable as directed by the Engineer, without additional cost to the Owner.

6. All tests shall be made by and at the expense of the Contractor who shall supply all testing equipment and qualified personnel. Test reports shall be submitted to the Engineer.

END OF SECTION

SECTION 16130 - RACEWAYS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This section of the Technical Specifications includes all raceways for accommodation of electrical conductors, communications conductors, sleeves for underground electrical installations, conduit stubs for future installations, fittings therefore and accessories.

B. All raceways shall be marked with the manufacturer's name or trademark as well as type of raceway and size. This marking shall appear at least once every 10 feet and shall be of sufficient durability to withstand the environment involved. All raceways shall be furnished and installed as outlined under Part 3 of this Specification.

C. All raceways and fittings shall be threaded, no compression or setscrew fittings.

D. All raceway terminations into panels and all bolts that penetrate cabinets and enclosures shall be provided with watertight hubs and sealing washers.

E. Under no circumstance shall cables or wires be run without raceway except for submersible pump vendor provided cords.

F. Raceways that transition from interior to exterior locations and all raceway terminations into control panels, starters, or disconnects shall be sealed with Polywater FST foam duct sealant, no substitutions are acceptable. Provide condulet fitting within 36" of penetration to apply sealant to duct.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Tubular Raceways

1. Steel, Galvanized, Rigid, Heavy-Wall, Threaded – "Wheatland Tube Co.," "Triangle," "Allied Tube & Conduit Corp.," or equal.

2. Plastic (PVC); Type A (Thin Wall); Type 40 (or Schedule 40); Type 80 (or Schedule 80) (Heavy -Wall) – "Carlon," "Cantex," or equal.

3. Liquidtight Flexible Metal Conduit – "Carol Cable Co., Inc.," "Superflex," "OZ Gedney," or equal.

4. Aluminum Conduit - "Wheatland Tube Co.", "Allied Tube & Conduit Corp.", or equal.

5. PVC Coated Metallic Conduit (PCMC) - "Plasti-Bond Red" as manufactured by Robroy Industries, "OCAL-Blue" as manufactured by Ocal, Inc., Perma-Cote Supreme by Perma-Cote Industries, or equal.

B. Raceway Fittings

1. Conduit fittings – "Crouse-Hinds," "Appleton," "OZ Gedney," or equal.

2. Non-metallic conduit fittings –"Carlon," "Cantex," or equal.

3. Flexible conduit fittings – "Raco," "T & B," "OZ Gedney," or equal.

4. PVC Coated Metallic Conduit fittings - "Plasti-Bond Red" as manufactured by Robroy Industries, "OCAL-Blue" as manufactured by Ocal, Inc., Perma-Cote Supreme by Perma-Cote Industries, or equal.

2.02 MATERIALS

A. Rigid Steel Conduit

1. Rigid steel conduit and fittings shall be of mild steel piping, galvanized inside and out, and shall conform to UL standards. The conduit and fittings shall be listed and labeled by a NRTL. The galvanized coating of zinc shall be of uniform thickness applied by the hot-dipped process and shall be applied also to the threads. It shall be further dipped in a chromic acid bath to chemically form a corrosion resistant protective coating of zinc chromate which has a characteristic yellow-green color. Each piece of conduit shall be straight, free from blisters and other defects, cut square, and taper reamed. It shall be delivered with plastic protectors on the threads.

2. Expansion fittings shall be provided on all runs penetrating exterior building walls, floor slabs on grade, tunnel walls from interior to exterior locations, and conduits that transition from below grade to above grade.

3. Expansion joints shall be provided in the center of each above grade of 100 feet.

B. Polyvinylchloride (PVC) Conduit

1. PVC conduit and fittings shall be Schedule 40, 80 heavy wall, or thin wall, as indicated in these Specifications manufactured to conform to UL standards. It shall be listed and labeled by a NRTL. It shall have at least the same temperature rating as the conductor insulation.

2. Expansion joints shall be provided in the center of each above grade of 100 feet. PVC systems shall be 90 degrees Celsius minimum NRTL rated, have a tensile strength of 7,000 psi @ 73.4 degrees Fahrenheit, flexural strength of 11,000 psi and compressive strength of 8,000 psi.

3. Expansion fittings shall be provided on all runs penetrating exterior building walls, floor slabs on grade, tunnel walls or tunnel ceilings from interior to exterior locations, and conduits that transition from below grade to above grade.

C. Liquid-Tight Flexible Metal Conduit

1. Liquid-tight flexible conduit (LFMC) shall be aluminum, single strip, with a copper strip interwoven and suitable as a grounding means. LFMC shall be UL or other NRTL listed. LFMC shall have an extruded moisture and oil-proof PVC jacket.

2. PVC coated or stainless-steel watertight connectors shall be used with liquid-tight flexible metal conduit on both ends.

3. Expansion fittings shall be provided on all runs penetrating exterior building walls, floor slabs on grade, tunnel walls from interior to exterior locations, and conduits that transition from below grade to above grade.

1. Flexible conduit shall not exceed 5'-0" in length.

D. Aluminum Conduit

1. Aluminum conduit shall be extruded from alloy 6063 and shall be the rigid type, non-toxic, corrosion resistant, and non-staining. It shall be manufactured per UL standards as well as listed/labeled by same.

2. Fittings, boxes, and accessories used in conjunction with aluminum conduit shall be die cast, copper free type. They shall be resistant to both chemical and galvanic corrosion. All covers shall have neoprene gaskets.

3. All aluminum conduit used for this project shall be UL listed for the purpose.

E. PVC Coated Metallic Conduit

1. PVC coated rigid aluminum conduit (PCMC) shall be rigid aluminum conduit covered with a bonded 40 mil (minimum) thickness PVC jacket and coated inside with urethane. The conduit shall comply with NEMA RN-1.

F. Conduit Fittings

1. Rigid Steel Conduit Fittings

a. Standard threaded couplings, hubs, locknuts, bushings, and elbows made only of steel. Malleable iron are NOT acceptable.

b. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.

c. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.

d. Set Screw or Compression Fittings: Not Permitted.

e. Sealing fittings: EATON EYSR with ECD-15 drain or equal. Solid bodies that cannot be split open and re-used are not acceptable. Use continuous drain type sealing fittings to prevent passage of water vapor. Sealing compound must be installed within 2 hours on puling cable or wire through fitting. Under no circumstance shall fitting remain unsealed for longer than 2 hours after cable or wire is installed.

f. Fittings for PVC coated rigid conduit shall be manufactured by the maker of the conduit.

2. Rigid Aluminum Conduit Fittings

a. Standard threaded couplings, locknuts, bushings, and elbows: Steel or aluminum alloy materials. Cadmium or zinc plate steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited. Apply Noalox or equal antioxidant compound on all aluminum conduit threads.

b. Locknuts and bushings: As specified for rigid steel conduit. Apply Noalox or equal antioxidant compound on all aluminum conduit threads.

c. Set screw or compression fittings: Not permitted.

d. Sealing fittings: EATON EYSR with ECD-15 drain or equal. Solid bodies that cannot be split open and re-used are not acceptable. Use continuous drain type sealing fittings to prevent passage of water vapor. Sealing compound must be installed within 2 hours on puling cable or wire through fitting. Under

no circumstance shall fitting remain unsealed for longer than 2 hours after cable or wire is installed. Apply Noalox or equal antioxidant compound on all aluminum conduit threads.

3. Expansion and Deflection Couplings

   a. Accommodate 1.9 cm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30-degree angular deflections.

   b. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL, and the NEC code tables for ground conductors.

   c. Watertight, seismically qualified, corrosion-resistant, threaded for and compatible with rigid conduit.

   d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material and stainless-steel jacket clamps.

   e. Apply Noalox or equal antioxidant compound on all aluminum conduit threads.

PART 3 - EXECUTION

3.01 PREPARATION

A. Exterior underground metallic conduits shall be degreased, pretreated, and coated with 2 coats of Carboline 888 epoxy, or equal. Other finishes may be acceptable upon the Engineer's review.

3.02 INSTALLATION

A. Conduit

1. All conduit shall be installed in a first-class workmanship manner. It shall be installed in horizontal and vertical runs in such a manner as to ensure against trouble from the collection of trapped condensation and shall be arranged so as to be devoid of traps wherever possible. Special care shall be used in assuring that exposed conduit runs are parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. No open wiring is allowed except for submersible pump vendor cables terminating at transition junction box and no more than 10 feet from pump location.

2. Fittings or symmetrical bends shall be required wherever right angle turns are made in exposed work. Bends and offsets shall be avoided wherever possible, but where necessary, they shall be made with an approved conduit bending machine. All conduit joints shall be cut square, reamed smooth and drawn up tight, using couplings intended for the purpose. All threaded ends of conduits shall be coated with an approved conducting compound as manufactured by Thomas & Betts, or equal prior to making up the joint.

3. Conduits shall be securely fastened to all sheet metal outlets, junction and pull boxes with double galvanized locknuts, threaded hubs indoors, watertight threaded hubs outdoors, and insulating-grounding bushings. Runs of exposed conduit shall be supported in accordance with the NEC using strut. No conduit shall be supported directly to walls, floors or ceilings.

4. During construction, all conduit work shall be protected to prevent lodgement of dirt, plaster or trash in conduits, fittings or boxes. Conduits which have been plugged

shall be entirely freed of accumulations or be replaced. All conduits in floors or below grade shall be swabbed free of debris and moisture before wires are pulled. Crushed or deformed conduit shall not be permitted.

5. Where rigid metal conduit penetrates a floor slab, the conduit shall be painted with 2 coats of Koppers Bitumastic 300-M or equal to a point 6 inches above the penetration.
6. Conduit penetrations shall be sealed through concrete walls, floors and ceilings with 5000 psi non-shrink grout the entire depths of the penetration.

7. The final section of conduit connecting each motor or piece of utilization equipment subject to vibration shall be of the flexible type. Type "UA" shall be used in all process areas and in outdoor or wet locations.

8. Raceways that transition from interior to exterior locations and all raceway terminations into control panels, starters, or disconnects shall be sealed with Polywater FST foam duct sealant, no substitutions are acceptable. Provide condulet fitting within 36" of penetration to apply sealant to duct.

9. All conduit penetrations from below grade shall have expansion fittings installed at 18" above grade without exception.

10. Conduit expansion joints shall be required at building expansion joints and at each 100 foot of above grade straight conduit run in the center of run to ensure against conduit and/or cable damage due to settling or thermal expansion and contraction.

11. Unless specifically identified on the Drawings as "Direct Buried," all conduits in the earth, including conduits below slabs-on-grade, shall be concrete encased. Joints in conduit shall be staggered so as not to occur side by side. Rigid non-metallic (PVC) conduit shall be connected to PVC coated rigid steel conduit at the point before it leaves the ground, with the transition to metal conduit occurring inside the concrete encasement prior to the final 90. PVC coated rigid steel conduit may transition to non-coated conduit after exiting the encasement. The transition coupling between PVC coated conduit and non-coated conduit shall be PVC coated.

12. It is the general intent that boxes for switches, receptacles, etc. in or on the building be flush mounted with concealed conduit to the device, except in areas with concrete or masonry construction as the finished surface.

13. All metal raceway systems shall be grounding conductive, solidly bonded throughout and grounded in accordance with NEC requirements and/or as noted on the Contract Drawings. In addition, all raceway systems shall be provided with separate grounding conductors.

14. **Minimum conduit size shall be 3/4 inch unless otherwise indicated or if instrument attachment hub requires smaller conduit.**

15. The minimum burial depth of the top of conduit shall be 30"

16. Wire pulling shall be facilitated by the use of a UL approved pulling compound in pulls over 30 feet in length or where there are 2 or more 90 degree bends. Only polypropylene, nylon, or manila pulling ropes will be permitted. **Standard industry recognized wire pulling equipment shall be used.**

17 Areas of use for each type of conduit:

Location	Schedule 40 PVC	Schedule 80 PVC	Aluminum	PCMC

Electrical Room – Exposed		X	X
Tunnels – Exposed		X	X
Exterior Exposed			X
Exterior Underground, Underslab, or In Slab		PVC Coated	
Exterior Underground Service Entrance (Primary and Sec.)	X	PVC Coated	

18. All conduit shall have an insulated ground wire pulled to all equipment and receptacles.

19. All raceway runs are shown diagrammatically to outline the general routing of the raceway. The installation shall be made to avoid interference with pipes, ducts, structural members or other equipment. Should structural or other interference prevent the installation of the raceways, or setting of boxes, cabinets, or the electrical equipment, as indicated in the Drawings, deviations must be approved by the Owner, and after approval, shall be made without additional charges and shown on the Record Drawings.

20. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.

21. No conduit shall be run exposed across roofs without first obtaining permission from the Engineer.

22. Conduit may be run inside concrete slabs as long as the slab is at least 6-inches thick and conduit will have at least 1 2-inches of cover on both sides.

23. Runs of flexible conduit above accessible ceilings shall be limited to 10 ft. Runs of exposed flexible conduit shall be limited to 6 ft. All runs of flexible conduit shall be supported in accordance with NEC requirements.

24. All PVC coated conduit shall be installed in accordance with manufacturer's instructions. The Contractor shall use tools that are specifically suited for coated conduit systems. The use of pipe wrenches and other such tools on PVC coated RGS conduit is prohibited. The Engineer and Owner reserve the right to reject any installation of coated conduit that does not meet the requirements of the Section or the manufacturer's instructions. The Engineer and Owner also reserve the right to reject any installation that exhibits damage due to the improper use of tools. All rejected installations shall be replaced by the Contractor at no additional cost to the Owner. The use of PVC coated conduit repair compounds to repair damages or improper installation is prohibited.

25. All Contractor personnel that install PVC coated RGS conduit shall be trained by the PVC coated RGS conduit manufacturer. Training shall include proper conduit system assembly techniques, use of tools appropriate for coated conduit systems, and field bending/cutting/threading of coated conduit. The Contractor shall furnish evidence of such training as specified herein. Training shall have been completed within the past 24 months prior to the Notice to Proceed on this Contract for all coated conduit installation personnel. Contractor personnel not trained within this timeframe shall not be allowed to install coated conduit or shall be trained/re-trained as required prior to commencement of conduit installation.

26. Sealing fittings shall be installed where conduits pass from non-hazardous locations to hazardous locations and as required by Chapter 5 of the NEC. For class I Division 2 areas, only retrofit EYSR type fittings with ECD-15 drains are to be used. Fittings shall be sealed within 2 hours after wire pull to prevent migration of moisture and fumes.

27. All raceways for instrumentation, ethernet and fiber optic communication systems shall use Mogul style pulling elbows above grade and log sweep factory 90's below grade

28. No more than three (3) 90 degree bends (maximum 270 degrees total) will be allowed in any one conduit run. Where more bends are necessary, a condulet or pull box shall be installed.

29. Weatherproof, aluminum, insulated throat "Meyers" hubs shall be used on all conduit entries to boxes and devices without integral hubs in process areas to maintain NEMA 4X integrity. The Contractor shall furnish and install Meyers" hubs on all conduit entries into non-cast enclosures such as metallic or non-metallic control panels, control equipment enclosures, wireways, pull boxes, junction boxes, control stations, and similar type equipment when this type of equipment is located in process areas requiring NEMA 4X integrity. This requirement for "Meyers" hubs does not apply to any areas of the plant facilities where NEMA 4X integrity is not required.

END OF SECTION

SECTION 16131 - BOXES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Outlet and junction boxes shall be furnished and installed where indicated on the Contract Drawings. Additionally, boxes shall be provided as required as required by the work in accordance with the NEC.

1.02 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE INFORMATION

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted per Section 01300.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Boxes – "Wiegmann," "Appleton," "Raco," "Crouse-Hinds," "Hoffman," "Robroy Industries," "Spring City," "Carlon," or equal.

2.02 GENERAL

A. All junction and/or pull boxes for dry (non-corrosive) areas shall be of code gauge sheet metal construction, of the inside dimensions as required by code, with hinged covers.

B. Outlet boxes for wet or damp locations shall be cast metal, rust and corrosion resistant (NEMA 4X), with at least 5-1/2 full threads for each (bossed) conduit opening, and shall be suitable for surface mounting as required with drilled external, cast mounting extensions (bossed to provide at least 1/8" between back of box and mounting surface for drainage). Box covers shall be hinged of the same material as the box and provided with stainless steel (rustproof) hardware.

C. Junction and/or pull boxes for out-of-doors use or indoor process areas and tunnels, not mounted in concrete, shall be stainless steel (NEMA 4X), waterproof, rustproof, rain and sleetproof, with hinged covers and latches and provided means of locking by means of keyed locks, tamper-resistant screws or padlocking as required and with clamping cap-screws top and bottom door edges to provide firm contact with gasketing. All gaskets shall be molded (unbroken) neoprene or butyl rubber. Where door and box meet to form sealed opening, a 1/8"-1/4" lip shall be present to deflect water around seal. All boxes over 6 inches in width shall have a 1 inch rain cover on top extending past the face of the door.

D. NEMA 4X junction and/or pull boxes may be 316 stainless steel.

E. Underground junction or pull boxes shall be constructed of reinforced concrete cast-in-place or prefabricated with a minimum AASHTO H-25 rating. Lids shall be AASHTO H-25 galvanized steel.

F. Junction boxes for use in wet-wells and other hazardous areas shall be watertight, rustproof and corrosion resistant, and explosion proof with threaded conduit openings (5-1/2 full threads - minimum) and provided with rustproof hardware.

G. Explosionproof sealing fittings shall be furnished and installed in accordance with NEC requirements. Fittings shall be aluminum and shall be split (EYSR) construction type with EC-15 drains. Drains shall be installed at the lowest point.

H. Junction and/or pull boxes for chemical storage and transfer areas shall be Schedule 80 PVC where Schedule 80 PVC conduit is specified in 16130. When conduits leave the chemical area they shall immediately transition to metal.

PART 3 - EXECUTION

3.01 INSTALLATION, APPLICATION, AND ERECTION

A. General

1. Outlets shall be installed in the locations shown on the Contract Drawings. The Contractor shall study the general building plans in relation to the space surrounding each outlet, in order that his work may fit the other work required by these Specifications. When necessary, the Contractor shall relocate outlets so that when fixtures or other fittings are installed, they will be symmetrically located according to room layout and will not interfere with other work or equipment.

2. All supports for outlet boxes shall be furnished and installed by the electrical trades. Boxes shall NOT be mounted directly to surfaces. All boxes shall be mounted to strut.

B. Exposed Work

1. Outlet or junction boxes for use with exposed aluminum conduit shall be copper free, cast aluminum type.

2. Outlet or junction boxes for use with exposed PVC conduit shall be PVC.

C. Pull Boxes

1. Pull boxes for exterior underground work are shown on the Contract Drawings and are the minimum number required. Others may be added at the Contractor's option, but no extra pay shall be allowed. Interior pull boxes are not shown but shall be used as needed. Pull box types are as follows:

Exterior	-	Per detail on the Contract Drawings.
Interior	-	Interior pull boxes in dry areas shall be of code gauge steel of not less than the minimum required by the NEC and shall be provided with hinged covers. In wet areas or pipe galleries, they shall be rated watertight, of stainless steel, cast aluminum, PVC, fiberglass, or equal. Hardware shall be stainless steel.

E. Openings in Electrical Boxes

1. All openings in electrical equipment, enclosures, cabinets, outlet and junction boxes shall be by means of welded bosses, standard knockouts, or shall be sawed, drilled, or punched with tools specially made for the purpose. The use of a cutting torch is prohibited. Unused openings shall be plugged per the NEC.

END OF SECTION

SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Wiring devices shall be installed where indicated on the Contract Drawings.

1.02 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE INFORMATION

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted per Section 01300.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. "Hubbell," "Eagle," "General Electric," "Wiremold," "P&S," "Leviton," "Daniel Woodhead," or equal.

2.02 EQUIPMENT

A. Receptacles

1. Twin-convenience - outlet (interior) – "Hubbell" cat. no. 5362, or equal.

2. Twin-convenience - outlet (exterior) – "Hubbell" cat. no. 5362 with Taymac Corporation or Intermatic, Inc. safety outlet enclosure.

3. Special purpose outlet - Per equipment requirements.

4. Ground fault interrupting receptacles shall be required where shown on the Contract Drawings, and shall be indicated by the abbreviation "GFI" beside the circuit symbol on the Contract Drawings. They shall be rated 20 amps (125 volts) and shall be of the duplex, feed through type, capable of protecting all downstream receptacles on the same circuit. They shall be UL listed and interrupt the current between 4-6 milliamps of ground fault leakage. Appropriate plates shall be furnished and installed. The 20 ampere rating shall apply not only to device internals but to the faceplate as well.

B. Plates and Covers

1. Furnish and install plates of the appropriate type and size for all wiring and control devices, signal and telephone outlets.

2. All plates on flush and surface mounted boxes shall be of 302 stainless steel (nonmagnetic) with rounded or beveled edges, except where weatherproof covers are shown. All device plate screws shall be nylon or stainless steel with countersunk heads. Plates shall be installed vertically and with an alignment tolerance of 1/16 inch. Device plates shall be of the one-piece type, of suitable shape for the devices to be covered. Plates shall have a smooth finish with no crevices to collect dirt. Oversize plates are not acceptable.

3. Covers for boxes serving equipment where flexible conduit is to be tapped into cover plates shall be sheet metal drilled for conduit. Gaskets shall be required as well as all special adapters for mounting.

C. Wall Switches (Tumbler Type)

1. Single pole (interior) – "Hubbell" cat. no. 1221, or equal.

2. Single pole (exterior) – "Hubbell" cat. no. 1222, or equal, and Hubbell 1795 or equal plate.

3. 3-way switches (interior) – "Hubbell" cat. no. 1223, or equal.

4. 4-way switches (interior) – "Hubbell" cat. no. 1224, or equal.

5. Outside receptacles shall be labeled for the purpose.

PART 3 - EXECUTION

3.01 INSTALLATION/APPLICATION/ERECTION

A. Wall Switches

1. Wall switches shall be mounted at a height as indicated in Section 16050, unless otherwise noted on the Contract Drawings.

B. Receptacles

1. Outlets shall be located as shown on the Contract Drawings. Where located in special interior finishes, they shall be properly centered. Boxes shall be of the type noted and accepted for the specific installation.

2. Furnish and install receptacle circuits where called for on the Contract Drawings and/or by these Specifications. Circuits shall be installed in conduit from panel to receptacle, with flush mounted boxes except as noted on the Contract Drawings.

3. Receptacles and lighting circuits shall not be combined on the same overcurrent device. For runs over 75 feet or for 30 amp receptacles, minimum wire size shall be AWG No. 10.

4. Receptacles for specific devices (i.e., air conditioner), shall be rated at the correct voltage and amperage for that unit.

5. The minimum free length of conductor at each box for the connection of a fixture, switch or receptacle shall be 8 inches. All connections shall be made mechanically and electrically secure.

6. Receptacles shall be duplex type, rated at 20 amps, 125 volts, brown colored, unless otherwise noted. Mounting height shall be as specified for low outlets in Section 16050. All receptacles shall be of the grounding type.

7. Receptacles over workbenches or countertops or at medium or high mountings shall be mounted so that the grounding slot is below the neutral and hot. All other receptacles shall be mounted with the grounding slot above the neutral and hot.

8. Exterior weatherproof receptacles, shall be weatherproof while in use. This requirement shall apply on all outdoor units and on others as indicated on the Drawings. To meet this requirement, appropriate safety outlet covers as manufactured by Taymac Corporation, Intermatic Guardian Series, or equal shall be utilized in these areas.

END OF SECTION

SECTION 16150 - WIRE CONNECTIONS AND CONNECTING DEVICES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Wire connection and connecting devices shall be as herein specified.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Connectors, Lugs, etc. – "T & B", "Anderson", "Burndy", or equal.

B. Termination and splice connectors – "3M Scotchlok", "Anderson", "T & B", "Burndy", or equal.

2.02 MATERIALS

A. Wire Splicing and Terminations (600 Volts and Below)

1. Electrical Terminal and Splice Connectors (#22 - #4 AWG)

   a. Terminals and splice connectors from #22 - #4 AWG shall be compression types with barrels to provide maximum conductor contact and tensile strength. Performance, construction, and materials shall be in conformance with UL standards for wire connectors and rated for 600 volts and 105 degrees Celsius.

   b. Connectors shall be manufactured from high conductivity copper and entirely tin plated. Terminal barrels shall be serrated on the inside surface and have a chamfered conductor entry. Terminals shall have funnel entry construction to prevent strand fold-back. All barrels shall be brazed seam or seamless construction.

   c. Spade type terminals shall be sized for the appropriate stud and shall be locking type that snap firmly onto studs with a close fit for maximum retention. Spade type terminals shall be insulated with an insulation suitable for maintaining a high dielectric strength when crimped and be made form nylon, PVC, or equal.

2. Electrical Lugs and Connectors (#6 AWG - 1000 Kcmil)

   a. Lugs and splice connectors from #6 AWG - 1000 Kcmil shall be compression types with barrels to provide maximum conductor contact and tensile strength. They shall be manufactured from high conductivity copper and entirely tin plated. They shall be crimped with standard industry tooling. The lugs and connectors must have a current carrying capacity equal to the conductors for which they are rated and must also meet all UL requirements. All lugs above 4/0 AWG shall be 2 hole lugs with NEMA spacing. The lugs shall be rated for operation through 35 KV. The lugs shall be of closed end construction to exclude moisture migration into the cable conductor.

3. Twist-on Wire Connectors (#22 AWG - #10 AWG)

   a. All twist-on wire connectors must have a corrosion resistant spring that is free to expand within a steel jacket. The steel jacket must be insulated with a flexible vinyl jacket capable of withstanding 105 degrees Celsius ambient temperatures and of sufficient length to cover wires that are inadvertently overstripped.

b. Each connector size must be listed by UL for the intended purpose and color coded to assure that the proper size is used on the wire combinations to be spliced. The connectors must be compatible with all common rubber and thermoplastic wire insulations.

4. Solderless/re-usable lugs shall be used only when furnished with equipment such as control panels, furnished by others, where specification of compression type lugs is beyond the Contractor's control. In the event their use is necessary, the Contractor shall be responsible for assuring that they are manufactured to NEMA standards, with proper number and spacing of holes and set screws.

PART 3 - EXECUTION

3.01 INSTALLATION, APPLICATION, & ERECTION

A. Insulation of Splices and Connections

1. Connections/splices with a smooth even contour shall be insulated with a conformable 7 mil thick vinyl plastic insulating tape which can be applied under all weather conditions and is designed to perform in a continuous temperature environment up to 105 degrees Celsius. The tape shall have excellent resistance to abrasion, moisture, alkalies, acids, corrosion, and varying weather conditions (including sunlight). The tape shall be equal to Scotch 33+ and shall be applied in conformance with manufacturer's recommendations. In addition, it shall be applied in successive half-lapped layers with sufficient tension to reduce its width to 5/8 of its original width. The last inch of the wrap shall not be stretched.

2. Connections/splices with irregular shapes or sharp edges protruding shall be first wrapped with 30 mil rubber tape to smooth the contour of the joint before being insulated with 33+ insulating tape specified in the previous paragraph. The rubber tape shall be high voltage (69 KV) corona-resistant based on self-fusing ethylene propylene rubber and be capable of operation at 130 degrees Celsius under emergency conditions. The tape must be capable of being applied in either the stretched or unstretched condition without any loss in either physical or electrical properties. The tape must not split, crack, slip, or flag when exposed to various environments. The tape must be compatible with all synthetic cable insulations. The tape must have a dissipation factor of less than 5 percent at 130 degrees Celsius, be non-vulcanizing, and have a shelf life of a least 5 years. The rubber tape shall be applied in successive, half-lapped wound layers and shall be highly elongated to eliminate voids. Other manufacturer's recommendations on installation shall be adhered to. The rubber tape shall be equal to Scotch 23 or 130C electrical splicing tape.

3. Splices made in wet or damp locations shall be made submersible and watertight with special kits made for the application and compatible with type of cables employed.

B. Connection Make-up

1. Connections of lugs to bus bars, etc., shall be made up with corrosion resistant steel bolts having non-magnetic properties with matching nuts, and shall utilize a Belleville spring washer (stainless steel) to maintain connection integrity. Connections shall be torqued to the proper limits. Prior to bolting up the connection, electrical joint compound shall be brushed on the contact faces of the electrical joint.

2. All motor lead connections shall be made up to match the type of lead furnished on the motor. If the lead is not lugged, then twist-on wire connectors may be used. To

prevent possible vibration problems, twist-on connectors shall be taped after installation.

3. All lugged motor lead connections (excluding motors over 200 horse-power) shall be made up using ring tongue compression lugs with proper size stainless steel nuts and bolts. Belleville type spring shall be used to maintain tension on the connections. The connections shall then be insulated using the procedure described for irregular shapes, utilizing rubber tape in conjunction with vinyl electrical tape.

4. At the time of final inspection, the Engineer may request the Contractor to disassemble 3 randomly selected motor lead connections in the Engineer's presence, to assure conformance with these Specifications.

5. The Contractor shall include all necessary tools, materials, and labor in his bid for disassembly of the connections and for remaking them with new insulating materials after inspection.

END OF SECTION

SECTION 16170 – SAFETY SWITCHES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide horsepower-rated, quick-make, quick-break, safety switches provided with the number of poles and fuses as required. When used with variable speed drives, provide auxiliary contacts to open before switch opens and e-stop with red mushroom head on cover. Wire e-stop and auxiliary contact in series.

1.02 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE INFORMATION

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted per Section 01300.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS/EQUIPMENT

A. Safety switches shall be as manufactured by Square D Company.

B. Switches shall be NEMA Type HD, single-throw, externally operated, non-fused or fused with Class R fuse clips.

C. Switches shall have arc shields, shall be of enclosed construction and fusible or non-fusible as indicated. Switches shall be rated for either 250-volt AC or 600-volt AC service as required.

D. All switches shall be capable of interrupting locked rotor current of motor which it serves.

E. Enclosures shall be NEMA-4X stainless steel unless noted otherwise.

F. Provide dual-element Bussman type FRN (250 volt) or type FRS (600 volt) fuses for any fusible safety switch serving a motor circuit.

G. For non-motor loads, provide dual element Bussman type LPN (250 volt) or type LPS (600 volt).

H. All switches shall be capable of being padlocked in either the "On" or "Off" position.

I. Safety switches shall be provided with auxiliary contacts where indicated on Contract Drawings.

J. Safety switches shall be UL listed and shall conform to NEMA Standards. NEMA 4X enclosed safety switches where called for shall be 316 stainless steel. Enclosures for switches located in sodium hypochlorite storage or transfer areas shall be NEMA 4X non-metallic.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide non-fusible switches at remote motor locations as indicated on drawings.

B. Provide fusible disconnects at package A/C units, fused as specified on unit nameplate.

C. Mount switches to walls or to equipment enclosures with a minimum of 4 bolts using toggle anchors for masonry construction, Phillips "Red Head" anchors for poured concrete construction and bolts, jumbo washers, lock washers and nuts for equipment enclosure mounting.

D. All safety switches to be identified with nameplates per Section 16075.

END OF SECTION

SECTION 16220 - MOTORS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Motors are to be furnished with driven equipment except where otherwise noted on the Contract Drawings or elsewhere in this Division of the Specifications. All motors shall conform to the following Specifications and any special requirements of the driven equipment. Special requirements of the driven equipment shall take precedence over these Specifications should a discrepancy occur. Starting torque and slip ratings shall conform to the requirements of the driven equipment.

B. Polyphase motors shall be of the squirrel cage induction type and single phase of the capacitor start-induction run type except as otherwise noted. Conduit boxes shall be tapped for the size conduit shown on the Contract Drawings.

C. All motors shall be manufactured and installed in accordance with applicable NEMA standards and NEC provisions, latest revisions.

1.02 DELIVERY, STORAGE, & HANDLING

A. All electrical motors shall be protected against the accumulation of moisture, dust and debris and physical damage during the course of installation of the job.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Motors – "General Electric", "Westinghouse", "U.S. Motors", "Gould Century", "Lincoln", "Baldor", "Marathon", "Reliance", "Magnatek", "Siemens", or equal.

2.02 EQUIPMENT

A. Motors 200 Horsepower and Under for Service Under 600 Volts

1. Ratings and Electrical Characteristics

a. Time: All motors shall be rated for continuous duty.

b. Temperature: Based on NEMA standards for a maximum ambient temperature of 40 degrees Celsius and an altitude of 3,300 feet or less, according to service factor and insulation class employed.

c. Voltage: All motors shall be 460-volt, 3-phase, inverter duty, and explosion proof for rated environments. All motors shall be capable of normal operation at balanced voltages in the range of ±10 percent from rated winding voltage.

d. Frequency: All a-c motors shall be rated for 60 Hz. operation. All motors shall be capable of normal operation at frequencies 5 percent above or below the nominal rating of 60 Hz.

e. Horsepower: Horsepower of the motors shall be as given in the Specification Division on the driven equipment or as shown on the Contract Drawings. Submersible motors shall be allowed to be furnished even though the horsepower rating may not be in accordance with standard NEMA assignments. In many cases, the horsepower specified is a minimum

requirement and certain alternate manufacturers may require larger horsepower motors. The larger motor shall be furnished at no extra cost to the Owner.

f. Locked Rotor Current: Locked rotor current shall be in accordance with NEMA standards.

g. Efficiency and Power Factor: Efficiency and power factor shall be given consideration during Shop Drawing review. The ratings at full, 3/4, and 1/2 load shall be compared to similar motors manufactured by acceptable suppliers listed in these Specifications. Excessive variation shall be considered grounds for rejection.

h. Speed: Synchronous speed of motors shall correspond to standard NEMA ratings. Actual speed shall be as given in the Specification Division on the driven equipment. Slip shall not exceed 5 percent at full load.

i. Service Factor: The service factor shall be 1.15 unless requirements of the driven load necessitate a higher service factor. The service factor for inverter duty rated motors shall be 1.0.

j. Insulation Class: Insulation shall be NEMA Class H, except as otherwise noted. Submersible motors shall be Class H, and inverter duty motors to be operated at variable speed shall be Class H. Motors shall operate at a Class B rise at nameplate horsepower loading regardless of Insulation Class.

k. Design Level: Motors shall be NEMA design B, except as otherwise noted.

l. Enclosure: Motors for process equipment 2 HP and smaller shall be totally enclosed. All motors for process equipment larger than 2 HP shall be TEFC (totally enclosed fan cooled), suitable for use indoors or outdoors, except as otherwise noted. Totally enclosed non-ventilated (or air-over) motors may be used for ventilators and other auxiliary equipment that by virtue of the load are provided with more than adequate ventilation. ODP (open dripproof) motors may be used for ventilators where the motor is outside the air stream yet still protected from the weather. Division 15 of the Specifications and the HVAC Contract Drawings will detail the type of enclosure required for ventilators. Submersible motors shall be air or oil filled and of watertight construction. Motors used in classified atmospheres shall be properly rated for that hazard.

m. Frame Size: Frame designations shall be in accordance with NEMA standards.

n. Winding Overtemperature Sensors: All motors 15 horsepower and over shall be provided with motor winding thermostats. The devices shall be hermetically sealed, snap-acting thermal switches, actuated by a thermally responsive bi-metallic disk. A minimum of 1 per phase is required, with switches wired into the control circuit of the starter to provide deenergization should overheating threaten. All submersible motors shall be equipped with motor winding thermostats.

o. All submersible pump/motor assemblies shall be equipped to detect presence of moisture and alarm at the controller.

p. Motors specified for operation with variable frequency drives shall be inverter duty and shall be designed to output 100 percent of nameplate horsepower under continuous duty service without exceeding the temperature rise specified herein when controlled by the actual drives furnished. Inverter duty motors

shall be designed to operate down to 10% of full load speed without the need for a line powered cooling fan.

2. Mechanical Characteristics

   a. Integral Horsepower Motor Construction

      1) Motor frames for horizontal motors shall be cast iron, heavy fabricated steel, or cast aluminum (alloy 356 or 360). A steel insert ring shall be set into the aluminum alloy endshield when cast to minimize wear of the bearing support. **Aluminum alloy motors shall not be used in areas where exposed to chlorine gas.**

      2) Motor frames for vertical motors shall be cast iron, heavy fabricated steel, or extruded aluminum (alloy 6063-T4 or 6063-T6). Endshields for vertical motors **must** be cast iron.

      3) If an aluminum frame is used, the endshields and/or all other steel hardware must be plated with zinc or cadmium and coated with grease before assembly to minimize the galvanic action between the steel and aluminum.

      4) Motor frames and endshields shall be of such design and proportions as to hold all motor components rigidly in proper position and provide adequate protection for the type enclosure employed. Lifting lugs of all motors shall conform to NEMA standards.

      5) Windings shall be random or form wound, adequately insulated and securely braced to resist failure due to electrical stresses and vibration. If the windings are aluminum, there shall be a cold welded aluminum-copper transition joint at the termination of the windings to permit the use of standard copper to copper connection techniques by the electrician and to prevent galvanic action between the copper power wires and the aluminum windings.

      6) The motor shaft shall be made of high grade machine steel or steel forging of size and design adequate to withstand the load stresses normally encountered in motors of that particular rating. Bearing journals shall be ground and polished.

      7) Rotors shall be made from high grade steel laminations adequately fastened together and to the shaft. Rotor cage windings may be cast aluminum of bar type construction with brazed end rings.

      8) Integral horsepower motors shall be equipped with cone, roller, or ball bearings made to AFBMA standards, Grade 1 and shall be of ample capacity for the motor ratings. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent relubrication (ten years normal operation without lubrication), but facilities shall be provided for adding new lubricant and draining out old lubricant without motor disassembly. The bearing housing shall have long, tight running fits or rotating seals to protect against the entrance of foreign matter into the bearings or leakage of lubricant out of the bearing cavity.

9) See the specification division relating to each piece of motor driven equipment for additional motor requirements to those listed above.

b. Fractional Horsepower Motor Construction

1) Motor and shell shall be rigid welded steel designed to maintain accurate alignment of motor components and provide adequate protection. End shields shall be reinforced, lightweight, die cast aluminum. Windings shall be of varnish insulated wire with slot insulation of polyester film and baked on bonding treatment to make the stator winding strongly resistant to heat, aging, moisture, electrical stresses, and other hazards. Motor shafts shall be made from high grade, cold rolled, shaft steel with drive shaft extensions carefully machined to standard NEMA dimensions for shaft coupled drive connection. Bearings shall be carefully selected precision ball bearings with extra quality, long life grease and large reservoir providing 10 years normal operation without relubrication, AFBMA Grade 1.

c. Submersible Motor Construction

1) See Equipment Specifications.

3. Tests, Nameplates, and Shop Drawings

a. Tests

1) Tests shall be required on integral horsepower motors only. A factory certified test report of "electrically duplicate motors previously tested" shall be supplied on all motors under 200 horsepower. The test shall be certified by the factory and shall contain a statement to the effect that complete tests affirm the guaranteed characteristics published in the manufacturer's catalogs or descriptive literature.

2) Tests will be in accordance with IEEE test procedures.

b. Nameplates

1) Each motor shall have a permanently affixed nameplate of brass, stainless steel, or other metal of durability and corrosion resistance. The data contained on the nameplate shall be in accordance with NEMA standards.

c. Shop Drawings

1) Shop Drawings shall consist of motor dimensions, nameplate data from each motor and tests as outlined above. Also included shall be efficiency and power factor at 100, 75, and 50 percent load. Operation, maintenance, and lubrication information (including bearing catalog numbers) shall be submitted with Shop Drawings for review.

4. Efficiency Requirements

a. The following motor full load efficiency requirements shall be met as a minimum for totally enclosed 3 phase integral horsepower motors, per NEMA test methods:

Horsepower	Nominal 3600 RPM (Minimum %)	Nominal 1800 RPM (Minimum %)	Nominal 1200 RPM (Minimum %)
1	75.5	82.5	80.0
1.5	82.5	84.0	85.5
2	84.0	84.0	86.5
3	85.5	87.5	87.5
5	87.5	87.5	87.5
7.5	88.5	89.5	89.5
10	89.5	89.5	89.5
15	90.2	91.0	90.2
20	90.2	91.0	90.2
25	91.0	92.4	91.7
30	91.0	92.4	91.7
40	91.7	93.0	93.0
50	92.4	93.0	93.0
60	93.0	93.6	93.6
75	93.0	94.1	93.6
100	93.6	94.5	94.1
125	94.5	94.5	94.1
150	94.5	95.0	95.0
200	95.0	95.0	95.0

Open Motors where specified shall also comply with NEMA efficiency minimums.

b. Motors shall be energy efficient type to comply with requirements of the Energy Policy Act of 1992.

B. Motors Over 200 Horsepower for Service Under 600 Volts (Not Used)

PART 3 - EXECUTION

3.01 INSTALLATION/APPLICATION/ERECTION

A. Installation of motors shall comply with motor manufacturer's instructions as well as applicable NEMA recommendations and requirements of the driven equipment OEM (original equipment manufacturer).

B. Motors shall be aligned to acceptable tolerances and shall not vibrate excessively.

C. Motors shall not be energized until they have been accepted by the OEM start up personnel.

END OF SECTION

SECTION 16280 – SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 REQUIREMENTS

A. The Contractor shall furnish, install, and place in satisfactory operation, the surge protective devices (SPD) as specified herein.

B. Surge protective devices shall be provided as a stand-alone unit, separate from the enclosure of the equipment to which they are connected or as integrally mounted devices as noted on the Contract Drawings.

1.02 CODES AND STANDARDS

A. The surge protective device shall be designed, manufactured, and listed to the following standards:

1. Underwriters Laboratories, Inc. (UL)

   a. UL1449 3rd Edition: Surge Protective Devices

   b. UL1283 5th Edition: Electromagnetic Interference Filters

2. American National Standards Institute (ANSI)/Institute of Electrical & Electronic Engineers (IEEE)

   a. C62.41.1: 2002 Guide for Surge Voltages in Low-Voltage AC Power Circuits

   b. C62.41.2: 2002 Recommend Practice on Characterization of Surges in Low Voltage (100V and Less) AC Power Circuits.

   a. C62.45: 2002 IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits

   b. C62.62: 2000 IEEE Standard Test Specifications for Surge Protective Devices for Low Voltage (1000V and Less) AC Power Circuits

3. National Electric Code (NEC), Latest Edition

1.03 TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Witnessed Shop Tests

   a. None required.

2. Certified Shop Tests and Reports

   a. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA, ANSI, and UL standards.

   b. All surge protective devices, subassemblies, and components shall be 100% tested and certified by the manufacturer to meet their published performance parameters.

3. Field Tests

   a. None required.

1.04 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE INFORMATION

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted per Section 01300.

1. Shop Drawings
2. Operation and Maintenance Manuals
3. Spare Parts List
4. Special Tools List
5. Reports of ShopTests

1.05 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for re-submittal.

C. Drawings submitted by the manufacturer shall be complete and documented to provide the Owner with operations and maintenance capabilities.

D. Shop drawings for each SPD shall include but not be limited to:

1. Product Data Sheets.
2. Detailed drawings showing weights and dimensions.
3. Wiring diagrams showing field connections.
4. Proof that all products provided under this Section are UL listed and labeled by Underwriters Laboratories to UL1449 3rd Edition. This proof shall be a copy of the data listed under the UL File Number for the manufacturer, which may be obtained from the UL Online Certification Directory. No other means of proving compliance (such as manufacturer data sheets, marketing material, etc) will be considered acceptable.
5. Proof of Short Circuit Current Ratings (SCCR), Voltage Protection Ratings (VPRs) for all modes, Maximum Continuous Operating Voltage rating (MCOV), Nominal Discharge Current (In), and device listing Type shall be submitted using the same means as described in the paragraph above.
6. Proof that all products provided under this Section are UL listed and labeled by Underwriters Laboratories to UL 1283 5th Edition. This proof shall be a copy of the data listed under the UL File Number for the manufacturer, which may be obtained from the UL Online Certification Directory. No other means of proving compliance (such as manufacturer data sheets, marketing material, etc) will be considered acceptable.
7. Warranty Information

E. The shop drawing information shall be complete and organized in such a way that the Engineer can determine if the requirements of these Specifications are being met. Copies of technical bulletins, technical data sheets from "Soft Cover" catalogs, and similar information which is "highlighted" or somehow identifies the specific equipment items the Contractor intends to provide are to provide are acceptable and shall be submitted.

1.06 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall submit operation and maintenance manuals.

1.07 TOOLS, SUPPLIES, AND SPARE PARTS

A. The SPDs and accessories shall be furnished with all special tools necessary to disassemble, service, repair, and adjust the equipment. All spare parts as recommended by the equipment manufacturer shall be furnished by the Contractor to the Owner.

B The Contractor shall furnish one (1) spare field replacement module of each rating provided under this Contract.

C. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

D. Spare parts shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such spare parts until completion of the Work, at which time they shall be delivered to the Owner.

E. Spare parts lists, included with the shop drawing submittal shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

F. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same part number.

1.08 IDENTIFICATION

A. Each SPD shall be identified by equipment name. A nameplate shall be securely affixed in a conspicuous place on each SPD.

1.09 TRAINING

A. The Contractor shall provide training for Owner personnel. Training shall be conducted by the manufacturer's factory trained specialists who shall instruct Owner personnel in operation and maintenance of all equipment provided under this Section. The training shall also include an overview of current SPD standards, as well as basic SPD operation and maintenance.

B. Provide the services of an experienced, factory trained technician or service engineer of the SPD manufacturer at the jobsite for minimum of 1/2 day for training of Owner personnel, beginning at a date mutually agreeable to the Contractor and the Owner.

1.10 WARRANTY

A. All SPDs, associated hardware, and supporting components shall be warranted to be free from defects in materials and workmanship, under normal use and in accordance with the instructions provided, for a period of five (5) years after acceptance of the equipment by the Owner.

B. Any component or subassembly contained within the surge protection system that shows evidence of failure or incorrect operation during the five (5) year warranty period, shall be replaced and reinstalled by the manufacturer at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 GENERAL

A. The SPD shall be UL 1449 3rd Edition Listed and must bear the 3rd Edition mark. Units that are "manufactured in accordance with" UL 1449 3rd Edition or tested by other testing agencies "in accordance with" UL 1449 3rd Edition are not acceptable and will be rejected.

B. The SPD shall be UL 1283 5th Edition Listed and must bear the UL mark. Units that are "manufactured in accordance with" UL 1283 5th Edition or tested by other testing agencies "in accordance with" UL 1283 5th Edition are not acceptable and will be rejected. Further, SPD units using UL 1283 capacitors but not tested to UL 1283 will be rejected.

C. SPDs shall be provided as a stand-alone unit, separate from the equipment to which they are connected.

D. All SPDs furnished and installed under this Contract shall be from the same manufacturer.

2.02 PRODUCTS

A. Type I surge protective devices (SPD) shall be furnished and installed. Type II SPDs are not acceptable.

B. Each SPD shall be rated for the voltage and configuration of the equipment to which it is connected.

C. Each SPD shall have UL 1283 5th Edition EMI/RFI filtering with minimum attenuation of -50dB at 100kHz.

D. The short circuit current rating of each SPD shall match or exceed the rating of the equipment to which it is connected. The Contractor shall reference the Pump Station Schedule for short circuit current rating of each piece of equipment.

E. Each SPD system shall provide surge protection in all possible modes. Surge protection shall be as follows:

SYSTEM CONFIGURATION	MODES OF PROTECTION	NUMBER OF MODES
3-Phase Wye	L-N, L-G, N-G	7
3-Phase Delta	L-L, L-G	6
3-Phase Impedence Grounded	L-L, L-G	6
Single-Phase	L-N, L-G, N-G	3

F. Each SPD shall have a Maximum Continuous Operating Voltage (MCOV) of at least 115% of the nominal voltage of the equipment to which it is connected.

G. The Nominal Discharge Current (I_n) of each SPD shall be 20kA. Peak surge current ratings shall not be used as a basis for applying the SPD to the system.

H. The Voltage Protection Rating (VPR) of each SPD shall not exceed the following:

SYSTEM VOLTAGE	L-N	L-G	L-L	N-G
208Y/120	700V	700V	1200V	700V
480Y/277	1200V	1200V	1800V	1200V
480 DELTA	N/A	1200V	2000V	N/A
240 DELTA	N/A	1200V	1200V	N/A
120/240	700V	700V	1200V	700V

I. The surge current rating for each SPD shall be as indicated on the Contract Drawings. Surge current rating indicated is on a per phase basis.

J. Each SPD shall be provided in an enclosure to match or exceed the NEMA rating of the equipment enclosure that it is serving (i.e. NEMA1, NEMA 12, NEMA 4X, etc).

K. Each SPD shall be provided with the following accessories:

1. Each individual module shall feature an LED indicating the individual module has all surge protection devices active. If any single component is taken off-line, the LED shall turn off and another LED shall illuminate, providing individual module as well as total system status indication.

2. Surge counter and audible alarm with reset/silence switch.

3. One set of Form C (SPDT) dry contacts rated for at least 5A at 120VAC.

L. SPDs shall be as manufactured by Eaton Electrical, Thor Systems, Advanced Protection Technologies (APT), or LEA International.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The SPD units shall be furnished and installed in accordance with the manufacturer's installation instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

B. The SPD units shall be mounted such that the conductor lengths are as short as possible, but no greater than 36 inches. Any installation resulting in a conductor length of greater than 36 inches shall be reviewed with the Engineer as a special type of cable may need to be installed. For equipment such as panelboards, the Contractor shall relocate the circuit breaker that is to be connected to the SPD as needed to achieve the shortest conductor length possible.

C. The Contractor shall use a close nipple to enclose the conductors between the SPD and the equipment served. However, if due to field conditions a 90 degree conduit bend is required to connect the SPD to the equipment that it serves, the bend shall have a minimum radius of 36 inches to eliminate any potential for sharp bends in the conductors.

D. Conductors between the equipment served and the SPD shall be 600V power wire and cable as specified in Section 16120 – Conductors and Cables. The individual conductors shall be gently twisted.

E. Prior to energizing, the Contractor shall verify that the SPD unit voltage and configuration is suitable for the system to which it is connected.

F. Prior to energizing, the Contractor shall also verify that any Neutral to Ground bonding jumpers are installed as required.

G. Prior to energizing, the Contractor shall also verify that the impedence of the equipment grounding conductor between the SPD and the grounding electrode system is less than 1 ohm.

END OF SECTION

SECTION 16440 - MOTOR CONTROL

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Contractor shall furnish and install motor control equipment as specified herein and as shown on the Drawings.

1.02 RELATED WORK

A. The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section (and shall be included in the bid by a single Instrumentation Supplier for this Project):

Section 16170 - Safety Switching
Section 16446 – Variable Frequency Drives
Section 16900 - Controls
Section 17410 - Basic Measurement and Control Instrumentation Materials and Methods
Section 17430 - Boxes, Panels and Control Centers
Section 17490 - Measurement and Control Commissioning

B. The following Divisions of these Specifications contain requirements on equipment furnished by other suppliers that must interface with the instrument system, or on methods and materials to be performed/used in the installation and/or wiring of the instrumentation system.

Division 1 - General Requirements
Division 11 - Equipment
Division 16 - Electrical

1.03 SUBMITTALS

A. Motor control equipment shall be new and the equipment of one manufacturer unless otherwise noted. Each component is specified by a particular trade name; however, this does not relieve the Contractor of the responsibility of submitting descriptive literature and Shop Drawings for review of all components.

B. Shop drawings, including layout drawings, complete schematic and composite wiring diagrams, control circuit wiring diagrams and descriptive literature shall be submitted to the Engineer for review. **Service manuals shall be submitted on all equipment and shall be bound in 3-ring loose leaf binders.** The manuals shall also include information on accessories such as timers, etc., built in the control center.

1.04 SERVICE OF MANUFACTURER'S REPRESENTATIVE

A. The Contractor shall provide the services of a qualified manufacturer's technical representative who shall adequately supervise the installation and testing of all equipment furnished under this Contract and instruct the Contractor's personnel and the Owner's operating personnel in its maintenance and operation as outlined elsewhere in Division 1. Manufacturer's Technician shall configure all equipment and settings. The services of the manufacturer's representative shall be provided for a period of not less than as follows:

1. One trip of one (1) working day during installation of the equipment for each motor controller type or as required.

2. One trip of one (1) working day after acceptance of the equipment.

3. One trip of one (1) working day during the warranty period.

B. Any additional time required to achieve successful installation and operation shall be at the expense of the Contractor. The manufacturer's representative shall sign in and out at the office of the Engineer's Field Representative on each day he is at the project.

1.05 TRAINING

A. The Contractor shall provide training for Owner personnel. Training shall be conducted by the manufacturer's factory trained specialists who shall instruct Owner personnel in operation and maintenance of all equipment provided under this Section and Section 16050.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Control Equipment

1. Allen Bradley

B. Timers

1. "Allen Bradley", or approved equal

2.02 MOTOR CONTROLLERS

A. General

1. Quality of built-in transformers, starters, timers, etc. shall be as written elsewhere in this Division unless otherwise noted.

2. Provide "Intelligent" E300 series of starters with network communications via Ethernet/IP. Unless otherwise noted, all starters shall have Allen Bradley E300 electronic overloads, with ground fault protection, % thermal utilization, analog input expansion module, power supply, dual Ethernet communication ports and a fiber media converter.

3. The construction of the Motor Controller shall meet the requirements set forth by Underwriters' Laboratories publication UL-508, NEMA publication number ICS-2-2000, the National Electrical Code, and color coded.

4. All equipment shall bear NRTL labels.

5. Enclosures shall be NEMA 4X unless otherwise indicated, and each controller for connection to an available fault current of 65,000 RMS symmetrical amperes unless otherwise indicated on the Drawings.

B. Construction

1. Disconnect Operators

a. An external operator handle shall be supplied for each starter, switch or breaker. This mechanism shall be engaged with the switch or breaker at all times regardless of unit door position to prevent false circuit indication. The operator handle shall be color coded to display red in the "ON" position and black in the "OFF" position. The operator handle shall have a conventional up-down motion and shall be designed so that the down position will indicate the unit is "OFF". For added safety it shall be possible to lock this handle in the "OFF" position with up to three padlocks. The operator handle shall be interlocked with the unit door to prevent switching the unit to "ON" while the unit door is open. A defeater mechanism shall be provided for the purpose of defeating this interlock by a deliberate act of an electrician should he desire to observe the operation of the operator handle assembly or the unit components. Operators shall not be higher than 6'-6" above finished floor elevation, as installed.

2. Wiring

a. Wiring shall be NEMA Class II, Type B.

b. All control wiring to the terminal strips from outside the controller shall be made with spade or ferrule type terminals of the proper size and rating for the wire used. Pull apart terminal blocks shall be provided in unit spaces of motor starters that contain field wiring energized from a remote source to comply with NEC Article 430-74.

c. All control wiring shall be No. 14 AWG (minimum) labeled at each end in accordance with the wiring numbers shown on the accepted shop drawings. Power wiring shall be sized to suit the maximum horsepower rating of unit; No. 12 AWG (minimum). Wiring shall be type MTW rated for 105° C. Wire color coding shall be red for control and black for power.

3. Finish

   a. The finish shall be manufacturer's standard gray enamel applied over a rust inhibiting phosphate primer unless unit is required to be stainless steel, which shall be powder coated white.

4. Optional Modifications and Accessories

   a. Additional modifications and accessories shall be as listed and specified on the Contract Drawings and sections 11224, 11241 and 13645 of specifications.

   b. Enclosures shall have minimum 1" rain cover on top extending past front door or enclosure.

5. Identification

   a. Provide phenetic engraved nameplates with equipment designation, voltage, phases, fed from and circuit information.

6. Surge Protective Devices

   a. Specification Section 16280 – Surge Protective Devices (SPD) requirements. Provide SPD on incoming power and secondary of control transformers

7. Communications

   a. The controller shall have Ethernet/IP incorporated into its design.

      1. Each motor starter, electronic overload relay, AC drive, and soft starter unit shall be supplied with dual RJ45 ports to communicate via EtherNet/IP.

      2. Plug-in units should be able to move around without impacting the network.

      3. Maintenance activities should be able to be performed without impacting the network.

      4. Provide 62.5/125 multi-mode fiber media converter on all units.

C. Power Supplies.

   1. Power supplies shall provide 24V DC for the devices that require it.

   2. Power supply output shall be rated 8 A, 24V DC.

   3. Power supplies shall be Allen-Bradley Bulletin 1606-XLSDNET8 or approved equal.

   4. Power supplies unit shall be provided with a buffer module to provide a minimum of 500 ms ride-through at full load.

   5. Buffer modules shall be Allen-Bradley Bulletin 1606-XLBUFFER or approved equal.

D. EtherNet/IP/interface for Motor Starter Units.

   1. Motor starter units shall have an electronic overload relay that incorporates the following features:

      a) EtherNet/IP/communication.

      b) Overload relay powered by 120VAC or 24VDC as required.

c) Heavy Duty, Liquid Tight 30.5mm LEDs for status indication, include:

Power - White

On - Red

Off - Green

Fault - Yellow

d) Test/Reset button.

e) Selectable trip of NEMA Class 5 to 30. Unless indicated, the trip class shall be set for NEMA Class 20 operation.

f) Up to six (6) inputs and three (3) outputs of direct I/O. Additional I/O can be provided with an add-on module to the overload relay. Input voltage shall match the overload relay power voltage.

g) Protective functions.

i. Functions shall provide a programmable trip level, warning level, time delay, and inhibit window.

ii. Protective functions shall include Thermal overload, Phase loss, Stall, Jam, Underload, Current imbalance, Remote trip, and PTC thermistor input.

iii. Ground fault protection is required.

a. Ground fault protection is required on all units, the protection range shall be 20 mA to 5 A.

iv. Voltage protection is not required.

v. Input fusing is required to comply with fault current rating of 65,000 Amp interrupting rating.

h) Current monitoring functions shall include phase current, average current, full load current, current imbalance percent, percent thermal capacity utilized, and ground fault current.

i) Voltage, energy, and frequency measuring capabilities shall be included when voltage protection is required.

j) Diagnostic information shall include device status, warning status, time to reset, trip status, time to overload trip, and history of last five trips.

k) Preventive maintenance information shall include Allowable starts per hour, required Time between starts, Starts counter, Starts available, Time until next start, total operating hours, and elapsed operating time.

l) Overload relay shall include an on-board logic processor to allow basic logic to be performed within the overload relay based on network data and the status of the inputs to the overload relay.

m) The overload relay shall support the following CIP messaging types: Polled I/O messaging, Change-of-state/cyclic messaging, Explicit messaging, Group 4 offline node recovery messaging, and Unconnected Message Manager (UCMM).

n) The overload relay shall provide the following functions to minimize network configuration time: Full parameter object support, Configuration consistency value, and Add-on Profile.

2. The overload relay shall be Allen-Bradley E300™ model or approved equal

E. EtherNet/IP Interface for Variable Frequency AC Drives and Solid-State Reduced Voltage Motor Controllers.

1. The EtherNet/IP communication interface shall be supplied to allow for communication between the solid-state component and the Ethernet network

2. EtherNet/IP Interface for Other Units.

3. Provide an EtherNet/IP interface for other units as indicated on the contract drawings

4. Refer to the contract drawing wiring diagrams for points to be monitored

5. Programming and Testing.

6. The manufacturer shall load the IP Address and Subnet Mask into each unit

7. The IP Address shall be as provided by the contractor in consultation with the owner's IT representative.

8. The manufacturer shall test the to ensure that each unit communicates properly prior to shipment

9. Each unit shall have a label showing the IP Address for the devices within it

10. The manufacturer shall provide a disk containing applicable electronic data sheet (EDS) files for the EtherNet/IP devices

F. Cabinet Heaters

1. Provide heaters in all outdoor units to maintain 50°F under ASHRAE 98% weather conditions for the location installed. Provide calculations with submittals.

G. Transformers

1. 480 volt primary, 120/240 volt or 120/208 volt secondary transformers shall be provided with NEC compliant overload protection.

H. Installation

1. All wall mount individually mounted disconnects, push-button stations, latchout stations, starters, etc., indoors shall be mounted on a 1 inch galvanized unistrut, 1 inch Kindorf channel, or equal to provide an air space at rear. Outside mounted equipment shall utilize 1-inch 316 stainless steel strut with 316 stainless fasteners.

2. Units not located on walls shall be installed with framing and mounting systems as shown on Drawings.

I. Starters

1. General

a. All starters shall be of the voltage rating, type, and sized for the motor size shown in these Specifications and/or on the Contract Drawings. For enclosure type see the system operation description and/or the Contract Drawings. All starters shall be of the magnetic type. Should a piece of electrically driven equipment be furnished with a larger motor than shown on the Contract Drawings, the proper size combination starter shall be provided for the equipment supplied, at no extra cost to the Owner.

b. See the Contract Drawings for the auxiliary equipment to be furnished and/or Section 16900 - Controls of this division. **Maximum control voltage shall be 120 volts, a-c.** Minimum starter size shall be NEMA Size 1.

2. Contactors

a. All contactors for motor starters shall be of the a-c magnetic type with "undervoltage" protection when used in conjunction with momentary contact push-button control and "undervoltage" release when used with maintained contact push-button control.

b. Contactor size shall be in accordance with NEMA Standards for the motor controlled and shall be horsepower rated. IEC rated equipment is not acceptable and shall be used as a basis for rejection of the equipment.

c. Contacts shall be of the heavy duty silver-to-silver type and shall be totally enclosed in individual arc quenching chambers. Contacts shall be easily accessible for replacement.

d. The contactor coil shall be of the vacuum impregnated or epoxy resin type, moisture resistant and corrosion proof.

K. Control Stations

1. General

a. Control stations shall be heavy duty, maintained or momentary contact type, as noted on the Contract Drawings. Contacts shall be silver alloy, double break type. The number and marking of controls shall be as shown on the Contract Drawings. Enclosures shall be NEMA 4X for indoor and outdoor mounting, unless otherwise noted on the Contract Drawings. All control stations shall operate on 120 volt, a-c maximum, unless otherwise designated on the Contract Drawings. "Latch-out" facilities shall be provided where called for in these Specifications and/or on the Contract Drawings.

2. Maintained Contact

a. Maintained contact control switches shall be marked "On" and "Off". The button pushed shall remain in and push the other button out until the other button is pushed. In general, they are to be used for hand control of motors which have to operate continuously and restart whenever power is off then resumed, without any manual operator. This is needed for motors which have to operate continuously in the absence of an operator.

3. Momentary Contact

a. Momentary contact control push-button switches shall be marked "start" and "stop". Pushbuttons shall spring out whenever pushed. If the circuit is dropped for any reason, operation cannot be resumed until a "start" push-button is pushed. In

general, they are to be used for hand control of motors which are desired to operate intermittently in the presence of the operator and stop and start independently from more than one parallel control location.

L. Circuit Breakers

1. Circuit breakers shall be molded case type. Trip elements of multi-pole breakers shall be effectively insulated from one another. Multi-pole breakers shall be designed so that an overload on any one pole shall open all poles simultaneously.

2. The breaker operating mechanism shall be the quick-make, quick-break type and shall be entirely trip free to prevent the contacts being held in a closed position against a short circuit.

3. Breakers not used with motor starters shall be of the thermal magnetic type with a thermal bimetallic element for time delayed overload protection and a magnetic element for short circuit protection.

4. The breaker shall be trip indicating with the trip position midway between the "On" and "Off" positions.

5. Breakers for combination starters shall be 100 amp frame or larger. All breakers for combination starters shall have an adjustable magnetic trip element of the motor circuit protector type.

6. Breakers for combination starters shall be F frame or larger. All breakers shall have adjustable magnetic trip elements. Circuit breakers K frame and larger shall have interchangeable thermal-magnetic trip elements.

M. Safety Switches

1. Safety switches shall be of the heavy duty industrial, quick make, quick-break type. Ratings shall correspond to that of the equipment in which circuit it is used, fuses sized as shown on the Contract Drawings. All safety switches at motor locations are of the nonfused type unless otherwise noted.

2. Safety switches shall have a mechanical door interlock to prevent the door from being opened with the switch in the on position and facilities for locking it in the closed or open position. Enclosures for process areas and outside installations shall be NEMA 4X and enclosures for indoor, non-process areas, shall be NEMA 12, unless otherwise designated in Section 16900 of this division and/or on the Contract Drawings.

3. Safety switches shall be UL listed and shall conform to NEMA Standards. NEMA 4X enclosed safety switches where called for shall be stainless steel, or fiberglass.

4. NEMA 1 enclosed switches shall be phosphate coated or equivalent, code gauge steel with baked enamel finish.

N. Selector Switches

1. Hand-off-automatic and hand-off-remote type selector switches shall be of oil-tight construction and shall have 3 positions. The switch must not have a spring-loaded return. It shall be of the "quick-make", "quick-break" type.

O. Manual Motor Starting Switches

1. Manual motor starting switches for the control of fractional horsepower motors shall be single pole and shall be provided with a thermal heater of the correct size for the load controlled. Each starting switch shall be mounted where shown on the Contract

Drawings. Where they are used for rotating equipment such as grinders, they shall be equipped with low voltage protection, and required manual reset after power failure. As an alternate to low voltage protection built-in, a "Safety Restart Plug" may be utilized, available from Mitchell Instrument Company.

P. Timing Relays

1. Time delay relays shall have an adjustable timing range as shown on the Contract Drawings. The time delay shall be after energizing timer coil. Timing relays shall be Agastat, Square D, or equal.

2.03 TIMERS

A. Timers for various services required in the motor control equipment shall be Paragon, Tork or equal as indicated in control circuits shown on the Drawings.

B. Timers requiring tripping pins shall be supplied with enough pins to completely fill all locations on the dial face.

PART 3 - EXECUTION

3.01 INSTALLATION/APPLICATION/ERECTION

A. Motor Controllers

1. One-inch air space (min.) shall be allowed between back of controllers and wall surface.

2. Conduits shall only enter through bottom of the controllers, starters, disconnects, etc.

3. Conduits shall be routed so as not to interfere with maintenance of pumps and motors.

B. Individually Mounted Motor Control Devices (480, 240, or 120 Volt)

1. Each motor disconnect shall be located as near as possible to its respective motor.

2. Remote control station at or near motor shall be mounted near its respective motor, adjacent to the motor disconnect.

3. All devices and equipment furnished under this section (electronic circuit monitors, power correction equipment, etc.) shall be programmed, configured, and calibrated by the manufacturer. Any settings required shall be as determined by the manufacturer. If coordination studies or power system analysis is required, it shall be performed by the manufacturer.

3.02 EXTRA STOCK/SPARE PARTS

A. Provide the following spare parts:

10	Fuses of each type/amperage used
1	Circuit breaker of each type/amperage used
1	Pilot light lamp for each pilot light socket assembly provided
1	Control transformer for each size utilized
2	E300 overload relays
4	24 VDC power supplies for each type and size utilized
2	E300 Analog expansion cards
4	Media converters

END OF SECTION

SECTION 16460 - SMALL POWER AND MISCELLANEOUS TRANSFORMERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Transformer locations and size shall be as shown on the Contract Drawings, as specified herein.

1.02 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE INFORMATION

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted per Section 01300.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. "Square D", "Cutler Hammer", "ABB" or approved equal.

2.02 FABRICATION

A. General Purpose Dry-Type Transformers

1. Single phase transformers shall be 480 volt primary and 120/240 volt secondary. Three phase transformers shall be 480 volts delta primary and 208 Y/120 or 240 volt delta secondary. Transformers 25 KVA and larger shall have a minimum of 4 (2 above, 2 below) 2 1/2 percent full capacity primary taps.

2. Transformers shall be 150 degrees Celsius temperature rise above a 40 degrees Celsius ambient. All insulating materials are to be in accordance with the latest NEMA Standards for a 220 degrees Celsius UL recognized insulation system.

3. Transformer coils shall be of the continuous wire wound copper construction and shall be impregnated with non-hygroscopic, thermo-setting varnish. The coils shall also have a final wrap of electrical insulating material to prevent mechanical injury to the wire as well as increasing the electrical breakdown strength.

4. All cores shall be constructed of high grade, non-aging silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point. The core laminations shall be clamped together with steel angles. The completed core and coil shall then be bolted to the base of the enclosure but isolated from the base by means of rubber, vibration absorbing mounts. There shall be no metal-to-metal contact between the core and coil to the enclosure. On transformers 500 KVA and smaller, the vibration isolation system shall be designed to provide a permanent fastening of the core and coil to the enclosure. To further facilitate vibration and noise isolation, the final section of conduit to the transformer shall be flexible.

5. Transformers 25 KVA and larger shall be in heavy gauge, sheet steel, ventilated enclosures. The ventilating openings shall be designed to prevent accidental access to live parts in accordance with UL, NEMA, and National Electrical Code Standards for ventilated enclosures. Transformers 25 KVA through 75 KVA shall be designed so they can either be floor or wall mounted. Above 75 KVA they shall be of the floor mounted design.

6. The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed, and finished in the same color as the motor control equipment. For more details see Division 9 of these Specifications.

7. The maximum temperature of the top of the enclosure shall not exceed 50 degrees Celsius rise above a 40 degrees Celsius ambient.

8. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with NEMA and NEC Standards.

9. The transformer shall be marked "DANGER HIGH VOLTAGE" with labels specified in the section on marking, this Division.

10. The transformers shall be manufactured to requirements of applicable standards, especially as they apply to noise level and surface temperatures.

PART 3 - EXECUTION

3.01 INSTALLATION / APPLICATION / ERECTION

A. Transformers shall be rigidly mounted to the structure or the foundation in the case of freestanding units.

B. Transformers shall be megger tested prior to energization.

C. Transformers with taps shall be adjusted to supply the nominal service voltage required on the secondary.

D. Transformers shall be installed in accordance with NEC requirements and manufacturer recommendations.

END OF SECTION

SECTION 16710 - COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section of the specifications addresses Contractor's requirements for communication systems. The work includes raceways, cables, cabling, programming, configuration, setup, labor and equipment to execute communication systems as detailed on the Drawings.

B. The Contractor is responsible for furnishing and installing all raceway and cables with 14 feet of slack at terminals of starters, drives, controllers, switches, gateways, instruments, monitors, analysers, etc.

C. The structured telecommunications cable and pathway distribution and wiring system shall include permanently installed horizontal cabling, horizontal pathways, telecommunications and control assemblies, conduit, raceway, and hardware for splicing, terminating, and interconnecting. The horizontal system includes the cabling and pathway between the end devices and PLC's network switches, DeviceNet panels, etc. Hardware and terminating equipment shall consist of UL approved connectors. Horizontal cable shall consist of Category 6 (1,000 MPBS) 100 ohm four (4) pair cable, unshielded twisted pair (UTP), and om4 multimode fiber – 6 strand.

D. Use shielded cables inside VFD cabinets.

E. Use multi-mode OM2 fiber optic cable for interface with existing plant SCADA.

F. Contractor is responsible to conduct meetings and coordinate complete system installation, including but not limited to, assigning IP address's with owner assistance configuring all drives, updating PLC and network programming modifying local and remote HMI displays and updating CITECT programming operator displays, historian and report generation.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and General Provisions of this Contract including General and Supplementary Conditions and Division 1 Specifications Sections, apply to work of this Section.

B. Related Work in Other Technical Sections

1. Section 16050 - Basic Electrical Materials and Methods
2. Section 16120 – Conductors and Cables
3. Section 16130 - Raceways
4. Section 16131 – Boxes
5. Section 16440 – Motor Control
6. Section 16900 – Controls

1.03 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE INFORMATION

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted per Section 01300.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Telephone and Data Cables: Belden, or approved equal. All cables are to be manufactured in the Untied States, Canada or Europe.

B. FO Cables: Optical Cable Corp. All cables are to be manufactured in the Untied States, Canada or Europe.

2.02 MATERIALS

A. Components

1. Cabling passages shall be accessible via junction boxes and equipment cabinets. All cable installation will be facilitated with pull wires. Fixed cables and pathway systems for telecommunications systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70.

B. Pathways (Horizontal)

1. EIA/TIA-569 Pathway shall be conduit. Provide grounding and bonding as required by EIA/TIA-607. Provide Mogul style pulling elbows (See section 16130,3.02,27).

C. Telecommunications Cabling

1. Ethernet Cabling shall be UL listed for the application and shall comply with TIA-568 and ANSI/TIA/EIA-568-B.2-1 and NFPA 70. Cabling shall consist of shielded Category 6 (1,000 MBPS) UTP cable. Provide a labeling system for cabling as required by EIA/TIA 606 and UL 969. Cabling manufactured more than 12 months prior to date of installation shall not be used.

2. DeviceNet cabling shall be Belden 7895A, No alternates.

D. Telecommunications Outlet/Connector Assemblies

1. Ethernet Jacks shall comply with FCC Part 68.5, and TIA/EIA-568. Jacks shall accommodate UTP. UTP jacks shall be RJ-45 designation T568A type, UL 1863 listed, eight position, constructed of high impact rated thermoplastic housing rated for Category 6 (1,000 MBPS) service. UTP jacks for data shall be Category 6 (1,000 MBPS) hardware and shall comply with the attenuation requirements contained in ANSI/TIA-568-B.2-1. Telecommunications cover plates shall comply with UL 514C, and TIA/EIA-568.

E. Fiber Optic Cable

1. The fiber optic cable shall be a round, water-resistant, tight buffer OM2 cable suitable for both indoor and outdoor installation. The fiber optic cable shall consist of, but not be limited to the following components:

a. Multimode, helically arranged, optical fibers with Aramid strength member and 900 micrometer tight buffer

b. Elastomeric subcable jacket to prevent moisture intrusion

c. A synthetic yarn strength member helically laid directly over the stranded core

d. PVC core-locked outer jacket

2. Each optical fiber shall be all glass, graded index, with a core diameter of 62.5 microns and cladding diameter of 125 microns. The optical fiber shall have an attenuation no greater than 3.0dB/km at a wavelength of 850nm supporting a bandwidth of no less than 220MHz-km. The fiberglass shall be manufactured by AT&T, or equal.

3. The minimum bend radius of the cable under full long-term tensile load shall be no longer than 10-times the outside diameter of the cable. The outer jacket of the cable shall be surface printed with the manufacturer's identification, the cable part number and sequential numerical footmarks.

4. The cable manufacturer shall be ISO 9001 certified, UL listed and optimized for 10 Gigabit Ethernet applications. Gell-filled cables are not acceptable. The cable shall be manufactured by Optical Cable Corp., B Series Ultra-Fox Plus Breakout Cables (fiber part no. W3RB/1GC), or equal.

F. Fiber optic waterproof termination shall be of ST all polymer type (including body and ferrule) as manufactured by Methode Electronics, Inc. Termination fiber must be bonded within the ST connector ferrule utilizing two part anaerobic bonding compound. Crimp type connectors and/or epoxy heat cure connectors that require ovens shall not be deemed acceptable. The fiber optic ST connector shall be the 908 Series MST Style by Methode Electronics, Inc. Upon proper termination of the fiber optic cabling, the Contractor shall measure dB losses over the cable length using an Engineer approved fiber testing device. This device shall be capable of producing hard copy test results for submittal to the Engineer. Official fiber tests are to be witnessed by the Engineer. In addition to allowing 1dB loss per connector, losses exceeding 3dB per kilometer of fiber will not be acceptable. All fiber technicians must be trained and certified by the fiber connector manufacturer. All connections must be approved by the fiber connector manufacturer. SC Connectors may be used as well.

PART 3 - EXECUTION

3.01 INSTALLATION/APPLICATION

A. Telecommunications cabling and pathway systems, including the horizontal cabling and pathway systems, telecommunications outlet/connector assemblies, and associated hardware shall be installed in raceway in accordance with TIA/EIA-568, EIA/TIA-569, NFPA 70, and UL standards as applicable.

B. Cabling

1. Install Category 6 (1,000 MBPS) UTP, telecommunications cabling and pathway system as detailed in TIA/EIA-568. Each RJ-45 connector shall have run to it one dedicating cable containing four pairs. Cabling installation shall comply with EIA TSB4O and EIA TSB-36. Screw terminals shall not be used except where specifically indicated on drawings. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations. Do not untwist Category 6 (1,000 MBPS) UTP cables more than 12 mm (one half inch) from the point of termination. Provide service loop on each end of the cable (one meter) for future additions. Do not exceed manufacturers' cable pull tensions for copper cables. Provide a device to monitor cable pull tensions. Do not exceed 110 N(25 pounds) pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples.

2. Install DeviceNet cabling and pathway as detailed in Omron DeviceNet Operation Manual W267-EI-11.

C. Pathway Installations

1. Comply with EIA/TIA-569. Keep conduit minimum 150 mm (6-inches) away from parallel runs of electrical power equipment, flues, steam, and hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit is visible after completion of project. Install no more than two 1.57 rad (90 degree) bends for a single horizontal cable run.

2. All wiring shall be installed in conduit or a metal raceway. 3/4-inch minimum conduit size.

3. All communication junction boxes shall be marked "DATA" or painted green.

3.02 TESTING

A. Telecommunications Cabling Field Testing

1. Perform telecommunications cabling inspection, verification, and performance tests in accordance with TIA/EIA-568 and Omron DeviceNet Operation Manual W267-EI-11.

B. Inspection

1. Visually inspect cabling jacket materials for UL or third party certification markings. Visually inspect UTP and OFO jacket materials for UL or other certification markings. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for tip and ring pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568. Visually confirm Category 6 (1,000 MBPS) marking of outlets, wallplates and jacks.

C. Verification Tests

1. UTP copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, near-end cross talk, proper pinning and termination and polarity between conductors. Test operation of shorting bars in connection blocks. Perform 250 MHz near-end cross talk (NEXT), far-end cross talk (FEXT) return loss, propagation delay, delay skew requirements, and attenuation tests for Category 6 (1,000 MBPS) 100 ohm 4-pair systems installations.

2. DeviceNet test shall use a multimeter to confirm resistance from CANH and CANL is between 50-70 OHM's.

D. FO Cable Verification Tests

1. Contractor's Field Test: The Contractor shall verify the complete operation of the data transmission system in conjunction with field testing associated with systems supported by the fiber optic data transmission system prior to formal acceptance testing. Field tests shall include a flux density test. These tests shall be performed on each link and repeated from the opposite end of each link.

2. Optical Time Domain Reflectometer Tests: Optical time domain reflectometer tests shall be performed using the FO test procedures of EIA 455-59. An optical time domain reflectometer test shall be performed on all fibers of the FO cable on the reel prior to installation. The optical time domain reflectometer shall be calibrated to show anomalies of 0.2 dB as a minimum. An optical time domain reflectometer test shall be performed on all fibers of the FO cable after it is installed. The optical time

domain reflectometer shall be calibrated to show anomalies of 0.2 dB as a minimum. If the optical time domain reflectometer test results show anomalies greater than 1 dB, the FO cable segment is unacceptable. The unsatisfactory segments of cable shall be replaced with a new segment of cable. The new segment of cable shall then be tested to demonstrate acceptability.

3. Power Attenuation Test: Power attenuation test shall be performed at the light wavelength of the transmitter to be used on the circuit being tested. The flux shall be measured at the FO receiver end and shall be compared to the flux injected at the transmitter end. There shall be a jumper added at each end of the circuit under test so that end connector loss shall be validated. Rotational optimization of the connectors will not be permitted. If the circuit loss exceeds the calculated circuit loss by more than 2 dB, the circuit is unsatisfactory and shall be examined to determine the problem. The Engineer shall be notified of the problem and what procedures the Contractor proposes to eliminate the problem. The Contractor shall prepare and submit a report documenting the results of the test.

4. Gain Margin Test: The Contractor shall test and verify that each circuit has a gain margin which exceeds the circuit loss by at least 6 dB.

END OF SECTION

SECTION 16900 - CONTROLS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Equipment controls shall be as specified herein and shown on the Contract Drawings. Legends for starter nameplates shall be taken from the one-line diagram in the Contract Drawings.

B. Certain equipment starters contain nonresettable elapsed time meters as shown in the Contract Drawings. Also, certain motor starters have remote control devices and require connections to operate these control devices as shown on starter schematics (control circuits).

C. Unless otherwise noted, all starters contain red "on" lights, green "off" lights, white "power available" lights, control transformers, and auxiliary contacts to operate as defined on the control circuits of the Contract Drawings. Reset pushbuttons shall also be provided for overloads built into the starters.

D. Unless otherwise noted, all starters shall have Allen Bradley E300 electronic overloads, with ground fault protection, % thermal utilization, analog input expansion module, power supply, dual Ethernet communication ports and a fiber media converter.

1.02 RELATED WORK

A. The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section (and shall be included in the bid by a single Instrumentation Supplier for this Project):

Section 16170 - Safety Switching
Section 16440 - Motor Control
Section 17410 - Basic Measurement and Control Instrumentation Materials and Methods
Section 17430 - Boxes, Panels and Control Centers
Section 17490 - Measurement and Control Commissioning

B. The following Divisions of these Specifications contain requirements on equipment furnished by other suppliers that must interface with the instrument system, or on methods and materials to be performed/used in the installation and/or wiring of the instrumentation system.

Division 1 - General Requirements
Division 11 - Equipment
Division 16 - Electrical

1.03 CUSTOM CONTROL PANELS

A. All control panels furnished under this Contract shall be manufactured in accordance with industry standards and as herein specified. Some control panels are specified to be furnished with the equipment controlled and others are to be furnished by the Contractor, as written elsewhere.

B. Panel construction shall comply with OSHA and other code requirements as applicable and may be attested to by UL listing the panels as an assembly. Otherwise, panel modifications as required by the Electrical Inspector shall be performed by the supplier at no extra cost to the Owner.

C. Control panels to be furnished on this project shall be wired to function according to

schematics shown on the contract Drawings. In addition to the requirements shown on the Contract Drawings, the panels shall adhere to additional requirements as written herein, and in the utilization equipment specifications.

D. Enclosures shall be dead front with all operators' devices accessible without opening the enclosure door. All relays, timers, terminal strips, etc., shall be mounted to a subpanel inside the enclosure. All wiring must be stranded and sized to be protected by a 20 A circuit breaker. Supplemental overcurrent protection may be used in lieu of oversized wiring. All panels mounted outside shall have operator devices that are oil-tight and UV rated.

E. All terminal strips and lugs shall be of a type UL listed to terminate the size and quantity of wires encountered. Myers hubs shall be installed to maintain the enclosure rating where conduits enter NEMA 4X rated enclosures. The exterior of stainless steel NEMA 4X enclosures shall be unpainted. The exterior of NEMA 12 panels shall be painted ANSI 49 light gray, lacquer or enamel.

F. Enclosures shall be provided with a locking hasp and any exterior hardware shall be stainless steel or other corrosion resistant material. Enclosures for use in process or outdoor areas shall be NEMA 4X and enclosures for interior use in dry areas shall be NEMA 12, unless otherwise indicated.

G. Elementary control schematics and connection diagrams showing the spatial relationship of components and wiring shall be submitted for review. Also, a bill of materials, drawing of device arrangement on front, and enclosure fabrication drawings shall be submitted. Further, descriptive literature is required on all components. A copy of the shop drawings shall be furnished and stored in a pocket inside the enclosure.

H. Sleeve type wire markers or other "permanent" type marker shall be installed on all wires, keynoted back to the elementary schematic or the connection diagram, and all terminals identified.

I. All outdoor starters and control panels shall have a thermostatically controlled heater capable of maintaining 50°F under ASHRAE 98% weather conditions for the area of the country installed. Provide calculations for heater sizing in submittals.

1.02 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE INFORMATION

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted per Section 01300.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED

END OF SECTION

DIVISION 17

INSTRUMENTATION

SECTION 17410 - BASIC MEASUREMENT AND CONTROL INSTRUMENTATION MATERIALS AND METHODS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall furnish all materials, labor, tools, equipment, supplies and services necessary to install, program, configure and test all process control and instrumentation equipment complete as specified herein and shown on the Drawings. The Contractor shall be responsible for the expense of changing Drawings or structures, or any other expense necessitated by reason of installing alternative equipment. The Contractor will assume the responsibility for the satisfactory operation of any and all equipment offered.

B. The following equipment specification is included to establish the quality of equipment to be obtained. It is the intent of these Specifications to obtain industrial quality instrumentation and control equipment. Equipment furnished shall be accepted by the Engineer, prior to purchase by the Contractor.

C. Auxiliary and accessory devices necessary for system operation or performance, such as transducers or relays to interface with equipment provided under other Sections of this Specification, shall be included whether specified or not, at no extra cost.

D. In order to ensure proper integration and compatibility of the plant instrumentation and control systems, the systems must be supplied by a single provider of instrumentation and control equipment. This is not to say that all equipment being supplied shall be manufactured by a single manufacturer, but rather that a single provider of instrumentation and control equipment shall be responsible for supplying the complete system. To facilitate the Owner's future operation and maintenance, products performing the same function shall all be of the same manufacturer, type, and model number.

E. In order to ensure proper integration and compatibility with the plant SCADA system, the equipment provider (integrator) shall also perform all programming and setup of evidence and new PLC's, OIT's and SCADA system. Integrator shall also be responsible for network switches setup and configuration.

F. Substitutions on functions or equipment specified will not be acceptable. In order to ensure the interchangeability of parts, the maintenance of quality, the ease of interfacing between the various subsystems, and the establishment of minimums with regard to ranges and accuracy, strict compliance with the above requirements shall be maintained. In order to ensure compatibility between all equipment, it shall be the responsibility of the system supplier hereunder to coordinate all interface requirements with mechanical and electrical system suppliers and furnish any signal isolation devices that might be required.

G. Equipment shall be fabricated, assembled, installed, and placed in proper operating condition in full conformity with detail drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer as accepted by the Engineer.

H. The instrument supplier for this Contract shall be responsible for making the modifications shown on the Drawings and for recalibrating all instruments and placing them in proper working order.

1.02 RELATED WORK

A. The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section (and shall be included in the bid by a single Instrumentation Supplier for this Project):

Section 17420 - Instruments
Section 17430 - Boxes, Panels and Control Centers
Section 17490 - Measurement and Control Commissioning

B. The following Divisions of these Specifications contain requirements on equipment furnished by other suppliers that must interface with the instrument system, or on methods and materials to be performed/used in the installation and/or wiring of the instrumentation system.

Division 1 - General Requirements
Division 11 - Equipment
Division 16 - Electrical

1.03 QUALITY ASSURANCE

A. The system supplier shall be required to demonstrate a minimum of 4 years recent, past experience in the design, manufacture, and commissioning of instrumentation and control systems of comparable size, type, and complexity to the proposed project. Further, the manufacturer must have at least 10 similar systems in operation currently. The system supplier shall be required to have his own in-house capability to handle complete system engineering, fabrication, and testing.

B. The system supplier shall have in his employ the capable personnel for detail engineering, coordination, drafting, procurement and expediting, scheduling construction, testing inspection, installation, start-up service for calibration and commissioning, and warranty compliance for the period specified.

1.04 REFERENCES

A. The Contractor is referred to Standards and Practices for Instrumentation published by the International Society of Automation (latest edition), for terminology, symbols, methods and practices used or described herein or on the Drawings.

1.05 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE INFORMATION

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted per Section 01300.

B. General

1. Complete detail Drawings of the instrumentation and control systems and all components shall be submitted in 3 copies in a 3-ring loose-leaf cardboard reinforced vinyl binder to the Engineer for preliminary review. They shall include installation instructions, operation and maintenance instructions, descriptive literature, connection drawings, and parts list for each item as well as individual control schematic drawings for each item.

2. The Contractor shall make any corrections or changes required by the Engineer, within the scope of the Drawings and Specifications, and return copies in 3-ring loose-leaf cardboard reinforced vinyl binders for final review and distribution. Number of copies shall be as specified in Special conditions and as agreed at the pre-construction conference.

3. Should any system submitted in the shop drawings not meet with the Engineer's acceptance as to conformity with requirements of the Drawings and Specifications, it shall be the responsibility of the successful Contractor to make whatever changes are necessary for acceptance at no extra cost to the Owner.

B. Detailed Requirements - Instruments/Hardware

1. Detailed information for each instrument or control device shall be submitted, including manufacturer's descriptive literature and a specific data sheet for each device which shall include as a minimum:

    a. Tag number assigned by the Contract Documents.

    b. Product (item) name used herein and on the Contract Drawings.

    c. Manufacturer's complete model number.

    d. Location of the device.

    e. Input - output characteristics.

    f. Electrical characteristics.

    g. Range, size, and graduations.

    h. Physical size with dimensions, enclosure NEMA classification, and mounting details.

    i. Materials of construction of all components.

    j. Instrument or control device sizing calculations where applicable.

    k. Certified calibration data on all flow metering devices.

2. Submit a detailed loop diagram, for each monitoring or control loop, each on a single 8 ½ in. x 11 in. sheet. The format shall be the Instrument Society of America, Standard for Instrument Loop Diagrams, ISA-S5.4.

3. The data sheets shall be provided with an index and proper identification and cross-referencing. Partial submittals will be rejected.

4. Submit detailed drawings concerning control panels and/or enclosures including:

    a. Cabinet assembly and layout drawings to scale.

    b. Fabrication and painting specifications.

    c. I/O layout.

    d. Elementary panel wiring diagrams

    e. Point to point wiring diagrams depicting wiring within the panel as well as connections to external devices.

    f. Color samples for paint selection by the Engineer and/or Owner.

    g. Panel submittal drawings shall be on 11 in x 17 in. sheets.

5. Exceptions to the Specifications or Drawings shall be clearly indicated in the submittal by the system supplier. Data shall contain sufficient details so a proper evaluation may be made by the Engineer.

6. Prior to final acceptance, the final shop drawing submittal, which is to include Installation, Operation, and Maintenance instructions, shall be updated to reflect "As Constructed" status, and shall provide at least the following as a minimum:

    a. A comprehensive index.

b. A complete "As Constructed" set of accepted shop drawings.

c. A complete list of the equipment supplied, including serial numbers, ranges, and pertinent data.

d. Full specifications on each item.

e. System schematic drawings "As Constructed", illustrating all components, piping and electrical connections of the systems supplied under this Section.

f. Detailed service, maintenance, and operation instructions for each item supplied.

g. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.

h. The operating instructions shall also incorporate a functional description of the entire system, with reference to the systems schematic drawings and instructions.

i. Complete parts lists with stock numbers and name, address, and telephone number of the local supplier.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Shipping Precautions:

1. After completion of shop assembly, factory test, and acceptance, all equipment, cabinets, panels, and consoles shall be packed in protective crates and enclosed in heavy duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust, and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing, and handling at the job site.

2. Special instructions for proper field handling, storage and installation required by manufacturer for proper protection, shall be securely attached to each piece of equipment proper to packaging and shipment.

B. Identification:

1. Each component shall be tagged to identify its location, tag number and function in the system. Identification shall be prominently displayed on the outside of the package.

2. A permanent stainless steel or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number, as given in the tabulation, shall be provided on each piece of equipment supplied under this Section.

C. Storage:

1. Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters including in-line equipment, and shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired by the Contractor at his own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such tests as directed by the Engineer. This shall be at the cost and expense of the Contractor, or the apparatus shall be replaced by the Contractor at his own expense.

1.07 WARRANTY (MAINTENANCE CONTRACT)

A. A written total instrument maintenance contract shall be provided to the Owner, executed by the system supplier as a part of the work under this Section. The maintenance contract shall include all labor, parts, and emergency calls providing on-site response within 48 hours, to provide complete instrument system maintenance for a period of one year after the date of final acceptance of the system. The maintenance contract shall also include a minimum of 2 semi-annual preventive maintenance visits by a qualified serviceman of the supplier who is familiar with the type of equipment provided for this project. Each preventive maintenance visit shall include routine adjustment, calibration, cleaning, and lubrication of all system equipment and verification of correct operations. Emergency maintenance procedures or plant visits may coincide with a scheduled preventive maintenance visit, however, they shall not replace the work intended to be performed during a preventive maintenance visit. The system supplier shall have full responsibility for the preventive and corrective maintenance including replacing of defective components, maintaining sufficient spare parts on-site, and complete calibration of all components under this section, all at no cost to the Owner. The maintenance contract shall not begin until both the instrumentation training course and the system acceptance test have been successfully completed, at which time the Owner shall be capable of performing necessary preventive maintenance, and all instruments shall be functional.

B. During the one-year maintenance period, observation of maintenance operations by designated Owner personnel, and the instruction of said personnel in the details of the maintenance work being performed shall be provided.

C. A complete written report shall be furnished the Engineer and Owner after each scheduled and unscheduled visit, giving problems corrected, systems needing recalibration, and recommendations to prevent recurrence, if applicable.

D. The costs for the one-year maintenance service contract shall be included in the Contract price.

1.08 TRAINING

A. As the equipment installed at the plant shall be used for the "hands-on" training, the training program shall not be conducted until all of the systems are operational, and operational related "punch list" items are corrected.

B. Training on equipment supplied by the original equipment manufacturer and shall be scheduled with plant.

C. The training shall be conducted at a time mutually agreeable to the Engineer, Owner, Contractor, and Supplier. The Owner shall decide how many of his personnel shall attend the training. A representative of the Engineer may observe the training in progress. The Owner shall have the right to videotape all training as it is conducted.

PART 2 - PRODUCTS

2.01 GENERAL

A. All instrumentation supplied shall be of the manufacturer's latest design and shall produce or be activated by signals which are established standards for the water industry.

B. All electronic instrumentation shall be of the solid-state type and shall utilize linear transmission signals of 4 to 20 mAdc (milliampere direct current), however, signals between instruments within the same panel or cabinet may be 0-10 V.d-c (volts direct current), or other manufacturer standard.

C. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standard signals for remote transmission. No zero-based signals will be allowed for remote transmission.

D. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks as shown on the Drawings or as required.

E. All indicators and LED readouts shall be linear, direct reading in process units, unless otherwise noted. Percentage scales and indicators are prohibited.

F. All transmitters shall be provided with either integral indicators or conduit mounted indicators in process units, accurate to two percent, unless otherwise noted.

G. Electronic equipment shall be of the manufacturer's latest design, utilizing printed circuitry and suitably coated to prevent contamination by dust, moisture and fungus. Solid state components shall be conservatively rated for their purpose, to assure optimum long term performance and dependability over ambient atmosphere fluctuations and 0 to 95 percent relative humidity. The field mounted equipment and system components shall be designed for installation in dusty, humid, and slightly corrosive service conditions.

H. All equipment, cabinets and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, in-so-far as possible, and shall consist of equipment models which are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion.

I. All equipment shall be designed to operate on a 60 Hertz alternating current power source at a nominal 115 volts, plus or minus 10 percent, except where specifically noted. All regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

J. All analog transmitter and controller outputs shall be 4-20 milliamperes into a load of 0-750 ohms, unless higher load capacity is required.

K. All switches shall have double-pole double-throw contacts rated at a minimum of 600 VA, unless specifically noted otherwise.

L. Materials and equipment used shall be UL listed (or other independent lab listed) wherever such listed equipment and materials are available.

M. All equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation without manual resetting when power is restored.

N. All circuit boards in instruments mounted in damp locations or mounted outdoors shall be fungus proofed. All field transmitters mounted outside shall be equipped with sunshields and shall be capable of operation to -20° Fahrenheit.

O. Equipment installed in a hazardous area shall meet Class, Group and Division as shown on the contract drawings, to comply with the National Electrical Code. All power supply and signals coming from and going to hazardous areas shall have intrinsic safety barriers provided.

2.02 INSTRUMENTS AND ACCESSORY EQUIPMENT

A. Refer to other Division 17 Instrumentation Specification Sections for equipment requirements for field mounted primary devices, transmitters and secondary instruments, receivers and central control equipment.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 17420 - INSTRUMENTS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall furnish and install all primary devices, transmitters, primary and secondary receivers, analyzers and accessory items as shown on the Contract Drawings and as specified herein.

1.02 RELATED WORK

A. The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section (and shall be included in the bid by a single Instrumentation Supplier for this Project):

Section 16170 - Safety Switching
Section 16440 - Motor Control
Section 17410 - Basic Measurement and Control Instrumentation Materials and Methods
Section 17430 - Boxes, Panels and Control Centers
Section 17490 - Measurement and Control Commissioning

B. The following Divisions of these Specifications contain requirements on equipment furnished by other suppliers that must interface with the instrument system, or on methods and materials to be performed/used in the installation and/or wiring of the instrumentation system.

Division 1 - General Requirements
Division 11 - Equipment
Division 16 – Electrical

1.03 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE INFORMATION

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted per Section 01300.

PART 2 - PRODUCTS

2.01 INSTRUMENTS AND ACCESSORY EQUIPMENT

A. Product Descriptions

1. Loop Isolator/Signal Converter:

   a. Loop isolators or signal converters shall be furnished and installed where indicated, to isolate signals or to increase the load capacity of a system required to have many devices in the loop. Isolators shall provide 3-way isolation, and shall have a power supply voltage of 115 VAC unless otherwise indicated. 2 wire style isolators are not acceptable. Isolators shall be Moore SCT, AGM, RIS, or equal, enclosed as appropriate for the application, or as indicated.

2. Transient/Lightning Suppressors:

   a. Device Locations: As a minimum, provide surge protection devices at the following locations:

1) At any connections between ac power and electrical and electronic equipment, including panels, assemblies, and field mounted analog transmitters.

2) At both ends of all analog signal circuits that have any portion of the circuit extending outside of a protecting building.

3) At both ends of all copper-based communications cables which extend outside of a building, including at field instruments and the field side of analog valve position signals.

4) On all external telephone communications lines.

b. Surge protection device assemblies for connections to AC power supply circuits shall:

1) Be provided with two 3-terminal barrier terminal strips capable of accepting No. 12 AWG solids or stranded copper wire. One terminal strip shall be located on each end of the unit.

2) Have a nonflammable enclosure that meets or exceeds UL 94 V0 flammability requirements. The surge protection device shall be provided with provisions for mounting to interior of equipment racks, cabinets, or to the exterior of freestanding equipment.

3) Be constructed as multistage devices consisting of gas tube arrestors, high energy metal oxide varistors, or silicon avalanche suppression diodes. Assemblies shall automatically recover from surge events, and shall have status indication lights.

4) Comply with all requirements of UL 1449, Latest edition.

5) Be able to withstand a peak surge current of 10,000 amps based on a test surge waveform with an 8-microsecond rise time and a 20-microsecond exponential decay time, as defined in UL 1449.

6) Have the following characteristics:

a) Maximum Continuous Operating Voltage: 150VAC
b) Maximum Operating Current: 20 amps
c) Ambient Temperature Range: -20 degrees C to +65 degrees C
d) Response Time: 5 nanoseconds

c. Surge protection device assemblies for analog signal circuits shall:

1) Have four lead devices with a threaded mounting/grounding stud or DIN Rail mounting.

2) Have a nonflammable enclosure that meets or exceeds UL 94 V0 flammability requirements.

3) Be constructed as multistage devices consisting of gas tube arrestors and silicon avalanche suppression diodes. Gas tube arrestors and diodes shall be separated by a series impedance of no more than 20 ohms. Assemblies shall automatically recover from surge events.

4) Comply with all requirements of UL 497B.

5) Be able to withstand a peak surge current of 10,000 amps based on a test surge waveform with an 8-microsecond rise time and a 20-microsecond exponential decay time, as defined in UL 1449.

6) Limit line-to-line voltage to 40 volts on 24VDC circuits.

7) Have the following characteristics:

a) Maximum Continuous Operating Voltage: 28VDC
b) Ambient Temperature Range: -20 degrees C to +65 degrees C
c) Response Time (Line-to-Line): 5 ns

d. Acceptable manufacturers shall be Phoenix Contact, Weidmuller, Transtector, or equal.

3. Altitude and Pressure Gauges:

a. All indicating gauges are pipe mounted with male and brass threaded pipe connections. Gauges shall be 4 1/2 inch liquid filled for maximum vibration and corrosion protection. Gauges shall have phosphor bronze Bourdon tubes, white laminated phenol dials. Gauges shall have micrometer adjustment of pointers and black phenol, black cast iron, brass, or aluminum case and ring, original rotary gear design, corrosion resistant, stainless steel movement, blowout protection, and bronze socket with wrench flats. Accuracy shall be within 1/2 of 1 percent of the scale range. They shall be as manufactured by Helicoid Gage Division, "410"; Ashcroft; U.S. Gauge; Wika; or equal.

b. All gauges shall be piped with provisions for venting pressure to allow calibration (zero) checks. Valves for gauge shutoff and zeroing shall be 1/4 turn ball valves with lever handle, corrosion-resistant.

c. Liquid filled diaphragm seals shall be installed on all gauges as indicated in the Gauge Schedule in Section 17480 of the Specifications. Diaphragm seals shall be of the continuous duty type, 3 piece construction with 1/4 inch flushing connection, 1/4 inch fill connection, 316 stainless steel lower housing and diaphragm material 1/4 inch gauge connection and 1/2 inch lower connection. Housing bolts shall also be stainless steel. Acceptable models are Marsh 42-01, Helicoid 100H, Ashcroft, or equal. Viton diaphragms are required on low range pressure applications (less than 15 psig). To prevent accidental loss of fluid, diaphragm seals shall be permanently attached to gauges by installation of a lead sealed wire connecting the two. Fill fluid shall be factory installed silicone. All gauges shall be pre-calibrated, as an assembly, with the seal.

4. Magnetic Flowmeter

a. Meter shall be obstructionless, short form, characterized coil design, and the output signal produced shall be directly proportional to the liquid flow rate. The metering tube shall be steel with 150 pound ANSI flanged end connections. Liner shall be polyurethane or rubber. The electrodes shall be bullet nosed 316 stainless steel or Hastelloy C, and shall be field replaceable. The coils which generate the field shall be inside the pipe wall and shall be encapsulated in epoxy plastic and encased within the flow meter lining material. Laying length shall not exceed 1 ½ times the meter size. The meter shall have complete zero stability.

b. The temperature of the process will not exceed 135 degrees Fahrenheit. The meter primary shall be suitable for submersion in 33 ft. of water for 48 hours.

c. The signal converter (transmitter) shall be designed for use in connection with the magnetic flowmeter primary devices supplied and shall receive its signal from the primary device and convert it to a corresponding pulse and current signal. A linear output meter and 8 digit non-reset register shall be provided on the converter. Indication, totalization and output signal shall be for either forward or reverse flow, with flow direction indicated by contact closure. Signal converter shall be powered by 120

VAC, single phase.

d. The meter shall provide a constant zero output during conditions of false flow signals are possible. An empty pipe detection feature shall drive the output signals to zero or 130% of range when electrodes become uncovered.

e. The signal converter shall have a NEMA 4X wall mount enclosure. The enclosure shall have a gasketed cover with window for reading the horizontal output meter and 8 digit non-reset flow register. The converter shall have solid state, printed circuit constructionwith a continuously adjustable range from 0-3 to 0-30 ft./sec., requiring no zero adjustment. The transmitter shall utilize a pulsed DC technique to drive the flux producing coils of the primary, converting the low level, high impedance pulsed DC signal to a 4-20 mADC current output directly proportional to flow rate. Where indicated, provide RS-232 or RS-484 serial interface connection. The output shall be provided with HART™ digital communications, which provides a digital process variable superimposed on the 4-20 mADC signal, with protocol based on Bell 202 FSK standard.

f. Liner voltage and frequency variations of 10% shall have no effect on instrument calibration.

g. The scaled pulse output signal shall be inhibited when the flow rate is 2 percent or less of the maximum flow setting.

h. The accuracy, including the primary, shall be <0.25% ofr rate or <5% of full scale for a span setting of 0.53-30 ft/sec.

i. All magnetic flow meters shall be provided with type 316 stainless steel grounding rings. All interconnecting signal cable between the magnetic flowmeter and signal converter shall be provided by the meter manufacturer and be of sufficient length as required for the installation shown on the Drawings. Provide all special cable terminations/fittings to replace the meter body should removal be necessary.

j. The flowtube shall be suitable for use in Class I, Division 2, Group D hazardous locations, unless otherwise noted on drawings.

k. The flowmeter shall be 3000 or 3000G, COPA-X series as manufactured by ABB, or equal.

l. Provide ABB signal cable for sensor to transmitted in lengths sufficient for installation locations shown on plans.

5. Pump Controller

a. Description: Combination motor starter – Disconnect as indicated in drawing refer to section 16170. Starters shall use E300 electronic overloads with Ethernet communication.

b. The pump controller shall have the following functions for control:

1) Configuration: The pump control unit shall be configured with the following pump settings:

a) Start and Stop ramp times.

b) Overvoltage: 6% for 10 seconds

c) Undervoltage: 10% for 15 seconds.

d) Refer to plans for additional settings.

c. Communication and Interface:

1) The pump controller firmware shall be programmable and upgradeable with a laptop computer using a built-in RJ-45 communications port.

2) The built-in RJ-45 communications port shall be capable of receiving data connection from a dial-up modem for remote status reporting, changing of control settings and display of pump information on a remote computer using control and monitoring software.

d. Indication Characteristics: Display the following information:

1) Pump status including:

a. Pump running

b. Pump is in the HAND position

c. Pump is in the OFF position.

d. Pump is in the AUTOMATIC or remote position

e. Pump fault (manual)

f. Pump lockout (Manual Reset)

g. Motor overtemp (thermal) fault (curfew applicable)

h. Motor seal failure fault (curfew applicable)

2) Elapsed run time meter

3) Reset

e. Fault Monitoring: The control unit display panel shall have features which clearly identify faults and clearly indicate the status of conditions, such as lockouts and level alarms. The control unit shall provide the following user configurable fault monitoring capability:

1) Critical Faults: A fault condition that locks out a pump and prevents the pump from operating until the fault is cleared and the fault is manually reset on the control unit keypad.

2) Non-Critical Faults: A fault condition that will temporarily disable a pump until the fault condition is cleared.

3) Pump Seal Failure Detection: Adjustable pump seal detection shall be provided to indicate a pump inner seal failure and disable a pump when a seal fault is present.The seal fault function shall be user selectable to assign a seal leakage condition to a display only fault, critical (lockout) fault or non-critical (auto reset) fault.

4) Motor Overtemp Fault: Adjustable pump thermal detection shall be provided to indicate a motor over temperature (thermal) condition and disable a pump when the thermal condition is present. The motor overtemp function shall be user selectable to assign a motor overtemp (thermal) condition to a display only fault, critical (lockout) fault or non-critical (auto reset) fault.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 17430 - BOXES, PANELS, AND CONTROL CENTERS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall furnish and install all boxes, panels and control centers and accessory items as shown on the Contract Drawings and as specified herein.

1.02 RELATED WORK

A. The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section (and shall be included in the bid by a single Instrumentation Supplier for this Project):

Section 16440 – Motor Control
Section 16900 – Controls
Section 17410 – Basic Measurement and Control Instrumentation Materials and Methods
Section 17420 – Instruments
Section 17490 – Measurement and Control Commissioning

B. The following Divisions of these Specifications contain requirements on equipment furnished by other suppliers that must interface with the instrument system, or on methods and materials to be performed/used in the installation and/or wiring of the instrumentation system.

Division 1 - General Requirements
Division 11 - Equipment
Division 13 - Equipment
Division 16 – Electrical

1.03 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE INFORMATION

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted per Section 01300.

PART 2 - PRODUCTS

2.01 FABRICATION

A. Suppliers

1. Electro Power LLC, Orlando, FL 32824, (407) 751-0919

2. Allen Bradley

B. Control Panels

1. Unless otherwise noted. The panels shall be of all-welded Type 316 stainless steel construction, shall be rated NEMA 4X, and shall have a continuous drip lip over the door(s). Panels shall be suitable for surface wall mounting. Where door seal matches up to enclosure, a raised lip shall be provided to deflect water.

2. Doors shall have a continuous hinge. The top of the panel shall be covered.

3. The panels shall be sized to provide heat dissipation such that the maximum operating temperature for the lowest rated component is not exceeded with an ambient temperature of 100 deg F. Calculation shall include direct mid-summer sun exposure for exterior-mounted panels.

4. Provide thermostatically-controlled panel heater to maintain an interior panel temperature of not less than 50 degrees F with an ambient temperature of -20 deg F.

5. All conductors running from the field to the panels shall be a single, continuous length, without splices, except at accepted junction boxes. Junction boxes shall have terminal blocks with 20 percent spares in addition to terminals for all wires including spare wires. Special care shall be exercised to carry grounding lines through such junction boxes with the least possible resistance.

6. All panel equipment shall be mounted and wired on or within the cabinet. Wiring shall comply with the latest National Electrical Code. All wiring within the panel shall be grouped together with harnesses and secured to the structure. All wiring shall be numbered in accordance with the numbering system used on the wiring/connection diagrams. Power wiring shall be routed separate from low voltage DC signal wiring. Where crossing power and low voltage DC wiring is necessary, crossing shall be at right angles. Parallel troughs for different voltages shall be separated by a minimum of 12 inches. Power wire shall be 12 AWG type THWN stranded, insulated for not less than 600 volts, unless specified otherwise. Signal wire shall be 16 AWG, THW stranded, insulated for not less than 600 volts.

7. Wire color shall be as follows:

   a. Line Power – Black

   b. Neutral or common – White

   c. AC Control – Red

   d. DC Control – Blue

   e. Equipment or Chassis Ground – Green

   f. Externally powered circuits - Yellow

8. Wiring and connection diagrams shall conform to ISA S5.4 Instrument Loop Diagrams and shall be submitted by the manufacturer as part of the shop drawings for review by the Engineer.

9. All wiring in the panels shall terminate in terminal blocks. Terminal blocks shall be arranged in groups (Power, AC control, DC signal, alarm). Terminal blocks shall be barrier type with the appropriate voltage rating (600 volts minimum). They shall be the raised channel mounted type. Wire connectors shall be the hook fork type with non-insulated barrel for crimp type compression connection to the wire. Wire and tube markers shall be the sleeve type with heat impressed letters and numbers. Terminal strips shall be provided for the purpose of connecting all control and signal wiring. Direct interlock wiring between equipment will not be allowed. Only one side of a terminal block row shall be used for internal wiring.

10. All wiring to hand switches and devices which are live circuits independent of the panel's normal circuit breaker protection shall be clearly identified as such.

11. Nameplates shall be provided for all equipment. The nameplates shall be approximately 1 inch by 3 inch constructed of black and white laminated, phenolic material having

engraved letters approximately 1/4 inch high, extending through the white face into the black layer. Nameplates shall be attached to panels by self-tapping screws.

12. The control panel shall be factory-tested prior to shipment. Field installation by the Subcontractor shall consist only of setting the panel in place and making necessary electrical connections.

13. All components shall be mounted in a manner that shall permit servicing adjustment, testing and removal without disconnecting, moving or removing any other component. All gages, meters, receivers, switches, pushbuttons and accessories shall be flush mounted.

14. Components mounted on the inside of panels shall be mounted on removable plates and not directly to the enclosure. Mounting shall be rigid and stable unless shock mounting is required otherwise by the manufacturer to protect equipment from vibration. Component mounting shall be oriented in accordance with the component manufacturer's and industries' standard practices. All internal components shall be identified with suitable plastic or metal engraved tags attached with drive pins adjacent to (not on) each component identifying the component in accordance with Drawings, Specifications, and Supplier's data.

15. Pushbuttons shall be heavy-duty, oil tight, 30.5 mm, with momentary contacts. Switches shall be supplied with the number of poles required for the application, an escutcheon plate, and contacts rated for 10 amperes at 120 volts AC.

16. Relays shall be double pole, double throw, octal plug-in type with a transparent dust cover. The relay shall be equipped with an indicating light to indicate when its coil is energized. The relays shall have contacts rated for 10 amperes at 120-volts AC. The mechanical life of the relay shall be 10,000,000 operations minimum (ampere rating shall be increased as necessary for load handling capacity where needed.)

17. Timing relays shall be solid-state plug-in type with a dust and moisture resistant case. The timers shall be of the multi-range/analog or digital type with selectable ranges, between 1 second and 10 hours full scale. The output contacts shall be rated at 2.5 amperes minimum at 120 volts AC. The timing relay shall have a "timing in progress" indication. The mechanical life shall be 10,000,000 operations minimum.

18. Selector switches shall be heavy-duty 30.5 mm, oil tight. Switches shall be supplied with the number of poles required for the application, an escutcheon plate, and contacts rated for 10 amperes at 120 volts AC.

19. General layout of instruments and controls are shown on the Drawings. Minor deviations from the layout may be allowed after review by the Engineer.

20. Furnish Oxidation Inhibitors and install one in each panel at time of start-up.

21. Loop isolators called out or intrinsic safety barriers shall mount inside the instrument panels.

22. Contractor shall provide fiber optic patch cords, terminations, cross connects, media converters, gateways, etc.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 17490 - MEASUREMENT AND CONTROL COMMISSIONING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall furnish and install all instrumentation equipment and accessory items as shown on the Contract Drawings and as specified herein.

1.02 RELATED WORK

A. The following Sections of this Specification Division contain requirements on instrumentation and control equipment and software which are considered to be covered by applicable requirements of this section (and shall be included in the bid by a single Instrumentation Supplier for this Project):

Section 16440 - Motor Control
Section 17410 - Basic Measurement and Control Instrumentation Materials and Methods
Section 17420 - Instruments
Section 17430 - Boxes, Panels and Control Centers

B. The following Divisions of these Specifications contain requirements on equipment furnished by other suppliers that must interface with the instrument system, or on methods and materials to be performed/used in the installation and/or wiring of the instrumentation system.

Division 1 - General Requirements
Division 11 - Equipment
Division 13 - Equipment
Division 16 – Electrical

1.03 SHOP DRAWINGS, DESCRIPTIVE LITERATURE, INSTALLATION, OPERATION AND MAINTENANCE INFORMATION

A. Shop Drawings including descriptive literature and/or installation, operation and maintenance instructions shall be submitted per Section 01300.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SEQUENCE OF CONSTRUCTION

A. Installation and startup shall be coordinated with the Owner.

B. Delivery, startup, configuration and programming of new equipment furnished under this Division shall be coordinated with process equipment installation Divisions 11 and 13. A qualified technician shall be present on-site during equipment startups. Configuration and programming of existing equipment, network switches, SCADA and devices affected by this project shall be done by this contractor.

3.02 INSTALLATION/APPLICATION/ERECTION

A. Instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment, transmitters, alarms and similar devices shown on the Drawings are approximate only. Exact locations shall be as accepted

by the Engineer during construction. Obtain in the field all information relevant to the placing of process control work, proceed as directed by the manufacturer and furnish all labor and materials necessary to complete the work in an acceptable manner.

B. The instrumentation installation details on the Drawings indicate the designed installation for the instruments specified. Where specific installation details are not specified or shown on the Drawings, the manufacturer's recommended practice shall be followed.

C. All work shall be executed in full accordance with codes. Should any work be performed contrary to said codes and/or regulations, the Contractor shall bear full responsibility for such violations and assume all costs arising therefrom. All equipment used in areas designated as hazardous shall be designed for the Class, Division, and Group as required on the Drawings for the locations.

D. Unless specifically shown in the Contract Documents, direct reading or electrical transmitting instrumentation shall not be mounted on process piping. Instrumentation shall be mounted on instrument racks or stands. All instrumentation connections shall be provided with shutoff and drain valves.

E. All piping to and from field instrumentation shall be provided with necessary unions, test tees, couplings, adaptors, and shut-off valves.

F. Field instruments requiring power supplies shall be provided with local electrical shut-offs and fuses as required.

G. Brackets and hangers required for mounting of equipment shall be provided. They shall be installed in a workmanlike manner and not interfere with any other equipment.

H. The system supplier shall investigate each space in the building through which equipment must pass to reach its final location. If necessary, the system supplier shall be required to ship his material in sections sized to permit passing through restricted areas in the building. The system supplier shall also investigate, and make any field modifications to the allocated space for each cabinet, enclosure and panel to assure proper space and access (front, rear, side).

I. The shield on each process instrumentation cable shall be continuous from source to destination and be grounded as directed by the manufacturer of the instrumentation equipment but in no case shall more than one ground point be employed for each shield.

J. Lifting rings shall be removed from cabinets/assemblies. Hole plugs shall be provided for the holes of the same color as the cabinet.

K. The system supplier, acting through the Contractor, shall coordinate the installation, the placing and location of system components, their connections to the process equipment panels, cabinets and devices, subject to the Engineer's acceptance. He shall be responsible to ensure that all field wiring for power and signal circuits are correctly done in accordance with best industry practice and provide for all necessary system grounding to ensure a satisfactory functioning installation. The Contractor hereunder shall schedule and coordinate his work under this Section with that of the electrical work specified under applicable Sections of Division 16.

3.03 FIELD QUALITY CONTROL

A. After equipment and materials have been shipped to the job site, the Supplier shall furnish the services of a factory-trained service technician or engineer to assist and advise the Contractor during installation, setup, configuration and to provide programming/calibration/ adjustment at initial startup. A minimum period of two (2) days at eight (8) person hours a day on the job site is required, with a minimum of a one (1) calendar day follow up two (2) weeks after the original training and expenses associated with additional days necessary shall be at no cost to the Owner.

B. Following installation, checkout, and final adjustment of all panels, instruments, meters, monitoring, and control devices, the Contractor shall schedule a performance test in the presence of the Engineer on all equipment. The Contractor shall furnish the services of the system supplier's servicemen, all special tools, calibration equipment, and labor to perform the tests.

C. Meters shall be tested at 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent of scale, if possible. All status and alarm switches as well as all monitoring and control functions shall also be checked, including logging at printers and change of state on graphics. Testing shall be done from the signal source to the final element or device including all field wiring. Results of all testing shall be submitted to the Engineer in writing.

D. As much as possible, points shall be checked "end-to-end". For example, valve status inputs shall be checked by stroking the valve, and a pump start output shall be checked by using it to start to start the pump. Simulated testing shall be allowed only when no practical alternative exists. Workstation displays shall be verified for correctness at the same time. An I/O checklist shall be used to record test results and a copy provided to the Engineer upon completion. During system testing, the Contractor shall have a representative onsite continuously who is capable of troubleshooting and modifying system configuration programming.

E. If, during running of the tests, one or more points appear to be out by more than the system accuracy statement, or fails to perform in accordance with agreed strategies, the system supplier's servicemen shall make such adjustment or alterations as are necessary to bring equipment/programming up to specification performance. Following such adjustment, the tests shall be repeated for all specified points to ensure compliance.

3.04 PERFORMANCE TEST

A. Subsequent to the full system implementation, the Contractor shall conduct a successful 30 day final acceptance test for the system furnished and installed under this Contract. In this test, the entire system must operate continuously for 24 hours per day, 7 days per week during the test period, with zero downtime resulting from system failures. If a system failure occurs, the 30-day test period will be repeated, starting over at time zero, from the time that the system failure is repaired. The Contractor shall repeat the test until it is satisfactorily completed. The system will only be acceptable to the Owner after all equipment and software has satisfied the performance test requirements.

B. The Contractor shall submit a final acceptance test completion report which shall state that all Contract requirements have been met and which shall include a summary of maintenance/repair efforts that were required during the test period. Final acceptance of the system by the Owner until this has occurred.

3.05 ADJUSTING AND CLEANING

A. All equipment furnished under this Section of the Specifications shall be adjusted/calibrated as defined elsewhere this Section/Division.

B. All instruments and equipment shall be left free from shipping stickers, paint splatter, dirt, grease, etc., and shall be clean and in like new condition at final acceptance. Touch-up paint shall be furnished as needed to repair blemishes and scratches in finish paint on panels and enclosures, which shall be corrected by the Contractor.

3.06 EXTRA STOCK/SPARE PARTS

A. The following supplies and spare parts shall be furnished:

1. Ten fuses for each type/size in the system.

2. Forty-six (46) Cutler-Hammer C799L2 oxidation inhibitors; install one in each cabinet, starter, controller new and existing.

3. One relay of every size and type provided in the project.

4. One E300 electronic overload.

5. One VFD of each size used.

B. Other spare parts are listed in specific instrument technical specifications in the appropriate Division 17 Specification Section herein. All spare parts shall be packaged in an acceptable manner for long-term storage and adequately protected against corrosion, humidity and temperature extremes. All items shall be tagged externally with what they are; both a written description and a manufacturer brand/part number.

END OF SECTION

DIVISION 18

SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

SECTION 18000 - SCADA INTEGRATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide SCADA software development, testing, commissioning, debugging, and maintenance services as specified herein. The services specified in this section shall be provided by an integrator with proven experience in CITECT.

B. Integrate each I/O point indicated on the Contract drawings and associated vendor submittals for into the existing SCADA software.

C. Provide software operation training services.

D. Provide all Instrumentation, controls, panels, hardware, patch cords, connectors, fiber terminations and fiber testing, etc.

E. Provide all configuration, settings, programming of devices, network switches, controllers. Integrator shall be responsible for accepting device communications via Ethernet and can either process the received data through the existing PLCs or read the information directly via Citect and make all adjustments necessary for display and control in the Citect software. Integrator shall make all program changes and adjustments to the existing PLC's necessary for full control and monitoring of devices, refer to I/O list in section 18100.

F. Attend at least 10 Owner and Contractor coordination meetings to insure proper coordination with all trades and attend, via conference call, all weekly progress meetings for the entire duration of the project

1.02 RELATED WORK

A. General requirements are located in Division 1.

B. Section 16440 – Motor Control
Section 16446 – Variable Frequency Drives
Section 17410 – Basic Measurement and Control Instrumentation, Materials and Method
Section 17420 – Instruments
Section 17430 – Boxes, panels, and control centers.
Section 17490 – Measurement and control commissioning

1.03 SUBMITTALS

A. Software Submittals: Provide software submittal in hardcopy form. Provide initial graphic display and report format layouts as described later in this specification. List and briefly describe all operator interface functions provided at the SCADA PC, including: alarm annunciation and acknowledgment, status displays, report generation, event logging, trending, etc.

B. Operation & Maintenance: O&M manual shall consist of system description and as-built-screen shots with description of features and operator interface. Reports and report access shall be described. An alarm list and alarm description shall be included. Also it shall

describe backup procedures and how to check backup functionality and how to restore if an outage occurs.

C. Submit required changes to existing PLC's for review and approval.

1.04 QUALITY ASSURANCE

A. The project manager assigned by the integrator shall have at least five years' experience within the last five years in the design, manufacture, installation, calibration, and commissioning of instrumentation/Scada systems of similar size and complexity to this project.

B. The project manager assigned by the integrator shall have a minimum of a Bachelor's degree in Engineering or similar from an ABET accredited university.

C. Software Progress Meetings: Allow in Bid for (6) meetings at Engineer's office in Lexington, KY, for review of graphic operator screens. Meetings to commence at time of initial software development kickoff and continue up to final completion. These meetings shall be for specific purpose of assuring that software development work is in accord with Contract requirements and are in addition to project progress meetings that may otherwise be required. If the software can be hosted on a website such that the Engineer can access the logic and graphics, then the software progress meetings can be implemented via telephone or web conference.

1.05 WARRANTY & SERVICE

A. The Contractor shall guarantee all work including equipment, materials, and workmanship. This guarantee shall be against all defects of the electrical system or improper equipment operation. It shall last for the period of time specified in the General Conditions of the Contract, but not less than one year from the date of system acceptance (i.e. – when the Engineer accepts that the punchlist is complete.)

B. Return visits – the Contractor shall provide a minimum of one 16-hr return visit after final completion to implement additional software items as requested by the Owner. The costs for this return visit shall be included in the bid price.

1.06 TRAINING

A. The required training shall include instruction on how the software works with new devices, its relationship to site equipment and operation, detailed review of O & M instructions, troubleshooting and record-keeping recommendations.

B. Onsite software training shall be provided, a minimum of one (1) day with (8) person hours of training each day for total of eight (8) person-hours of training.

1.07 GENERAL SCADA SOFTWARE REQUIREMENTS

A. The existing Citect SCADA software shall be utilized. If additional software tag or other licensing is needed to implement the requirements of this Contract, then that licensing shall be provided. If a SCADA software version upgrade is necessary to implement the requirements of this Contract, then that version upgrade shall be provided.

1.08 COORDINATION WITH CONTROL CONTRACTOR

A. SCADA contractor shall be required to coordinate with owner for the development and installation of the WHWWS control system. This will involve assignment of IP addresses and other network parameters, and sharing of tag/address databases to ensure each contractor is able to successfully implement their portion of the scope for overall project success.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.01 SOFTWARE SERVICES

A. General: Software services shall include full integration into the existing control console, program development, testing, documentation, and work necessary to implement a complete and fully operating system as shown on Drawings and as specified. Work requires coordination with existing programmable controllers (PLCs), new flex I/O implementation of Operator Interface and reports, alarm handling, and data collection. Communicate PLC error conditions to Operator Interface for logging and reporting. Accept Operator Interface directives for set point changes and hand switches.

B. SCADA Interface Screens: Provide and overall site screen to allow selection of subsections for sample pumps, chemscan and chemical pumps. Provide graphic representation of processes and control over pumps. Also provide data collection activities to provide historical trend analysis and process data readings for use in management reporting. Provide the following screens as a bare minimum. Some of these screens (such as Network Status) may already exist and the pump and chemscan modifications will need to be integrated into the existing screen:

1. Active Alarms
2. Process Flow Diagram
3. Alarm & Event History
4. Network Status
5 Trending
6. Elapsed Run Time Reports
7. Flow Total Reports
8. Chemscan Status and Readings.
9. Heat Box Temperature and Alarms.

C. SCADA software required application features:

1. Screens shall be fully windowed and shall use a mouse for control. Use colors, function keys, and navigational controls consistently.

2. Alarm Management: For each process or system event classed as an alarm provide facilities for displaying and logging in database, acknowledgment, and

purging of stale messages. Alarm events are derived from discrete inputs, analog trip values, logic combinations and computations as needed. Log and display both alarm events and returns to normal. Provide date/time stamps for events, descriptive message, and event type code. Use color combinations to distinguish following alarm states: Alarm-Unacknowledged, Alarm-Acknowledged, Normal-Unacknowledged, and Normal-Acknowledged. Each alarm point indicated in the I/O Table is required to be integrated into SCADA. In addition to this, the following alarms must also be collected from the local WHWWS controller and integrated into SCADA:

a. Alarms for each pump controller
b. Equipment fail-to-start alarms
c. Instrument failure alarms
d. Chemscan Alarms

3. Graphic Displays:

a. Provide process-oriented displays showing current process status.
b. For each display, show process elements such as pumps, valves, tanks, pipe lines, etc., with their current operational status. Emphasis shall be placed on depicting the system in a "P&ID" format that allows easy conceptualization of process flow and tank levels rather than depicting equipment in actual physical location or scale. Three-dimensional graphics are not required.
c. Not running state: graphic shall be natural color with no motion.
d. Running state: Graphic shall be green color and shall rotate or show other type of motion as appropriate. Both color and motion shall be depicted.
e. Red color shall be reserved for alarm graphics.
f. Wells shall include both analog and digital indication of current fill/level status. Also, static text must be added to indicate level at bottom of wet well and top (or overflow) of wet well.
g. Indicators shall use an appropriate number of significant digits and dead band to produce steady values.

4. Print Screen function shall direct an image of the currently displayed screen to any system printer as the user directs. When directed to a color printer, a color screen image shall be produced.

5. Trending: Provide on-screen trending displays that are user definable that operate from either previously collected historical trend groups (named file) or from a group of real-time variables. Provide facilities for user selection of colors, time (horizontal), and measurement (vertical) scales. Accommodate real-time sampling intervals as short as 1 second. Real-time trends shall show alarm setpoints. Historical trend displays shall have time-scale panning controls. All trends must have an adjustable cursor that indicates both Y and X axis values at the user-selected location.

6. Data Storage:

a. Data shall be stored to the Historian's database. Text, binary, or otherwise "flat" file storage is not acceptable.

b. All tags, both analog and digital, shall be stored via "Delta" storage method. That is, a new value shall be stored only when the tag has changed an appropriate amount. Normally the delta storage should be triggered at 0.1% change against the tag's maximum value, although this level may need to be adjusted if the tag has an abnormally wide range of

operation.

c. Establish automatic backup of historical data on a daily basis. The data shall be stored on an external hard-drive unless other procedures have been approved by LFUCG.

7. Trending

a. For each tag selected to be trended in the I/O table, provide a pre-configured trend that shows both real-time and historical values. Certain tags may be added to the same trend where appropriate as long as they are uniquely identified via color and label.

b. Provide a custom trend screen whereby the operator has the ability to trend any tag in the database.

8. Reports:

a. Reporting requirements shall consist of both live HMI screens and published historical reports. The live HMI screens shall dynamically update the values for "today" or "this month" and shall display the values for "yesterday" or "last month". The published reports shall be accessible such that LFUCG can select which date or month they would like to view. In lieu of published reports, it is acceptable to store the data in a database with a report template as long as query date selection tools are provided to allow LFUCG to query a specific date range to obtain the desired report.

b. Daily totals and monthly totals (both run-times and flow totals) shall be captured from the flow meters and controllers and logged to the database.

c. The following parameters shall be reported:

i. Motor & Equipment Run times: For each motor or piece of equipment that is monitored, report "Run Time Today" and "Run Time Yesterday" on the HMI screen and log each runtime to the database daily.

ii. Flow Totals: For both Wet Well Influent and Effluent flows, report "Flow Total Today", "Flow Total Yesterday", "Flow Total This Month", and "Flow Total Last Month."

e. Data Export: Establish a simple method of data export to Excel for each run time and flow total value.

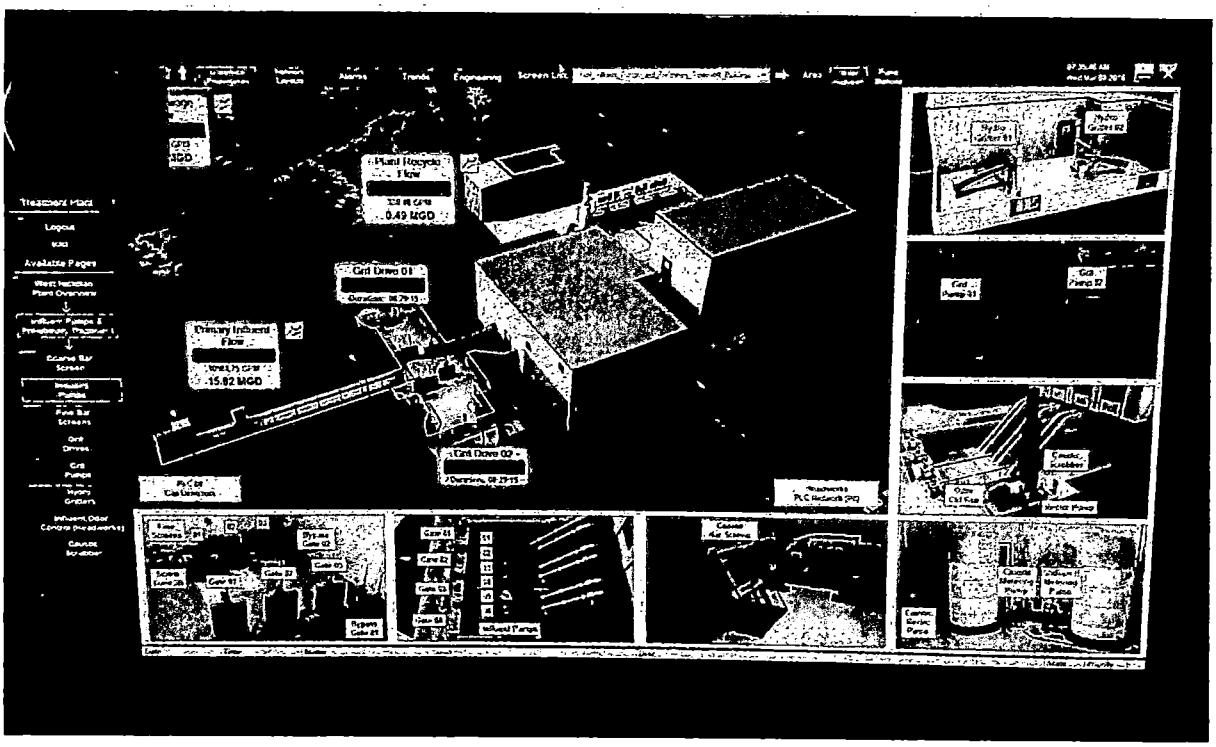
3.02 PERFORMANCE TEST

A. Following installation, checkout, and final adjustment of software, the Contractor shall schedule a performance test in the presence of the Engineer and the Owner.

B. Demonstrate to the Engineer and Owner that each I/O point scheduled on the Contract Drawings has been integrated and is functioning properly.

C. Demonstrate trending, reporting, and alarm messaging has been configured properly and is operational.

D. Software development shall not be accepted until the SCADA system functions for at least one week with zero nuisance alarms. Nuisance alarms shall be as defined by the Engineer.



END OF SECTION

Sheet #	Description	Tag	Drawing Tag	Type	Signal	Range / Off Status	Units / On Status	Field Wiring Data						
								Field ISA Signal Source / Destination	Local Display/ Indication	PLC Display/ Indication	SCADA Display/ Indication	Equipment Panel Location	Field FTC	SCADA Panel
I-222	Sample Pump 1 In-Auto	YIR-SP1-1001	HS-1001-1A	DI	ETH	Normal	Auto		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Running	YIP-SP1-1001	RL-1001-1A	DI	ETH	Normal	Running		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Fault	YAIR-SP1-1001	XA-1001-1A	DI	ETH	Normal	Alarm		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Flow	FIR-SP1-1001	FIT-1001	AI	ETH	0-120	GPM		N	N	Y	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Start/Stop	YCR-SP1-1001	HS-1001-1B	DO	ETH	Normal	Start/Stop		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Temperature	TIR-SP1-1001	TT-1001	AI	ETH	0-125	°F		N	N	Y	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Leak Detection	YAIR-SP1-1001	XS-1001-1B	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Thermal Overload	TAHR-SP1-1001	XS-1001-1A	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Amps Phase A	IRC-SP1-1001	II-1001-1A	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Amps Phase B	IRC-SP1-1001	II-1001-1B	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Amps Phase C	IRC-SP1-1001	II-1001-1C	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 In-Auto	YIR-SP2-1002	HS-1002-1A	DI	ETH	Normal	Auto		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 Running	YIP-SP2-1002	RL-1002-1A	DI	ETH	Normal	Running		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 Fault	YAIR-SP2-1002	XA-1002-1A	DI	ETH	Normal	Alarm		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 Flow	FIR-SP2-1002	FIT-1002	AI	ETH	0-120	GPM		N	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 Start/Stop	YCR-SP2-1002	HS-1002-1B	DO	ETH	Normal	Start/Stop		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 Leak Detection	YAIR-SP2-1002	XS-1002-1B	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 Thermal Overload	TAHR-SP2-1002	XS-1002-1A	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 Amps Phase A	IRC-SP2-1002	II-1002-1A	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 Amps Phase B	IRC-SP2-1002	II-1002-1B	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 Amps Phase C	IRC-SP2-1002	II-1002-1C	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 In-Auto	YIR-SP3-1003	HX-1003-1A	DI	ETH	Normal	Auto		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 Running	YIP-SP3-1003	RL-1003-1A	DI	ETH	Normal	Running		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 Fault	YAIR-SP3-1003	XA-1003-1A	DI	ETH	Normal	Alarm		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 Flow	FIR-SP3-1003	FIT-1003	AI	ETH	0-120	GPM		N	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 Start/Stop	YCR-SP3-1003	HS-1003-1B	DO	ETH	Normal	Start/Stop		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 Leak Detection	YAIR-SP3-1003	XS-1003-1B	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 Thermal Overload	TAHR-SP3-1003	XS-1003-1A	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 Amps Phase A	IRC-SP3-1003	II-1003-1A	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 Amps Phase B	IRC-SP3-1003	II-1003-1B	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 Amps Phase C	IRC-SP3-1003	II-1003-1C	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-224	Sample Pump 4 In-Auto	YIR-SP4-1004	HS-1004-1A	DI	ETH	Normal	Auto		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 4 Running	YIP-SP4-1004	RL-1004-1A	DI	ETH	Normal	Running		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 4 Fault	YAIR-SP4-1004	XA-1004-1A	DI	ETH	Normal	Alarm		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 4 Flow	FIR-SP4-1004	FIT-1004	AI	ETH	0-120	GPM		N	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 4 Start/Stop	YCR-SP4-1004	HS-1004-1B	DO	ETH	Normal	Start/Stop		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 4 Leak Detection	YAIR-SP4-1004	XS-1004-1B	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 4 Thermal Overload	TAHR-SP4-1004	XS-1004-1A	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 4 Amps Phase A	IRC-SP4-1004	II-1004-1A	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 4 Amps Phase B	IRC-SP4-1004	II-1004-1B	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 4 Amps Phase C	IRC-SP4-1004	II-1004-1C	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 In-Auto	YIR-SP5-1005	HS-1005-1A	DI	ETH	Normal	Auto		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 Running	YIP-SP5-1005	RL-1005-1A	DI	ETH	Normal	Running		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 Fault	YAIR-SP5-1005	XA-1005-1A	DI	ETH	Normal	Alarm		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 Flow	FIR-SP5-1005	FIT-1005	AI	ETH	0-120	GPM		N	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 Start/Stop	YCR-SP5-1005	HS-1005-1B	DO	ETH	Normal	Start/Stop		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 Leak Detection	YAIR-SP5-1005	XS-1005-1B	DI	ETH	Normal	Alarm		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 Thermal Overload	TAHR-SP5-1005	XS-1005-1A	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 Amps Phase A	IRC-SP5-1005	II-1005-1A	AI	ETH	0-10	Amps		N	N	N	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 Amps Phase B	IRC-SP5-1005	II-1005-1B	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 Amps Phase C	IRC-SP5-1005	II-1005-1C	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 In-Auto	YIR-SP6-1006	HS-1006-1A	DI	ETH	Normal	Auto		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 Running	YIP-SP6-1006	RL-1006-1A	DI	ETH	Normal	Running		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 Fault	YAIR-SP6-1006	XA-1006-1A	DI	ETH	Normal	Alarm		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 Flow	FIR-SP6-1006	FIT-1006	AI	ETH	0-120	GPM		N	N	Y	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 Start/Stop	YCR-SP6-1006	HS-1006-1B	DO	ETH	Normal	Start/Stop		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 Leak Detection	YAIR-SP6-1006	XS-1006-1B	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 Thermal Overload	TAHR-SP6-1006	XS-1006-1A	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 Amps Phase A	IRC-SP6-1006	II-1006-1A	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 Amps Phase B	IRC-SP6-1006	II-1006-1B	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 Amps Phase C	IRC-SP6-1006	II-1006-1C	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 In-Auto	YIR-SP7-1007	HS-1007-1A	DI	ETH	Normal	Auto		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Running	YIP-SP7-1007	RL-1007-1A	DI	ETH	Normal	Running		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Fault	YAIR-SP7-1007	XA-1007-1A	DI	ETH	Normal	Alarm		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Flow	FIR-SP7-1007	FIT-1007	AI	ETH	0-120	GPM		N	N	Y	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Start/Stop	YCR-SP7-1007	HS-1007-1B	DO	ETH	Normal	Start/Stop		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Temperature	TIR-SP7-1007	TT-1007	AI	ETH	0-125	°F		N	N	Y	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Leak Detection	YAIR-SP7-1007	XS-1007-1B	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Thermal Overload	TAHR-SP7-1007	XS-1007-1A	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Amps Phase A	IRC-SP7-1007	II-1007-1A	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Amps Phase B	IRC-SP7-1007	II-1007-1B	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Amps Phase C	IRC-SP7-1007	II-1007-1C	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-221	Sample Pump 8 In-Auto	YIR-SP8-1008	HS-1008-1A	DI	ETH	Normal	Auto		Y	N	Y	Combination Starter @ Pump	N/A	P2

Sheet #	Description	Tag	Drawing Tag	Type	Signal	Range / Off Status	Units / On Status	Field Wiring Data						
								Field ISA Signal Source / Destination	Local Display/ Indication	PLC Display/ Indication	SCADA Display/ Indication	Equipment Panel Location	Field FTC	SCADA Panel
I-221	Sample Pump 8 Running	YIP-SP8-1008	RL-1008-1A	DI	ETH	Normal	Running		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-221	Sample Pump 8 Fault	YAIR-SP8-1008	XA-1008-1A	DI	ETH	Normal	Alarm		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-221	Sample Pump 8 Flow	FIR-SP8-1008	FIT-1008	AI	ETH	0-120	GPM		N	N	Y	Combination Starter @ Pump	N/A	P2
I-221	Sample Pump 8 Start/Stop	YCR-SP8-1008	HS-1008-1B	DO	ETH	Normal	Start/Stop		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-221	Sample Pump 8 Leak Detection	YAIR-SP8-1008	XS-1008-1B	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P2
I-221	Sample Pump 8 Thermal Overload	TAHR-SP8-1008	XS-1008-1A	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P2
I-221	Sample Pump 8 Amps Phase A	IRC-SP8-1008	II-1008-1A	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-221	Sample Pump 8 Amps Phase B	IRC-SP8-1008	II-1008-1B	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-221	Sample Pump 8 Amps Phase C	IRC-SP8-1008	II-1008-1C	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-228	Sample Pump 1 Nitrite	AIR-SP1-1001-1A	AIR-1001-1A	AI	ETH	0.1-5	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 1 Nitrate	AIR-SP1-1001-1B	AIR-1001-1B	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 1 Ammonia	AIR-SP1-1001-1C	AIR-1001-1C	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 1 Phosphate	AIR-SP1-1001-1D	AIR-1001-1D	AI	ETH	0.1-10	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 2 Nitrite	AIR-SP2-1002-1A	AIR-1002-1A	AI	ETH	0.1-5	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 2 Nitrate	AIR-SP2-1002-1B	AIR-1002-1B	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 2 Ammonia	AIR-SP2-1002-1C	AIR-1002-1C	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 2 Phosphate	AIR-SP2-1002-1D	AIR-1002-1D	AI	ETH	0.1-10	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 3 Nitrite	AIR-SP3-1003-1A	AIR-1003-1A	AI	ETH	0.1-5	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 3 Nitrate	AIR-SP3-1003-1B	AIR-1003-1B	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 3 Ammonia	AIR-SP3-1003-1C	AIR-1003-1C	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 3 Phosphate	AIR-SP3-1003-1D	AIR-1003-1D	AI	ETH	0.1-10	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 4 Nitrite	AIR-SP4-1004-1A	AIR-1004-1A	AI	ETH	0.1-5	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 4 Nitrate	AIR-SP4-1004-1B	AIR-1004-1B	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 4 Ammonia	AIR-SP4-1004-1C	AIR-1004-1C	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 4 Phosphate	AIR-SP4-1004-1D	AIR-1004-1D	AI	ETH	0.1-10	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 5 Nitrite	AIR-SP5-1005-1A	AIR-1005-1A	AI	ETH	0.1-5	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 5 Nitrate	AIR-SP5-1005-1B	AIR-1005-1B	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 5 Ammonia	AIR-SP5-1005-1C	AIR-1005-1C	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 5 Phosphate	AIR-SP5-1005-1D	AIR-1005-1D	AI	ETH	0.1-10	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 6 Nitrite	AIR-SP6-1006-1A	AIR-1006-1A	AI	ETH	0.1-5	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 6 Nitrate	AIR-SP6-1006-1B	AIR-1006-1B	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 6 Ammonia	AIR-SP6-1006-1C	AIR-1006-1C	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 6 Phosphate	AIR-SP6-1006-1D	AIR-1006-1D	AI	ETH	0.1-10	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 7 Nitrite	AIR-SP7-1007-1A	AIR-1007-1A	AI	ETH	0.1-5	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 7 Nitrate	AIR-SP7-1007-1B	AIR-1007-1B	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 7 Ammonia	AIR-SP7-1007-1C	AIR-1007-1C	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 7 Phosphate	AIR-SP7-1007-1D	AIR-1007-1D	AI	ETH	0.1-10	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 8 Nitrite	AIR-SP8-1008-1A	AIR-1008-1A	AI	ETH	0.1-5	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 8 Nitrate	AIR-SP8-1008-1B	AIR-1008-1B	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 8 Ammonia	AIR-SP8-1008-1C	AIR-1008-1C	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 8 Phosphate	AIR-SP8-1008-1D	AIR-1008-1D	AI	ETH	0.1-10	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
E-23	Sodium Aluminate Pump P1021 In-Auto	YIR-NaAlO2-1021	HS-1021	DI	ETH	Normal	Auto		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021 Running	YIP-NaAlO2-1021	RL-1021	DI	ETH	Normal	Running		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021 Fault	YAIR-NaAlO2-1021	XA-1021	DI	ETH	Normal	Alarm		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021 Start/Stop	YCR-NaAlO2-1021	HS-1021	DO	ETH	Normal	Start/Stop		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021 Speed Setpoint	SY-NaAlO2-1021	SY-1021	AI	ETH	XX	GPM		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021 Speed Feedback	SX-NaAlO2-1021	SX-1021	AO	ETH	XX	GPM		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021 Pressure Switch High	PAHR-NaAlO2-1021	PSH-1021	DI	ETH	XX	Alarm		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021Thermal Overload	YAIR-NaAlO2-1021	XS-1021	DI	ETH	Normal	Alarm		Y	N	N	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021 Amps Phase A	IRC-NaAlO2-1021	II-1021-A	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021 Amps Phase B	IRC-NaAlO2-1021	II-1021-B	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021 Amps Phase C	IRC-NaAlO2-1021	II-1021-C	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 In-Auto	YIR-NaAlO2-1022	HS-1022	DI	ETH	Normal	Auto		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 Running	YIP-NaAlO2-1022	RL-1022	DI	ETH	Normal	Running		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 Fault	YAIR-NaAlO2-1022	XA-1022	DI	ETH	Normal	Alarm		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 Start/Stop	YCR-NaAlO2-1022	HS-1022	DO	ETH	Normal	Start/Stop		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 Speed Setpoint	SY-NaAlO2-1022	SY-1022	AI	ETH	XX	GPM		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 Speed Feedback	SX-NaAlO2-1022	SX-1022	AO	ETH	XX	GPM		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 Pressure Switch High	PAHR-NaAlO2-1022	PSH-1022	DI	ETH	XX	Alarm		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022Thermal Overload	YAIR-NaAlO2-1022	XS-1022	DI	ETH	Normal	Alarm		Y	N	N	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 Amps Phase A	IRC-NaAlO2-1022	II-1022-A	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 Amps Phase B	IRC-NaAlO2-1022	II-1022-B	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 Amps Phase C	IRC-NaAlO2-1022	II-1022-C	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 In-Auto	YIR-NaAlO2-1023	HS-1023	DI	ETH	Normal	Auto		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 Running	YIP-NaAlO2-1023	RL-1023	DI	ETH	Normal	Running		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 Fault	YAIR-NaAlO2-1023	XA-1023	DI	ETH	Normal	Alarm		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 Start/Stop	YCR-NaAlO2-1023	HS-1023	DO	ETH	Normal	Start/Stop		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 Speed Setpoint	SY-NaAlO2-1023	SY-1023	AI	ETH	XX	GPM		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3

Sheet #	Description	Tag	Drawing Tag	Type	Signal	Range / Off Status	Units / On Status	Field Wiring Data						
								Field ISA Signal Source / Destination	Local Display/ Indication	PLC Display/ Indication	SCADA Display/ Indication	Equipment Panel Location	Field FTC	SCADA Panel
E-23	Sodium Aluminate Pump P1023 Speed Feedback	SX-NaAlO2-1023	SX-1023	AO	ETH	XX	GPM		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 Pressure Switch High	PAHR-NaAlO2-1023	PSH-1023	DI	ETH	XX	Alarm		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023Thermal Overload	YAIR-NaAlO2-1023	XS-1023	DI	ETH	Normal	Alarm		Y	N	N	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 Amps Phase A	IRC-NaAlO2-1023	II-1023-A	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 Amps Phase B	IRC-NaAlO2-1023	II-1023-B	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 Amps Phase C	IRC-NaAlO2-1023	II-1023-C	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 In-Auto	YIR-NaAlO2-1024	HS-1024	DI	ETH	Normal	Auto		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 Running	YIP-NaAlO2-1024	RL-1024	DI	ETH	Normal	Running		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 Fault	YAIR-NaAlO2-1024	XA-1024	DI	ETH	Normal	Alarm		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 Start/Stop	YCR-NaAlO2-1024	HS-1024	DO	ETH	Normal	Start/Stop		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 Speed Setpoint	SY-NaAlO2-1024	SY-1024	AI	ETH	XX	GPM		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 Speed Feedback	SX-NaAlO2-1024	SX-1024	AO	ETH	XX	GPM		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 Pressure Switch High	PAHR-NaAlO2-1024	PSH-1024	DI	ETH	XX	Alarm		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024Thermal Overload	YAIR-NaAlO2-1024	XS-1024	DI	ETH	Normal	Alarm		Y	N	N	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 Amps Phase A	IRC-NaAlO2-1024	II-1024-A	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 Amps Phase B	IRC-NaAlO2-1024	II-1024-B	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 Amps Phase C	IRC-NaAlO2-1024	II-1024-C	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-10	Remote Operator Station Sample Pump 1 In-Auto	YIR-SP1-1001-1C	HS-1001-1C	DI	ETH	Normal	Auto		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 1 Off	YIR-SP1-1001-2C	HS-1001-1C	DI	ETH	Normal	Off		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 1 On	YIR-SP1-1001-3C	HS-1001-1C	DI	ETH	Normal	On		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Remote Operator Station Sample Pump 2 In-Auto	YIR-SP2-1002-1C	HS-1002-1C	DI	ETH	Normal	Auto		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 2 Off	YIR-SP2-1002-2C	HS-1002-1C	DI	ETH	Normal	Off		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 2 On	YIR-SP2-1002-3C	HS-1002-1C	DI	ETH	Normal	On		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Remote Operator Station Sample Pump 3 In-Auto	YIR-SP3-1001-1C	HS-1003-1C	DI	ETH	Normal	Auto		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 3 Off	YIR-SP3-1001-2C	HS-1003-1C	DI	ETH	Normal	Off		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 3 On	YIR-SP3-1001-3C	HS-1003-1C	DI	ETH	Normal	On		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Remote Operator Station Sample Pump 4 In-Auto	YIR-SP4-1004-1C	HS-1004-1C	DI	ETH	Normal	Auto		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 4 Off	YIR-SP4-1004-2C	HS-1004-1C	DI	ETH	Normal	Off		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 4 On	YIR-SP4-1004-3C	HS-1004-1C	DI	ETH	Normal	On		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Remote Operator Station Sample Pump 5 In-Auto	YIR-SP5-1005-1C	HS-1005-1C	DI	ETH	Normal	Auto		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 5 Off	YIR-SP5-1005-2C	HS-1005-1C	DI	ETH	Normal	Off		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 5 On	YIR-SP5-1005-3C	HS-1005-1C	DI	ETH	Normal	On		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Remote Operator Station Sample Pump 6 In-Auto	YIR-SP6-1006-1C	HS-1006-1C	DI	ETH	Normal	Auto		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 6 Off	YIR-SP6-1006-2C	HS-1006-1C	DI	ETH	Normal	Off		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 6 On	YIR-SP6-1006-3C	HS-1006-1C	DI	ETH	Normal	On		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Remote Operator Station Sample Pump 7 In-Auto	YIR-SP7-1007-1C	HS-1007-1C	DI	ETH	Normal	Auto		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 7 Off	YIR-SP7-1007-2C	HS-1007-1C	DI	ETH	Normal	Off		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 7 On	YIR-SP7-1007-3C	HS-1007-1C	DI	ETH	Normal	On		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Remote Operator Station Sample Pump 8 In-Auto	YIR-SP8-1008-1C	HS-1008-1C	DI	ETH	Normal	Auto		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 8 Off	YIR-SP8-1008-2C	HS-1008-1C	DI	ETH	Normal	Off		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 8 On	YIR-SP8-1008-3C	HS-1008-1C	DI	ETH	Normal	On		Y	N	Y	Chemscan Sample Pump Station	N/A	P2

Notes:

1. Verify wiring connections with the Electrical Contractor before submitting shop drawings
2. All Spare I/O to include graphical and historical database programming
3. ISA tags determined using ANSI / ISA 5.1 Instrumentation and Signals Identification Standards (See Typical Letter Combinations below).

* All Discrete Input Contacts shall be powered from input location

Discrete Input
Discrete Output
Analog Input
Analog Output
DeviceNet Communications
Ethernet / IP
Copper
Modbus Ethernet TCP/IP Communications

Abbreviations:

Tags

AIR	Analysis Indicating Record
FIR	Flow Indicating Record
JAIR	Power Alarm Indicating Record
LALR	Level Alarm Low Record
LIR	Level Indicating Record
LAHR	Level Alarm High Record
PALR	Pressure Alarm Low Record
PAHR	Pressure Alarm High Record
PSH	Pressure Switch High
PIR	Pressure Indicating Record
SCR	Speed Command Record
TAHR	Temperature Alarm High Record
WAHR	Force Alarm High Record
YAIR	Event / State Alarm Indicating Record
YCIR	Event / State Command Indicating Record
YIR	Event / State Indicating Record

Sheet #	Description	Tag	Drawing Tag	Type	Signal	Range / Off Status	Units / On Status	Field Wiring Data: Field ISA Signal Source / Destination	Local Display/ Indication	PLC Display/ Indication	SCADA Display/ Indication	Equipment Panel Location	Field FTC	SCADA Panel
			ZCR	Position Command Record										
			ZCCR	Position Command Close Record										
			ZCOR	Position Command Open Record										
			ZIO	Position Indicating Open										
			ZIOR	Position Indicating Open Record										
			System Designations											
			xxx-SPx-xxxx	Sample Pump										
			xxx-NaAlO2-xxxx	Sodium Aluminate Pumps										

Table 2 — Typical Letter Combinations

First-Letters	Initiating or Measured Variable	Controllers: Recording	Controllers: Indicating	Controllers: Blind	Controllers: Self-Actuated Control Valves	Readout Devices: Recording	Readout Devices: Indicating	Switches and Alarm Devices*: High**	Switches and Alarm Devices*: Low	Switches and Alarm Devices*: Comb	Transmitters: Recording	Transmitters: Indicating	Transmitters: Blind	Solenoids, Relays, Computing Devices	Primary Element	Test Point	Well or Probe	Viewing Device, Glass	Safety Device	Final Element
A	Analysis	ARC	AIC	AC		AR	AI	ASH	ASL	ASHL	ART	AIT	AT	AY	AE	AP	AW			AV
B	Burner/Combustion	BRC	BIC	BC		BR	BI	BSH	BSL	BSHL	BRT	BIT	BT	BY	BE		BW	BG		BZ
C	User's Choice																			
D	User's Choice																			
E	Voltage	ERC	EIC	EC		ER	EI	ESH	ESL	ESHL	ERT	EIT	ET	EY	EE					EZ
F	Flow Rate	FRC	FIC	FC	FCV, FICV	FR	FI	FSH	FSL	FSHL	FRT	FIT	FT	FY	FE	FP		FG		FV
FQ	Flow Quantity	FQRC	FQIC			FQR	FQI	FQSH	FQSL			FQIT	FQT	FQY	FQE					FQV
FF	Flow Ratio	FFRC	FFIC	FFC		FFR	FFI	FFSH	FFSL						FE					FFV
G	User's Choice																			
H	Hand		HIC	HC						HS										HV
I	Current	IRC	IIC			IR	II	ISH	ISL	ISHL	IRT	IIT	IT	IY	IE					IZ
J	Power	JRC	JIC			JR	JI	JSH	JSL	JSHL	JRT	JIT	JT	JY	JE					JV
K	Time	KRC	KIC	KC	KCV	KR	KI	KSH	KSL	KSHL	KRT	KIT	KT	KY	KE					KV
L	Level	LRC	LIC	LC	LCV	LR	LI	LSH	LSL	LSHL	LRT	LIT	LT	LY	LE		LW	LG		LV
M	User's Choice																			
N	User's Choice																			
O	User's Choice																			
P	Pressure/ Vacuum	PRC	PIC	PC	PCV	PR	PI	PSH	PSL	PSHL	PRT	PIT	PT	PY	PE	PP			PSV, PSE	PV
PD	Pressure, Differential	PDRC	PDIC	PDC	PDCV	PDR	PDI	PDSH	PDSL		PDRT	PDIT	PDT	PDY	PE	PP				PDV
Q	Quantity	QRC	QIC			QR	QI	QSH	QSL	QSHL	QRT	QIT	QT	QY	QE					QZ
R	Radiation	RRC	RIC	RC		RR	RI	RSH	RSL	RSHL	RRT	RIT	RT	RY	RE		RW			RZ
S	Speed/Frequency	SRC	SIC	SC	SCV	SR	SI	SSH	SSL	SSHL	SRT	SIT	ST	SY	SE					SV
T	Temperature	TRC	TIC	TC	TCV	TR	TI	TSH	TSL	TSHL	TRT	TIT	TT	TY	TE	TP	TW		TSE	TV
TD	Temperature, Differential	TDRC	TDIC	TDC	TDCV	TDR	TDI	TDSH	TDSL		TDRT	TDIT	TDT	TDY	TE	TP	TW			TDV
U	Multivariable					UR	UI							UY						UV
V	Vibration/Machinery Analysis					VR	VI	VSH	VSL	VSHL	VRT	VIT	VT	VY	VE					VZ
W	Weight/Force	WRC	WIC	WC	WCV	WR	WI	WSH	WSL	WSHL	WRT	WIT	WT	WY	WE					WZ
WD	Weight/Force, Differential	WDRC	WDIC	WDC	WDCV	WDR	WDI	WDSH	WDSL		WDRT	WDIT	WDT	WDY	WE					WDZ
X	Unclassified																			
Y	Event/State/Presence		YIC	YC		YR	YI	YSH	YSL				YT	YY	YE					YZ
Z	Position/Dimension	ZRC	ZIC	ZC	ZCV	ZR	ZI	ZSH	ZSL	ZSHL	ZRT	ZIT	ZT	ZY	ZE					ZV
ZD	Gauging/Deviation	ZDRC	ZDIC	ZDC	ZDCV	ZDR	ZDI	ZDSH	ZDSL		ZDRT	ZDIT	ZDT	ZDY	ZDE					ZDV

Note: This table is not all-inclusive.
*A, alarm, the annunciating device, may be used in the same fashion as S, switch, the actuating device.

**The letters H and L may be omitted in the undefined case.

Other Possible Combinations:

FQ	(Restriction Orifice)	PFR	(Ratio)
FRK, HIK	(Control Stations)	KQI	(Running Time Indicator)
FX	(Accessories)	QQI	(Indicating Counter)
TJR	(Scanning Recorder)	WKIC	(Rate-of-Weight-Loss Controller)
LLH	(Pilot Light)	HMS	(Hand Momentary Switch)

SECTION 18200 – CONTROL NARRATIVES

REVISION HISTORY

Revision	Date	Client Approval	Description of Revisions
0	2020-06-23		Issued for bid

TABLE OF CONTENTS

LIST OF TABLES

1. INTRODUCTION

This document describes the function of the Control Systems for the Chemscan analyzers and sample pumping system and the sodium aluminate dosing system at the West Hickman Wastewater Treatment Plant (WWTP).

1.1 CONTROL SYSTEMS

The existing Chemscan system is being removed. Integrator shall remove all unused tagging, programming, displays, trending, etc. for the existing system.

Devices to be added to the plant are: two (2) new Chemscan analyzers, eight (8) associated sample pumps and their starters, eight (8) associated flow meters, two (2) temperature transmitters in heat boxes, four (4) sodium aluminate pumps with associated VFD's and pressure switches, two (2) pump remote pump operator stations. It is the integrators responsibility to add all devices with all control points and functionality listed in specification sections 11241, 18000, and 18100 as well as make all changes to existing PLCs, MCC's, network panels, and interface cabinets to insure all functionality is provided at the operator control room via existing Citect system.

Further, the integrator shall configure all starters, VFD's, switches, sensors, meters, control systems, etc., in their entirety to insure proper operation and interface to the Citect SCADA system.

The integrator shall supply Ethernet interface media converters or gateways as necessary along with power supplies, system modifications and configuration to interface to Citect. The integrator may, at their option, either process the controls and instrumentation through existing PLCs or process the information and controls in the Citect SCADA software. In either case, the integrator is fully responsible for all new and existing PLC, equipment, and devices to integrate into the system.

2. GENERAL CONTROL AND MONITORING STRATEGY

2.1 Local and Remote Control

All pumps and motors have local starters with H-O-R control. Sample pumps are equipped with overload, seal leak, and thermal switches. A flow meter is provided at each sample pump to manually set flow rate. The flow shall be displayed at the operator control room via Ethernet. Integrator shall provide and install gateways as necessary. Sodium aluminate pumps are equipped with variable speed drives with H-O-R, pressure switches and local controls. Integrator shall provide gateways to interface via Ethernet to Citect.

All pumps shall be controlled locally and remotely via Ethernet. The local control station for any pump shall ALWAYS take precedence over all other control points. The sample pumps will have two additional remote H-O-R control stations located at the Chemscan units to allow operation from Chemscan room via Flex I/O. Integrator shall provide gateway to interface flex I/O to Citect.

Except for the local HAND mode of operation at the local pump control station, whenever a pump control point is in the OFF mode it shall not be overridden by any other control point. The local pump control panel in HAND mode shall always override all other control points.

When the local sample pump selector switch is in the REMOTE position, sample pumps shall be capable of control from the either the operator control room or the remote operator stations at the Chemscan units. When the selector switch at the Chemscan area is in HAND, the associated sample pump shall run unless

one of the other control points in in the OFF or HAND position. When the selector switch at the Chemscan area is in REMOTE, the operator control room shall be capable of HAND or REMOTE operation. When the operator control station at the Chemscan is in the OFF mode, pump shall not run unless directed to do so by the pumps local control station.

The sodium aluminate shall have manually set and be operator adjustable. Operator will determine rate based on system flows and reported levels of nitrites, nitrates, ammonia and phosphate from the Chemscan units.

Sample pumps one and seven each have temperature transmitters in the valve heat box. Sensors shall alarm to SCADA if the temperature in the box falls below 40°F indicating a failure of the heating system to maintain temperature.

2.2 Typical Signals and Alarms

Pumps are configured with the following signals:

- Start/stop
- Run feedback
- Speed reference (VFD pumps only)
- Speed feedback (VFD pumps only)
- Local
- Remote (Auto)
- Fault
- Thermal overload
- Current (3 phases)
- Flow rate (sample pumps via flow meter)
- Other pump/motor protection signals (refer to plan sheets) such as:
    - Leak detection
    - Seal fail
    - Pressure switch high
- Total run time
- Alarms which trigger after a time delay:
    - Fail to start
    - Fail to stop
    - Uncommanded start
    - Uncommanded stop

2.3 ALARM MANAGEMENT

2.4 Priority Levels

Priority levels shall be coordinated with plant operators during programming. Priority and setpoints shall be operator adjustable.

2.5 Alarm Acknowledgement and Reset

Every alarm shall be individually acknowledged at the plant operator console. Reset shall only be initiated at the pumps local control panel.

2.6 SIGNAL HISTORIZATION

The Data Historian shall document all settings, alarms and values. The following types of signals are configured for historizing:

- Process values
- Set points
- Alarm state
- Equipment status and commands
- PID controller settings (PV, SP, CV)
- Chemscan analyzed data.

2.7 EQUIPMENT CONTROL MODES

Table 2-1: Equipment Mode of Operation

TAG	DESCRIPTION	REMOTE (FIELD)	LOCAL (STARTER /VFD)	SCADA CONTROL ROOM
P100X	Sample Pumps	HAND/OFF/ REMOTE	HAND/OFF /REMOTE	HAND/OFF/REMOTE
P102X	Sodium Aluminate Pumps	HAND/OFF/ REMOTE	HAND/OFF /REMOTE	HAND/OFF/REMOTE

2.8 ALARM LIST

Table 2-2: System Alarm List

DESCRIPTION	RANGE	ALARM SP AND PRIORITY					DISCRETE ALARM PRIORITY
		High High	High Warning	High	Low	Low Low	
Pump Fault	N/A						High
Valve Box Temp	0-125°F	32°F		35°F	40°F		
Sample Pump Leak	N/A						High
Sample Pump Thermal Winding	N/A						Low
Sample Pump High Amps	0-10 Amps			X	X		Low
Sodium Aluminate Pressure	N/A						High
Chemscan Fault	N/A						High

Sheet #	Description	Tag	Drawing Tag	Type	Signal	Range / Off Status	Units / On Status	Field Wiring Data						
								Field ISA Signal Source / Destination	Local Display/ Indication	PLC Display/ Indication	SCADA Display/ Indication	Equipment Panel Location	Field FTC	SCADA Panel
I-222	Sample Pump 1 In-Auto	YIR-SP1-1001	HS-1001-1A	DI	ETH	Normal	Auto		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Running	YIP-SP1-1001	RL-1001-1A	DI	ETH	Normal	Running		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Fault	YAIR-SP1-1001	XA-1001-1A	DI	ETH	Normal	Alarm		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Flow	FIR-SP1-1001	FIT-1001	AI	ETH	0-120	GPM		N	N	Y	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Start/Stop	YCR-SP1-1001	HS-1001-1B	DO	ETH	Normal	Start/Stop		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Temperature	TIR-SP1-1001	TT-1001	AI	ETH	0-125	°I		N	N	Y	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Leak Detection	YAIR-SP1-1001	XS-1001-1B	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Thermal Overload	TAHR-SP1-1001	XS-1001-1A	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Amps Phase A	IRC-SP1-1001	II-1001-1A	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Amps Phase B	IRC-SP1-1001	II-1001-1B	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-222	Sample Pump 1 Amps Phase C	IRC-SP1-1001	II-1001-1C	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 In-Auto	YIR-SP2-1002	HS-1002-1A	DI	ETH	Normal	Auto		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 Running	YIP-SP2-1002	RL-1002-1A	DI	ETH	Normal	Running		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 Fault	YAIR-SP2-1002	XA-1002-1A	DI	ETH	Normal	Alarm		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 Flow	FIR-SP2-1002	FIT-1002	AI	ETH	0-120	GPM		N	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 Start/Stop	YCR-SP2-1002	HS-1002-1B	DO	ETH	Normal	Start/Stop		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 Leak Detection	YAIR-SP2-1002	XS-1002-1B	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 Thermal Overload	TAHR-SP2-1002	XS-1002-1A	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 Amps Phase A	IRC-SP2-1002	II-1002-1A	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 Amps Phase B	IRC-SP2-1002	II-1002-1B	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 2 Amps Phase C	IRC-SP2-1002	II-1002-1C	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 In-Auto	YIR-SP3-1003	HX-1003-1A	DI	ETH	Normal	Auto		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 Running	YIP-SP3-1003	RL-1003-1A	DI	ETH	Normal	Running		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 Fault	YAIR-SP3-1003	XA-1003-1A	DI	ETH	Normal	Alarm		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 Flow	FIR-SP3-1003	FIT-1003	AI	ETH	0-120	GPM		N	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 Start/Stop	YCR-SP3-1003	HS-1003-1B	DO	ETH	Normal	Start/Stop		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 Leak Detection	YAIR-SP3-1003	XS-1003-1B	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 Thermal Overload	TAHR-SP3-1003	XS-1003-1A	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 Amps Phase A	IRC-SP3-1003	II-1003-1A	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 Amps Phase B	IRC-SP3-1003	II-1003-1B	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-223	Sample Pump 3 Amps Phase C	IRC-SP3-1003	II-1003-1C	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-224	Sample Pump 4 In-Auto	YIR-SP4-1004	HS-1004-1A	DI	ETH	Normal	Auto		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 4 Running	YIP-SP4-1004	RL-1004-1A	DI	ETH	Normal	Running		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 4 Fault	YAIR-SP4-1004	XA-1004-1A	DI	ETH	Normal	Alarm		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 4 Flow	FIR-SP4-1004	FIT-1004	AI	ETH	0-120	GPM		N	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 4 Start/Stop	YCR-SP4-1004	HS-1004-1B	DO	ETH	Normal	Start/Stop		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 4 Leak Detection	YAIR-SP4-1004	XS-1004-1B	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 4 Thermal Overload	TAHR-SP4-1004	XS-1004-1A	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 4 Amps Phase A	IRC-SP4-1004	II-1004-1A	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 4 Amps Phase B	IRC-SP4-1004	II-1004-1B	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 4 Amps Phase C	IRC-SP4-1004	II-1004-1C	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 In-Auto	YIR-SP5-1005	HS-1005-1A	DI	ETH	Normal	Auto		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 Running	YIP-SP5-1005	RL-1005-1A	DI	ETH	Normal	Running		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 Fault	YAIR-SP5-1005	XA-1005-1A	DI	ETH	Normal	Alarm		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 Flow	FIR-SP5-1005	FIT-1005	AI	ETH	0-120	GPM		N	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 Start/Stop	YCR-SP5-1005	HS-1005-1B	DO	ETH	Normal	Start/Stop		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 Leak Detection	YAIR-SP5-1005	XS-1005-1B	DI	ETH	Normal	Alarm		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 Thermal Overload	TAHR-SP5-1005	XS-1005-1A	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 Amps Phase A	IRC-SP5-1005	II-1005-1A	AI	ETH	0-10	Amps		N	N	N	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 Amps Phase B	IRC-SP5-1005	II-1005-1B	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-224	Sample Pump 5 Amps Phase C	IRC-SP5-1005	II-1005-1C	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 In-Auto	YIR-SP6-1006	HS-1006-1A	DI	ETH	Normal	Auto		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 Running	YIP-SP6-1006	RL-1006-1A	DI	ETH	Normal	Running		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 Fault	YAIR-SP6-1006	XA-1006-1A	DI	ETH	Normal	Alarm		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 Flow	FIR-SP6-1006	FIT-1006	AI	ETH	0-120	GPM		N	N	Y	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 Start/Stop	YCR-SP6-1006	HS-1006-1B	DO	ETH	Normal	Start/Stop		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 Leak Detection	YAIR-SP6-1006	XS-1006-1B	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 Thermal Overload	TAHR-SP6-1006	XS-1006-1A	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 Amps Phase A	IRC-SP6-1006	II-1006-1A	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 Amps Phase B	IRC-SP6-1006	II-1006-1B	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-225	Sample Pump 6 Amps Phase C	IRC-SP6-1006	II-1006-1C	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 In-Auto	YIR-SP7-1007	HS-1007-1A	DI	ETH	Normal	Auto		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Running	YIP-SP7-1007	RL-1007-1A	DI	ETH	Normal	Running		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Fault	YAIR-SP7-1007	XA-1007-1A	DI	ETH	Normal	Alarm		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Flow	FIR-SP7-1007	FIT-1007	AI	ETH	0-120	GPM		N	N	Y	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Start/Stop	YCR-SP7-1007	HS-1007-1B	DO	ETH	Normal	Start/Stop		Y	N	Y	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Temperature	TIR-SP7-1007	TT-1007	AI	ETH	0-125	°I		N	N	Y	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Leak Detection	YAIR-SP7-1007	XS-1007-1B	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Thermal Overload	TAHR-SP7-1007	XS-1007-1A	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Amps Phase A	IRC-SP7-1007	II-1007-1A	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Amps Phase B	IRC-SP7-1007	II-1007-1B	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-226	Sample Pump 7 Amps Phase C	IRC-SP7-1007	II-1007-1C	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P3
I-221	Sample Pump 8 In-Auto	YIR-SP8-1008	HS-1008-1A	DI	ETH	Normal	Auto		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-221	Sample Pump 8 Running	YIP-SP8-1008	RL-1008-1A	DI	ETH	Normal	Running		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-221	Sample Pump 8 Fault	YAIR-SP8-1008	XA-1008-1A	DI	ETH	Normal	Alarm		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-221	Sample Pump 8 Flow	FIR-SP8-1008	FIT-1008	AI	ETH	0-120	GPM		N	N	Y	Combination Starter @ Pump	N/A	P2
I-221	Sample Pump 8 Start/Stop	YCR-SP8-1008	HS-1008-1B	DO	ETH	Normal	Start/Stop		Y	N	Y	Combination Starter @ Pump	N/A	P2
I-221	Sample Pump 8 Leak Detection	YAIR-SP8-1008	XS-1008-1B	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P2

Sheet #	Description	Tag	Drawing Tag	Type	Signal	Range / Off Status	Units / On Status	Field Wiring Data						
								Field ISA Signal Source / Destination	Local Display/ Indication	PLC Display/ Indication	SCADA Display/ Indication	Equipment Panel Location	Field FTC	SCADA Panel
I-221	Sample Pump 8 Thermal Overload	TAHR-SP8-1008	XS-1008-1A	DI	ETH	Normal	Alarm		Y	N	N	Combination Starter @ Pump	N/A	P2
I-221	Sample Pump 8 Amps Phase A	IRC-SP8-1008	II-1008-1A	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-221	Sample Pump 8 Amps Phase B	IRC-SP8-1008	II-1008-1B	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-221	Sample Pump 8 Amps Phase C	IRC-SP8-1008	II-1008-1C	AI	ETH	0-10	Amps		N	N	Y	Combination Starter @ Pump	N/A	P2
I-228	Sample Pump 1 Nitrite	AIR-SP1-1001-1A	AIR-1001-1A	AI	ETH	0.1-5	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 1 Nitrate	AIR-SP1-1001-1B	AIR-1001-1B	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 1 Ammonia	AIR-SP1-1001-1C	AIR-1001-1C	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 1 Phosphate	AIR-SP1-1001-1D	AIR-1001-1D	AI	ETH	0.1-10	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 2 Nitrite	AIR-SP2-1002-1A	AIR-1002-1A	AI	ETH	0.1-5	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 2 Nitrate	AIR-SP2-1002-1B	AIR-1002-1B	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 2 Ammonia	AIR-SP2-1002-1C	AIR-1002-1C	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 2 Phosphate	AIR-SP2-1002-1D	AIR-1002-1D	AI	ETH	0.1-10	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 3 Nitrite	AIR-SP3-1003-1A	AIR-1003-1A	AI	ETH	0.1-5	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 3 Nitrate	AIR-SP3-1003-1B	AIR-1003-1B	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 3 Ammonia	AIR-SP3-1003-1C	AIR-1003-1C	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 3 Phosphate	AIR-SP3-1003-1D	AIR-1003-1D	AI	ETH	0.1-10	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 4 Nitrite	AIR-SP4-1004-1A	AIR-1004-1A	AI	ETH	0.1-5	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 4 Nitrate	AIR-SP4-1004-1B	AIR-1004-1B	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 4 Ammonia	AIR-SP4-1004-1C	AIR-1004-1C	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 4 Phosphate	AIR-SP4-1004-1D	AIR-1004-1D	AI	ETH	0.1-10	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 5 Nitrite	AIR-SP5-1005-1A	AIR-1005-1A	AI	ETH	0.1-5	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 5 Nitrate	AIR-SP5-1005-1B	AIR-1005-1B	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 5 Ammonia	AIR-SP5-1005-1C	AIR-1005-1C	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 5 Phosphate	AIR-SP5-1005-1D	AIR-1005-1D	AI	ETH	0.1-10	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 6 Nitrite	AIR-SP6-1006-1A	AIR-1006-1A	AI	ETH	0.1-5	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 6 Nitrate	AIR-SP6-1006-1B	AIR-1006-1B	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 6 Ammonia	AIR-SP6-1006-1C	AIR-1006-1C	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 6 Phosphate	AIR-SP6-1006-1D	AIR-1006-1D	AI	ETH	0.1-10	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 7 Nitrite	AIR-SP7-1007-1A	AIR-1007-1A	AI	ETH	0.1-5	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 7 Nitrate	AIR-SP7-1007-1B	AIR-1007-1B	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 7 Ammonia	AIR-SP7-1007-1C	AIR-1007-1C	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 7 Phosphate	AIR-SP7-1007-1D	AIR-1007-1D	AI	ETH	0.1-10	mg/l		Y	N	Y	Chemscan B Blower Building	N/A	P2
I-228	Sample Pump 8 Nitrite	AIR-SP8-1008-1A	AIR-1008-1A	AI	ETH	0.1-5	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 8 Nitrate	AIR-SP8-1008-1B	AIR-1008-1B	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 8 Ammonia	AIR-SP8-1008-1C	AIR-1008-1C	AI	ETH	0.1-20	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
I-228	Sample Pump 8 Phosphate	AIR-SP8-1008-1D	AIR-1008-1D	AI	ETH	0.1-10	mg/l		Y	N	Y	Chemscan A Blower Building	N/A	P2
E-23	Sodium Aluminate Pump P1021 In-Auto	YIR-NaAlO2-1021	HS-1021	DI	ETH	Normal	Auto		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021 Running	YIP-NaAlO2-1021	RL-1021	DI	ETH	Normal	Running		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021 Fault	YAIR-NaAlO2-1021	XA-1021	DI	ETH	Normal	Alarm		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021 Start/Stop	YCR-NaAlO2-1021	HS-1021	DO	ETH	Normal	Start/Stop		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021 Speed Setpoint	SY-NaAlO2-1021	SY-1021	AI	ETH	XX	GPM		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021 Speed Feedback	SX-NaAlO2-1021	SX-1021	AO	ETH	XX	GPM		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021 Pressure Switch High	PAHR-NaAlO2-1021	PSH-1021	DI	ETH	XX	Alarm		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021Thermal Overload	YAIR-NaAlO2-1021	XS-1021	DI	ETH	Normal	Alarm		Y	N	N	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021 Amps Phase A	IRC-NaAlO2-1021	II-1021-A	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021 Amps Phase B	IRC-NaAlO2-1021	II-1021-B	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1021 Amps Phase C	IRC-NaAlO2-1021	II-1021-C	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 In-Auto	YIR-NaAlO2-1022	HS-1022	DI	ETH	Normal	Auto		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 Running	YIP-NaAlO2-1022	RL-1022	DI	ETH	Normal	Running		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 Fault	YAIR-NaAlO2-1022	XA-1022	DI	ETH	Normal	Alarm		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 Start/Stop	YCR-NaAlO2-1022	HS-1022	DO	ETH	Normal	Start/Stop		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 Speed Setpoint	SY-NaAlO2-1022	SY-1022	AI	ETH	XX	GPM		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 Speed Feedback	SX-NaAlO2-1022	SX-1022	AO	ETH	XX	GPM		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 Pressure Switch High	PAHR-NaAlO2-1022	PSH-1022	DI	ETH	XX	Alarm		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022Thermal Overload	YAIR-NaAlO2-1022	XS-1022	DI	ETH	Normal	Alarm		Y	N	N	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 Amps Phase A	IRC-NaAlO2-1022	II-1022-A	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 Amps Phase B	IRC-NaAlO2-1022	II-1022-B	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1022 Amps Phase C	IRC-NaAlO2-1022	II-1022-C	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 In-Auto	YIR-NaAlO2-1023	HS-1023	DI	ETH	Normal	Auto		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 Running	YIP-NaAlO2-1023	RL-1023	DI	ETH	Normal	Running		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 Fault	YAIR-NaAlO2-1023	XA-1023	DI	ETH	Normal	Alarm		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 Start/Stop	YCR-NaAlO2-1023	HS-1023	DO	ETH	Normal	Start/Stop		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 Speed Setpoint	SY-NaAlO2-1023	SY-1023	AI	ETH	XX	GPM		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 Speed Feedback	SX-NaAlO2-1023	SX-1023	AO	ETH	XX	GPM		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 Pressure Switch High	PAHR-NaAlO2-1023	PSH-1023	DI	ETH	XX	Alarm		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023Thermal Overload	YAIR-NaAlO2-1023	XS-1023	DI	ETH	Normal	Alarm		Y	N	N	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 Amps Phase A	IRC-NaAlO2-1023	II-1023-A	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 Amps Phase B	IRC-NaAlO2-1023	II-1023-B	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1023 Amps Phase C	IRC-NaAlO2-1023	II-1023-C	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 In-Auto	YIR-NaAlO2-1024	HS-1024	DI	ETH	Normal	Auto		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 Running	YIP-NaAlO2-1024	RL-1024	DI	ETH	Normal	Running		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 Fault	YAIR-NaAlO2-1024	XA-1024	DI	ETH	Normal	Alarm		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3

Sheet #	Description	Tag	Drawing Tag	Type	Signal	Range / Off Status	Units / On Status	Field Wiring Data						
								Field ISA Signal Source / Destination	Local Display/ Indication	PLC Display/ Indication	SCADA Display/ Indication	Equipment Panel Location	Field FTC	SCADA Panel
E-23	Sodium Aluminate Pump P1024 Start/Stop	YCR-NaAlO2-1024	HS-1024	DO	ETH	Normal	Start/Stop		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 Speed Setpoint	SY-NaAlO2-1024	SY-1024	AI	ETH	XX	GPM		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 Speed Feedback	SX-NaAlO2-1024	SX-1024	AO	ETH	XX	GPM		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 Pressure Switch High	PAHR-NaAlO2-1024	PSH-1024	DI	ETH	XX	Alarm		Y	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024Thermal Overload	YAIR-NaAlO2-1024	XS-1024	DI	ETH	Normal	Alarm		Y	N	N	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 Amps Phase A	IRC-NaAlO2-1024	II-1024-A	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 Amps Phase B	IRC-NaAlO2-1024	II-1024-B	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-23	Sodium Aluminate Pump P1024 Amps Phase C	IRC-NaAlO2-1024	II-1024-C	AI	ETH	0-10	Amps		N	N	Y	Variable Speed Drive @ Pump	N/A	P3
E-10	Remote Operator Station Sample Pump 1 In-Auto	YIR-SP1-1001-1C	HS-1001-1C	DI	ETH	Normal	Auto		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 1 Off	YIR-SP1-1001-2C	HS-1001-1C	DI	ETH	Normal	Off		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 1 On	YIR-SP1-1001-3C	HS-1001-1C	DI	ETH	Normal	On		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Remote Operator Station Sample Pump 2 In-Auto	YIR-SP2-1002-1C	HS-1002-1C	DI	ETH	Normal	Auto		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 2 Off	YIR-SP2-1002-2C	HS-1002-1C	DI	ETH	Normal	Off		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 2 On	YIR-SP2-1002-3C	HS-1002-1C	DI	ETH	Normal	On		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Remote Operator Station Sample Pump 3 In-Auto	YIR-SP3-1001-1C	HS-1003-1C	DI	ETH	Normal	Auto		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 3 Off	YIR-SP3-1001-2C	HS-1003-1C	DI	ETH	Normal	Off		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 3 On	YIR-SP3-1001-3C	HS-1003-1C	DI	ETH	Normal	On		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Remote Operator Station Sample Pump 4 In-Auto	YIR-SP4-1004-1C	HS-1004-1C	DI	ETH	Normal	Auto		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 4 Off	YIR-SP4-1004-2C	HS-1004-1C	DI	ETH	Normal	Off		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 4 On	YIR-SP4-1004-3C	HS-1004-1C	DI	ETH	Normal	On		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Remote Operator Station Sample Pump 5 In-Auto	YIR-SP5-1005-1C	HS-1005-1C	DI	ETH	Normal	Auto		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 5 Off	YIR-SP5-1005-2C	HS-1005-1C	DI	ETH	Normal	Off		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 5 On	YIR-SP5-1005-3C	HS-1005-1C	DI	ETH	Normal	On		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Remote Operator Station Sample Pump 6 In-Auto	YIR-SP6-1006-1C	HS-1006-1C	DI	ETH	Normal	Auto		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 6 Off	YIR-SP6-1006-2C	HS-1006-1C	DI	ETH	Normal	Off		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 6 On	YIR-SP6-1006-3C	HS-1006-1C	DI	ETH	Normal	On		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Remote Operator Station Sample Pump 7 In-Auto	YIR-SP7-1007-1C	HS-1007-1C	DI	ETH	Normal	Auto		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 7 Off	YIR-SP7-1007-2C	HS-1007-1C	DI	ETH	Normal	Off		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 7 On	YIR-SP7-1007-3C	HS-1007-1C	DI	ETH	Normal	On		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Remote Operator Station Sample Pump 8 In-Auto	YIR-SP8-1008-1C	HS-1008-1C	DI	ETH	Normal	Auto		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 8 Off	YIR-SP8-1008-2C	HS-1008-1C	DI	ETH	Normal	Off		Y	N	Y	Chemscan Sample Pump Station	N/A	P2
E-10	Sample Pump 8 On	YIR-SP8-1008-3C	HS-1008-1C	DI	ETH	Normal	On		Y	N	Y	Chemscan Sample Pump Station	N/A	P2

Notes:

1. Verify wiring connections with the Electrical Contractor before submitting shop drawings
2. All Spare I/O to include graphical and historical database programming
3. ISA tags determined using ANSI / ISA 5.1 Instrumentation and Signals Identification Standards (See Typical Letter Combinations below).

* All Discrete Input Contacts shall be powered from input location
Discrete Input
Discrete Output
Analog Input
Analog Output
DeviceNet Communications
Ethernet / IP
Copper
Modbus Ethernet TCP/IP Communications

Abbreviations:

Tags

AIR	Analysis Indicating Record
FIR	Flow Indicating Record
JAIR	Power Alarm Indicating Record
LALR	Level Alarm Low Record
LIR	Level Indicating Record
LAHR	Level Alarm High Record
PALR	Pressure Alarm Low Record
PAHR	Pressure Alarm High Record
PSH	Pressure Switch High
PIR	Pressure Indicating Record
SCR	Speed Command Record
TAHR	Temperature Alarm High Record
WAHR	Force Alarm High Record
YAIR	Event / State Alarm Indicating Record
YCIR	Event / State Command Indicating Record
YIR	Event / State Indicating Record
ZCR	Position Command Record
ZCCR	Position Command Close Record
ZCOR	Position Command Open Record
ZIO	Position Indicating Open
ZIOR	Position Indicating Open Record

System Designations

xxx-SPx-xxxx	Sample Pump
xxx-NaAlO2-xxxx	Sodium Aluminate Pumps

Sheet #	Description	Tag	Drawing Tag	Type	Signal	Range / Off Status	Units / On Status	Field Wiring Data: Field ISA Signal Source / Destination	Local Display/ Indication	PLC Display/ Indication	SCADA Display/ Indication	Equipment Panel Location	Field FTC	SCADA Panel

Table 2 — Typical Letter Combinations

First-Letters	Initiating or Measured Valable	Controllers: Recording	Indicating	Blind	Self-Actuated Control Valves	Readout Devices: Recording	Indicating	Switches and Alarm Devices*: High**	Low	Comb	Transmitters: Recording	Indicating	Blind	Solenoids, Relays, Computing Devices	Primary Element	Test Point	Well or Probe	Viewing Device, Glass	Safety Device	Final Element
A	Analysis	ARC	AIC	AC		AR	AI	ASH	ASL	ASHL	ART	AIT	AT	AY	AE	AP	AW			AV
B	Burner/Combustion	BRC	BIC	BC		BR	BI	BSH	BSL	BSHL	BRT	BIT	BT	BY	BE		BW	BG		BZ
C	User's Choice																			
D	User's Choice																			
E	Voltage	ERC	EIC	EC		ER	EI	ESH	ESL	ESHL	ERT	EIT	ET	EY	EE					EZ
F	Flow Rate	FRC	FIC	FC	FCV, FICV	FR	FI	FSH	FSL	FSHL	FRT	FIT	FT	FY	FE	FP		FG		FV
FQ	Flow Quantity	FQRC	FQIC			FQR	FQI	FQSH	FQSL			FQIT	FQT	FQY	FQE					FQV
FF	Flow Ratio	FFRC	FFIC	FFC		FFR	FFI	FFSH	FFSL						FE					FFV
G	User's Choice																			
H	Hand		HIC	HC						HS										HV
I	Current	IRC	IIC			IR	II	ISH	ISL	ISHL	IRT	IIT	IT	IY	IE					IZ
J	Power	JRC	JIC			JR	JI	JSH	JSL	JSHL	JRT	JIT	JT	JY	JE					JV
K	Time	KRC	KIC	KC	KCV	KR	KI	KSH	KSL	KSHL	KRT	KIT	KT	KY	KE					KV
L	Level	LRC	LIC	LC	LCV	LR	LI	LSH	LSL	LSHL	LRT	LIT	LT	LY	LE		LW	LG		LV
M	User's Choice																			
N	User's Choice																			
O	User's Choice																			
P	Pressure/ Vacuum	PRC	PIC	PC	PCV	PR	PI	PSH	PSL	PSHL	PRT	PIT	PT	PY	PE	PP			PSV, PSE	PV
PD	Pressure, Differential	PDRC	PDIC	PDC	PDCV	PDR	PDI	PDSH	PDSL		PDRT	PDIT	PDT	PDY	PE	PP				PDV
Q	Quantity	QRC	QIC			QR	QI	QSH	QSL	QSHL	QRT	QIT	QT	QY	QE					QZ
R	Radiation	RRC	RIC	RC		RR	RI	RSH	RSL	RSHL	RRT	RIT	RT	RY	RE		RW			RZ
S	Speed/Frequency	SRC	SIC	SC	SCV	SR	SI	SSH	SSL	SSHL	SRT	SIT	ST	SY	SE					SV
T	Temperature	TRC	TIC	TC	TCV	TR	TI	TSH	TSL	TSHL	TRT	TIT	TT	TY	TE	TP	TW		TSE	TV
TD	Temperature, Differential	TDRC	TDIC	TDC	TDCV	TDR	TDI	TDSH	TDSL		TDRT	TDIT	TDT	TDY	TE	TP	TW			TDV
U	Multivariable					UR	UI							UY						UV
V	Vibration/Machinery Analysis					VR	VI	VSH	VSL	VSHL	VRT	VIT	VT	VY	VE					VZ
W	Weight/Force	WRC	WIC	WC	WCV	WR	WI	WSH	WSL	WSHL	WRT	WIT	WT	WY	WE					WZ
WD	Weight/Force, Differential	WDRC	WDIC	WDC	WDCV	WDR	WDI	WDSH	WDSL		WDRT	WDIT	WDT	WDY	WE					WDZ
X	Unclassified																			
Y	Event/State/Presence		YIC	YC		YR	YI	YSH	YSL				YT	YY	YE					YZ
Z	Position/Dimension	ZRC	ZIC	ZC	ZCV	ZR	ZI	ZSH	ZSL	ZSHL	ZRT	ZIT	ZT	ZY	ZE					ZV
ZD	Gauging/Deviation	ZDRC	ZDIC	ZDC	ZDCV	ZDR	ZDI	ZDSH	ZDSL		ZDRT	ZDIT	ZDT	ZDY	ZDE					ZDV

Note: This table is not all-inclusive.

*A, alarm, the annunciating device, may be used in the same fashion as S, switch, the actuating device.

**The letters H and L may be omitted in the undefined case.

Other Possible Combinations:

FO	(Restriction Orifice)	PFR	(Ratio)
FRK, HIK	(Control Stations)	KOI	(Running Time Indicator)
FX	(Accessories)	QQI	(Indicating Counter)
TJR	(Scanning Recorder)	WKIC	(Rate-of-Weight-Loss Controller)
LLH	(Pilot Light)	HMS	(Hand Momentary Switch)

APPENDIX A

Allowances: Manufacturer's Proposals

INTELLIMODUS

July 29, 2020

Intellimodus Proposal Number: **200106**

Subject: **LFUCG West Hickman WWTP Biological Phosp. Equipment Replacement**

This is our proposal to supply the necessary new equipment, pump controllers, instrumentation and programming for the West Hickman WWTP Biological Phosphate Equipment Replacement Project as described in Division 17 (17410, 17420, 17430 and 17490) of the bid specifications and the P&ID drawings.

Deliverables:

Our base proposal pricing includes the following:

- (2) Sample pump controllers NEMA 12 for pumps 1-8.
- SCADA Integration, PLC modifications, assigning all IP addresses as needed to each starter, (8) VFD's programming and remote pump H-O-A switch for the sample pump controllers above.
- Modifying PLC code to interface to new the MCC's added.
- VFD programming will be based on vendor requirements when the manuals are received.
- (8) ABB 2" Magmeters and transmitters, (8) Ashcroft Pressure Gauges and programming.
- Work with Chemscan vendor for configuration communication set up and standby for 1 day.
- I/O check, spare parts and submittals (for our equipment only).
- One day (8 hours - first shift) of training and one day (8 hours first shift) of standby.
- Freight of our equipment to site.
- One year warranty on new equipment provided by Intellimodus.

Exclusions:

Our base proposal pricing does **not** include the following:

- All electrical and mechanical installation labor and materials required (including but not limited to mounting brackets, mounting plates, instrument pipe stands, sample tubes, cable, other wiring materials, terminations to the control panels and instruments, etc.).
- No flap gates.
- Any confined space work associated.
- Any control panels not listed above.
- Any MCC hardware or other control panels listed above.
- Equipment, instrumentation and controls not specified above.
- Write in allowances & bonding.

INTELLIMODUS, LLC

312 South 4th Street, 8th Floor - Louisville, KY 40202
(502) 452-9397 - Fax (502) 452-9373
intellimodus.com

INTELLIMODUS

Materials	$	32,500.00
Process Instrumentation Equipment Engineering	$	101,500.00
Estimated Sales Tax	$	2,000.00
Total Price	**$**	**136,000.00**

Terms and Conditions

- Terms shall be net thirty (30) days from the date of the invoice.
- A charge of 1½% per month will be assessed for all overdue payments.
- Payment of invoices per the above terms must be paid in full.
- We require 10% of our total contract as a down payment for our services as well as monthly progress billings.
- Late payments may result in the suspension and/or termination of this service contract.

Sincerely,

Kyle Schneider
Sales Engineer
Intellimodus LLC.

Note: The above price is good for 60 days from the date above. Our standard terms are net 30 days.

INTELLIMODUS, LLC

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