COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

Application of Troublesome Creek Environmental Authority, Inc. a Public Non-Profit Corporation for Certificate of Convenience and Necessity, to Construct Facility; to Set Initial Rates; to Incur Indebtedness and Authority to Operate	)	**Case No. 2010-00017**

SUPPLEMENTAL PETITION

MAY IT PLEASE THE COMMISSION, Troublesome Creek Environmental Authority, Inc. (hereinafter, TEA), by and through counsel, hereby tenders its Supplemental Petition to the original Petition submitted on January 14, 2010.

I. PRIORITY

No change.

II. BACKGROUND

No change.

III. PETITION FOR CERTIFICATE OF CONVENIENCE AND NECESSITY FOR CONSTRUCTION WASTE WATER TREATMENT PLANT AND COLLECTION SYSTEM AND TO BE PROVIDER OF UTILITY SERVICES (KRS 278.020)

(A) The Sewer Line Component:

6. Additional description for the proposed sewer collection lines are contained in enclosed exhibits, including:

- Proposed location
- Route of construction
- Description of construction utility service area, including collection mains and manholes

See Map Batch designated as Contract 2, attached as a hard copy designated as **Exhibit 24**, and further contained within the Disk designated as **Exhibit 27**.

7. No change.

8. No change.

9. Additional maps for the sewer line are contained in **Exhibit 24** (Map Sheet 2) and **Exhibit 27** (Disk).

(B) The Wastewater Treatment Facility:

10. Additional, more detailed description of the proposed waste water treatment plant are contained in the enclosed exhibits, including:

- Location of plant
- Effluent discharge
- Workings of plant

See Map Batch designated as Contract 1, attached as a hard copy designated as **Exhibit 25**, and as further contained within the Disk designated as **Exhibit 27**.

11. No change.

12. Additional maps for the waste water treatment plant are contained in **Exhibit 25** (Map Sheet 1) and **Exhibit 27** (Disk).

12A. The Professional Engineer Stephen Harris of R. M. Johnson Engineering has signed and stamped Map Batch designated as Contract 1, attached as a hard copy designated as **Exhibit 25**, and Map Batch designated as Contract 2, attached as a hard copy designated as **Exhibit 24**.

13. The manner in which the project will be financed pursuant to KAR 5:01 §9(2)(e) has changed and **Exhibit 12** is hereby changed as follows:

- The interim financing array is as follows:

  > The interim financing loan from KRW has been paid.

- The current financing array is as follows:

> Funding sources are now:

Source	Amount	Type
KIA	$1,500,000.00	Loan 1
HB 608 (LGEDF)	$1,425,000.00	Grant
Section 531 (Corp of Engineers)	$ 500,000.00	Grant
Knott Co. Coal Severance	$ 450,000.00	Grant 2
Multi-County	$ 388,817.00	Grant 3
Total	$4,263,817.00	

1 The details of the KIA loan is attached in the December 3, 2009 loan package and denoted as **Exhibit 28.** Note that the loan contains principle forgiveness feature of 52.1%, leaving a loan amount of $718,500.00 at an interest rate of 1% over 20 years. Estimated annual debt service and administrative fee is $41,164.00.

2 The Knott County Fiscal Court Resolution reflecting this grant is attached as **Exhibit 29.**

3 The Multi-County Severance Tax grant is pending. The request has been made via TEA Resolution attached as **Exhibit 30.**

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14. A more detailed description of the waste water treatment plant facility is provided under Contract 1, **Exhibit 25** and Bid Specifications, **Exhibit 26**, all as combined in **Disk Exhibit 27**.

15. No change.

16. No change.

17. No change.

18. No change.

IV. PETITION FOR ASSISTANCE IN SETTING INITIAL RATES USING APPROPRIATE PORTIONS OF 807 KAR 5:001 § 10 (6) AS TEMPLATE:

No change.

V. PETITION FOR PERMITTING INCURRING INDEBTEDNESS PURSUANT 807 KAR 5:001 § 11 and 807 KAR 5:001 § 6

39. No change.

40. Financing and sources of funding has changed, particularly the interim financing, that has been replaced by permanent financing. See supplemental explanation at § 13 above and **Exhibit 28.** As to debt service of the KIA permanent loan, Knott Fiscal Court has agreed to allocate future coal severance proceeds to subsidize the entire debt service. See Footnote A) of Exhibit 14.

41. No change.

42. No change.

43. No change.

44. No change.

45. No change.

46. **Exhibit 12** is amended as follows:
TEA's external debt now consists of the $1,500,000.00 permanent financing provided by KRWA, see **Exhibit 28.**

47. No change.

48. No change.

49. No change.

50. No change.

51. The estimated budget for construction is no longer valid. The new estimated cost of construction is $4,263,817.00. Bid lets and offers have since been received. Bid totals were over original budget, resulting in negotiated bid awards to Cleary Construction ($1,452,675.00) for sewer lines (**Exhibit 31**) and to Howard Engineering and Construction, Inc. ($1,993,517.00) for plant construction (**Exhibit 32**). This has likewise resulted in a revised construction budget of $4,263,817.00 as explained in **Exhibit 33.**

VII. CONCLUSION:

For these reasons, Troublesome Creek Environmental Authority request that it first be granted a Certificate of Convenience and Necessity to Construct Facility, then later, for assistance to set initial rates and incur indebtedness.

RESPECTFULLY SUBMITTED:

CALVIN R. TACKETT, ESQUIRE
40 MAIN STREET
WHITESBURG, KY 41858
Phone: (606) 633-0126
Fax: (606) 633-0972
Email: crtackett@setel.com

ATTORNEY FOR TROUBLESOME CREEK ENVIRONMENTAL AUTHORITY, INC.

As Chairman of the Troublesome Creek Environmental Authority, Inc., I am the Executive Officer having knowledge of the matters set forth herein including the original Petition and the Supplemental Petition, and am duly designed by Troublesome Creek Environmental Authority, Inc. to make this oath pursuant to KRS 278.300.

LEWIS H. WARRIX

COMMONWEALTH OF KENTUCKY

COUNTY OF Breathitt

I, Calvin R. Tackett, a Notary Public, in and for the County and State aforesaid, do certify that the foregoing was this day produced to me, and duly acknowledged before me in said County by LEWIS H. WARRIX, to be his true act and deed as Chairman of Troublesome Creek Environmental Authority.

Given under my hand this 8th day of February, 2010.

My commission expires: 10/12/12

NOTARY PUBLIC

INDEX

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a Public Non-Profit	)	
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and Necessity, to Construct Facility;	)	
to Set Initial Rates;	)	
to Incur Indebtedness	)	
and Authority to Operate	)	

SUPPLEMENTAL PETITION

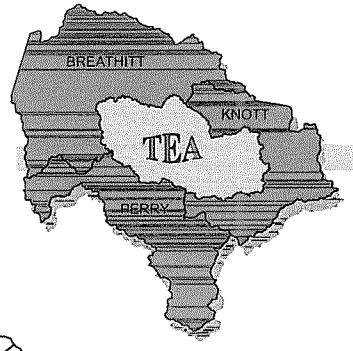
EXHIBIT 24

CONTRACT SHEET 2 - SEWER LINES

Ball Creek WWTP & Sanitary Sewer Collection Project

CONTRACT 2 - BALL CREEK SEWER COLLECTION

FOR



TroublesomeCreek
ENVIRONMENTAL AUTHORITY

R.M. JOHNSON ENGINEERING, INC.
P.O. BOX 444
HINDMAN, KY 41822
PH. (606)785-5926 FAX. (606)785-0244
E-MAIL: info@rmje.net

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SUPPLEMENTAL PETITION

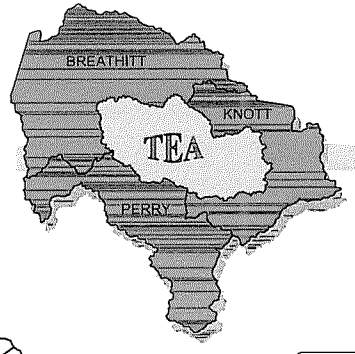
EXHIBIT 25

CONTRACT SHEET 1 - PLANT

Ball Creek WWTP & Sanitary Sewer Collection Project

CONTRACT 1 - BALL CREEK WWTP

FOR



TroublesomeCreek
ENVIRONMENTAL AUTHORITY

DRAWING INDEX	
P-0	COVER SHEET
P-0.1	BALL CREEK WWTP PROCESS DESIGN
P-1.1	BALL CREEK WWTP SITE LAYOUT
P-1.2	GRADE, DRAINAGE & EROSION CONTROL PLAN
P-2	BALL CREEK WWTP ONSITE PIPING
P-3.1 TO P-3.2	PRIMARY TREATMENT DETAILS
P-4.1 TO P-4.11	SEQUENTIAL BATCH REACTOR DETAILS
P-5	ULTRAVIOLET DISINFECTION DETAILS
P-6	POST AERATION & EFFLUENT STRUCTURE DETAILS
P-7	SLUDGE DEWATERING DETAILS
P-8	BALL CREEK WWTP OFFICE FLOOR PLAN
D-1 TO D-2	SITE DETAILS
S-0	STRUCTURAL NOTES
S-1 TO S-1.5	FOUNDATION PLANS
S-2 TO S-2.3	DETAILS AND SECTIONS
U-1 TO U-2	BALL CREEK WWTP ELECTRICAL PLANS

R.M. JOHNSON ENGINEERING, INC.
P.O. BOX 444
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SUPPLEMENTAL PETITION

EXHIBIT 26

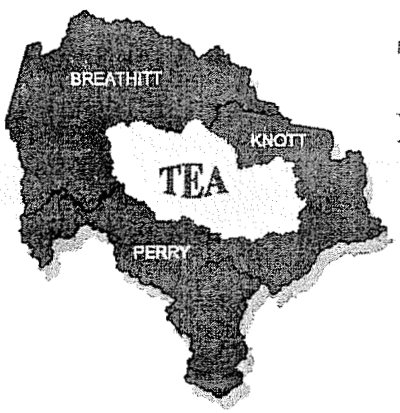
CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS

CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS

FOR

BALL CREEK WWTP & SEWER COLLECTION PROJECT

PREPARED FOR:



TroublesomeCreek
ENVIRONMENTAL AUTHORITY

SUBMITTED BY:

R.M. JOHNSON ENGINEERING, INC.
P.O. Box 444
Hindman, KY 41822

December 20

TABLE OF CONTENTS

PART I

ADVERTISEMENT FOR BIDS
Troublesome Creek Environmental Authority

Ball Creek WWTP & Sanitary Sewer Collection Project – Contract 1 & 2

Separate sealed bids for the construction of these two (2) contracts will be received by the Troublesome Creek Environmental Authority c/o KRADD, 917 Perry Park Road, Hazard, Kentucky 41701, until **January 7, 2010, 1:00 p.m.** local time.

All proposals which have been submitted in accordance with the conditions set forth will be publicly opened and read aloud at the Knott County Sportsplex conference room in Softshell, Kentucky on **January 7, 2010, 2:00 p.m.** local time.

The work to be bid consists of:
Contract 1 consists of the construction of a 0.10 MGD Sequential Batch Reactor (SBR) Wastewater Treatment Plant to be located at Knob Bottom Branch in Knott County. This contract includes all site development, paving, drainage, WWTP construction, plumbing, office/laboratory, electrical, mechanical, structural construction, etc.

Contract 2 consists of the construction of approximately 27,550 LF of 6" HDPE DR 11 force main, 4,600 LF of 12" SDR 35 PVC gravity sewer, one 200 GPM submersible lift station, 36 residential grinder lift stations, and all other appurtenances necessary to complete the project.

Time of completion will be 365 calendar days.

Attention of bidders is particularly called to:

This project is funded in part by the American Recovery and Reinvestment Act of 2009.

This procurement shall be subject to DOW Procurement Guidelines.

Bidders must comply with Title VI of the Civil Rights Act of 1964, the Anti-Kickback Act, and the Contract Work Hours Standard Act and 40 CFR 31.36 L(3, 4, & 6).

The requirements as to conditions of employment to be observed and minimum wage rates to be paid under the contract, Section 3, Segregated Facility, Section 109 and Executive Order 11246 and Title VI.

This project will be in compliance with Executive Order 11246 (Equal Employment Opportunity) as amended.

Bidder shall comply with 41 CFR 60-4, in regard to affirmative action, to insure equal opportunity to females and minorities and will apply the time tables and goal set forth in 41 CFR 60-4 if applicable to the area of the project.

Bidder shall make positive efforts to use small, minority, women owned and disadvantaged businesses.

Award will be made to the lowest, responsive, responsible bidder.

A pre-bid meeting will be held at **1:00 p.m. on December 30, 2009** at the Knott County Sportsplex conference room located at 450 Kenny Champion Loop, in Soft Shell, Kentucky. All potential bidders are encouraged to attend.

Sealed proposals for the Contracts shall be clearly marked on the outside of the envelope as follows:

Sealed Proposal For:
Troublesome Creek Environmental Authority
Ball Creek WWTP Project – Contract 1
Not to be opened until January 7, 2010, 2:00 pm

Sealed Proposal For:
Troublesome Creek Environmental Authority
Ball Creek San. Sewer Collection Project - Contract 2
Not to be opened until January 7, 2010, 2:00 pm

If forwarded by mail, the sealed envelope containing the proposal must be enclosed in another envelope and mailed to allow sufficient time for such mailing to reach this address prior to the scheduled closing time for receipt of proposals.

Plans and specifications may be reviewed on or after **December 21, 2009** at the following locations:

R.M. Johnson Engineering, Inc., 3376 Hwy. 550 E., Hindman, KY
R.M. Johnson Engineering, Inc., 3213 Summit Square Place, Suite 100, Lexington, KY
Kentucky River Area Development District, 917 Perry Park Road, Hazard, KY
F W Dodge, 950 Contract Street, Suite 100, Lexington, KY

Copies of the Contract Documents may be obtained at the office of Lynn Imaging, located at 328 Old Vine St., Lexington, Kentucky, 40507, (800)-888-0693 upon receipt of the non-refundable printing and shipping charges for the following:

$185.00 – Contract 1, Ball Creek WWTP Plans, Contract, & Technical Specifications
$185.00 – Contract 2, Ball Creek Sanitary Sewer Collection Plans, Contract, & Technical Specifications

For bidders interested in both contracts the additional project plans may be purchased separately without the Contract & Technical Specifications upon receipt of the non-refundable printing and shipping charge of $100.00. There will be a 24-hour turn-around on all orders.

Bids shall be accompanied by a certified check or bid bond made payable to the Troublesome Creek Environmental Authority in an amount not less than 5 percent of the base bid. No bidder may withdraw his bid for a period of 90 days after the date bids are opened. He may, however, withdraw his bid at any time prior to the time and date scheduled for opening of same or any authorized postponement thereof. Any bid received after the time and date specified shall not be considered and will be returned unopened to the bidder.

The Troublesome Creek Environmental Authority (TEA) is an Equal Employment Opportunity Employer. The Troublesome Creek Environmental Authority reserves the right to reject any or all bids.

Questions regarding the project(s) and contents of this advertisement shall be directed to Steve Harris, P.E, Project Engineer at R.M. Johnson Engineering at (606) 785-5926.

Instructions to Bidders

TABLE OF ARTICLES

ARTICLE 1 - DEFINED TERMS

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

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

ARTICLE 2 - COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents in the number and for the deposit sum, if any, stated in the Advertisement for Bids may be obtained from the Issuing Office.

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

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

ARTICLE 3 - QUALIFICATIONS OF BIDDERS

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

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

4.01 Subsurface and Physical Conditions

A. The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Bidding Documents.

2. Those drawings of physical conditions in or relating to existing surface and subsurface structures at or contiguous to the Site (except Underground Facilities) that Engineer has used in preparing the Bidding Documents.

B. Copies of reports and drawings referenced in paragraph 4.01.A will be made available by Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in paragraph 4.02 of the General Conditions has been identified and established in paragraph 4.02 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.02 Underground Facilities

A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

4.03 Hazardous Environmental Condition

A. The Supplementary Conditions identify those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that Engineer has used in preparing the Bidding Documents.

B. Copies of reports and drawings referenced in paragraph 4.03.A will be made available by Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in paragraph 4.06 of the General Conditions has been identified and established in paragraph 4.06 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.04 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated conditions, appear in paragraphs 4.02, 4.03, and 4.04 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in paragraph 4.06 of the General Conditions.

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

4.06 Reference is made to Article 7 of the Supplementary Conditions for the identification of the general nature of other work that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) that relates to the Work contemplated by these Bidding Documents. On request, Owner will provide to each Bidder for examination access to or copies of Contract Documents (other than portions thereof related to price) for such other work.

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

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

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

C. Become familiar with and satisfy Bidder as to all Federal, State, and local Laws and Regulations that may affect cost, progress, or performance of the Work;

D. Carefully study all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.02 of the General Conditions, and (2) reports and drawings of Hazardous Environmental Conditions at the Site which have been identified in the Supplementary Conditions as provided in paragraph 4.06 of the General Conditions;

E. Obtain and carefully study (or accept consequences for not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto;

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

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

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

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

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

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

ARTICLE 5 - PRE-BID CONFERENCE

5.01 A pre-Bid conference will be held at the *Knott County Sportsplex on December 30, 2009 at 1:00 P.M. local time*. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are

encouraged to attend and participate in the conference. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 6 - SITE AND OTHER AREAS

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

ARTICLE 7 - INTERPRETATIONS AND ADDENDA

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

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

ARTICLE 8 - BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5 % of Bidder's maximum Bid price and in the form of a certified check or a Bid bond (EJCDC No. C-430, 2002 Edition) issued by a surety meeting the requirements of paragraphs 5.01 and 5.02 of the General Conditions.

8.02 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 10 days after the Notice of Award, Owner may annul the Notice of Award and the Bid security of that Bidder will be forfeited. The Bid security of other Bidders whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Agreement or 91 days after the Bid opening, whereupon Bid security furnished by such Bidders will be returned.

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

ARTICLE 9 - CONTRACT TIMES

9.01 The number of days within which, or the date by which, the Work is to be substantially completed. Upon substantial completion, if necessary, a date for final completion and payment should be determined between the Owner, Contractor, and Engineer based on remaining work, market, and weather conditions.

ARTICLE 10 -LIQUIDATED DAMAGES

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

ARTICLE 11 - SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, or "or-equal" materials and equipment as defined in paragraph 6.05 of the General Conditions, or those substitute materials and equipment approved by the Engineer and identified by Addendum. The materials and equipment described in the Bidding Documents establish a standard of

required type, function, and quality to be met by any proposed substitute or "or-equal" item. No item of material or equipment will be considered by Engineer as a substitute or equal until after the bids have been opened and the contract has been awarded. The burden of proof of the merit of the proposed item, and cost for review of a proposed substitute item, is upon the Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. Bidders shall not rely upon approvals made in any other manner. Any reduction made in contract price due to approval of a substitute item or equal, will be subtracted from the bidders contract and placed into contingency funds for the project.

ARTICLE 12 - SUBCONTRACTORS, SUPPLIERS, AND OTHERS

12.01 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity if requested by Owner. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute, without an increase in the Bid.

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

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

12.04 The Contractor shall not award work to Subcontractor(s) in excess of the limits stated in SC 6.06.

ARTICLE 13 - PREPARATION OF BID

13.01 The Bid form is included with the Bidding Documents. Additional copies may be obtained from Engineer.

13.02 All blanks on the Bid form shall be completed by printing in ink or by typewriter and the Bid signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid From. A Bid price shall be indicated for each Bid item and alternative listed therein, or the words "No Bid," "No Change," or "Not Applicable" entered.

13.03 A Bid by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. If required by State where work is to be performed, the corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporation business address and state of incorporation shall be provided on the Bid Form.

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

13.05 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the business address of the firm must be provided on the Bid Form.

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

13.07 A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid form. The business address of the joint venture must be provided on the Bid Form.

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

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

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

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

ARTICLE 14 - BASIS OF BID; COMPARSION OF BIDS

14.01 Unit Price

A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the Bid schedule. The price for each alternate will be the amount added to the Bid if Owner selects the alternate. In the comparison of Bids, alternates will be applied in the same order as listed in the Bid Form.

B. The total of all bid prices will be the sum of the products of the estimated quantity of each item and the corresponding unit price. The final quantities and Contract Price will be determined in accordance with paragraph 11.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

ARTICLE 15 - SUBMITTAL OF BID

15.01 Bid Form is to be completed and submitted with all the attachments required.

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

ARTICLE 16 - MODIFICATION AND WITHDRAWAL OF BID

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

16.02 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid or negotiated, that Bidder will be disqualified from further bidding on the Work. This provision to withdraw a Bid without forfeiting the Bid security does not apply to Bidder's errors in judgment in preparing the Bid.

ARTICLE 17 - OPENING OF BIDS

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

ARTICLE 18 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.01 All Bids will remain subject to acceptance for 90 days.

ARTICLE 19 - EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, non-responsive, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to be non-responsible. Owner also reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.

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

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

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

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

19.06 If the Contract is to be awarded, Owner will award the Contract to the responsible Bidder whose Bid, conforming with all the material terms and conditions of the Instructions to Bidders, is lowest in price and in the best interest of the Owner by considering other factors such as work history, recommendations, etc... In cases where the low bidder is not awarded the contract, submit an explanation of the selection process used, along with the recommendation for award, in order for all bidding requirements to be met for RD to concur in award of contract.

ARTICLE 20 - CONTRACT SECURITY AND INSURANCE

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

ARTICLE 21 - SIGNING OF AGREEMENT

21.01 When Owner gives a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents which are identified in the Agreement as attached thereto. Within 10 days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within ten days thereafter, Owner shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.

21.02 This Contract is funded in part with funds provided by the ARRA.

Bid Form

Project Identification: *Ball Creek WWTP & Sanitary Sewer Collection Project, Phase I*

Contract Identification and Number: *Contract 1 – WWTP, Contract 2 – Sewer Collection*

ARTICLE 1 - BID RECIPIENT

1.01 This Bid Is Submitted To: *TROUBLESOME CREEK ENVIRONMENTAL AUTHORITY*

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

ARTICLE 2 - BIDDER'S ACKNOWLEDGMENTS

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

ARTICLE 3 - BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

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

Addendum No. Addendum Date

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

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

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

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in SC-4.02, and (2) reports and drawings of a Hazard Environmental Condition, if any, which has been identified in SC-4.06.

E. Bidder has obtained and carefully studied (or accepts the consequences for not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by the

Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents to be employed by Bidder, and safety precautions and programs incident thereto.

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

G. Bidder is aware of the general nature of the Work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

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

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

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

K. Bidder will submit written evidence of its authority to do business in the State where the Project is located not later than the date of its execution of the Agreement.

ARTICLE 4 - FURTHER REPRESENTATIONS

4.01 Bidder further represents that:

A. This Bid is genuine and not made in the interest of or on the behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation;

B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

ARTICLE 5 - BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):
See attached Bid Schedule.

A. Unit Prices have been computed in accordance with paragraph 11.03.A of the General Conditions.

B. Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Bid items will be based on actual quantities, determined as provided in the contract Documents.

ARTICLE 6 - TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially complete in accordance with paragraph 14.04 of the General Conditions on or before the date, or within the number of calendar days, indicated in the Agreement.

6.02 Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to

complete the work within the Contract Time.

ARTICLE 7 - ATTACHEMENTS TO THIS BID

7.01 The following documents are attached to and made a condition of the Bid:

A. Required Bid security in the form of a Bid Bond (EJCDC No. C-430) or Certified Check (circle type of security provided);

B. If Bid amount exceeds $10,000, signed Compliance Statement (RD 400-6). Refer to specific equal opportunity requirements set forth in paragraph 18.10 of the General Conditions;

C. If Bid amount exceeds $25,000, signed Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions (AD-1048);

D. If Bid amount exceeds $100,000, signed RD Instruction 1940-Q, Exhibit A-1, Certification for Contracts, Grants, and Loans. Refer to paragraph 18.11 of the General Conditions;

E. A tabulation of Subcontractors, Suppliers [and others] individuals and entities required to be identified in this Bid;}

F. Required bidder qualifications statement with supporting data; and}

G. List other documents as pertinent.}

ARTICLE 8 - DEFINED TERMS

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

ARTICLE 9 - BID SUBMITTAL

9.01 This Bid submitted by:

Name (typed or printed): _____

By: _____
(Individual's signature)

Doing business as: _____

Bidder's Business address:

_____

_____

Business Phone No. (_____)_____

Business FAX No. (_____)_____

Business E-Mail Address _____

State Contractor License No. _____. (If applicable)

Employer's Tax ID No. _____

Phone and FAX Numbers, and Address for receipt of official communications, if different from Business

contact information:

_____

_____

9.02 Bid submitted on _____, 20___.

SEAL, if required

BID SCHEDULE - Ball Creek WWTP & Sewer Collection Project -- Contract 1 (WWTP)

ITEM & DESCRIPTION		ESTIMATED QUANTITY	UNIT PRICE	TOTAL
1 SITE PREPARATION. Includes all grubbing and grading work necessary to establish the final grades as depicted on the drawings. Topsoil shall be stored and redistributed over the site during final detail grading. Includes all Erosion and Sediment Control Methods utilized to ensure compliance to Kentucky approved Best Management Practices.				
A.	Earthwork	1,900 CY	$ _____	$ _____
B.	Final Detail Grading	1.22 AC	$ _____	$ _____
C.	Silt Fence	715 LF	$ _____	$ _____
D.	Check Dams	3 EA	$ _____	$ _____
E.	Construction Entrance with #2 Stone	1 LS	$ _____	$ _____
2 INFLUENT METERING VAULT. Includes the furnishing and installation of the concrete vault, eletromagnetic flowmeter, power supply, piping and fittings necessary to complete the construction as depicted on the drawings. The concrete vault shall be complete with access hatch, steps, sump pump, and waterproofing. This bid item includes all piping inside the vault.				
A.	Influent Metering Vault	1 LS	$ _____	$ _____
B.	6" Ductile Iron Piping & Fittings	1 LS	$ _____	$ _____
C.	6" Plug Valves	3 EA	$ _____	$ _____
D.	4" Electromagnetic Flowmeter with Amplifier	1 EA	$ _____	$ _____
E.	Power Supply, Conduit & Wiring	1 LS	$ _____	$ _____
F.	Sump Pump & Piping	1 LS	$ _____	$ _____
3 HEADWORKS SCREENING. Includes the furnishing, installation, and/or construction of the concrete headworks structure, manual screens, sluice gates, piping, pipe insulation, stairs, fibreglass grating, waste chute, waste container, concrete foundations, concrete pads, etc. Includes all construction necessary to complete the headworks as depicted in the drawings.				
A.	Conc. Structure w/foundation and pad	1 LS	$ _____	$ _____
B.	SpiraLift, or equal	1 EA	$ _____	$ _____
C.	TaskMaster Grinder, or equal	1 EA	$ _____	$ _____
D.	Composite Sampler w/Enclosure	1 EA	$ _____	$ _____
E.	Manual Bar Screen	1 EA	$ _____	$ _____
F.	Manual Sluice Gates	4 EA	$ _____	$ _____
G.	Fibreglass Grating	110 SF	$ _____	$ _____
H.	3.5' Tall Aluminum Handrail	35 LF	$ _____	$ _____

ITEM & DESCRIPTION		ESTIMATED QUANTITY	UNIT PRICE	TOTAL
I.	26 Tread Steel Stairs	1 LS	$ _____	$ _____
J.	6"Influent Pipe Connection with Tideflex Check Valve for Odor Control	1 LS	$ _____	$ _____
K.	12" Effluent Pipe Connection	1 LS	$ _____	$ _____
L.	Power Supply, Conduit & Wiring	1 LS	$ _____	$ _____

4 CONCRETE BASINS & EQUIPMENT. Includes the furnishing, installation, and/or construction of the concrete basins, SBR equipment, Pre-EQ basin equipment, Digestor equipment, hoists, handrails, probes, transducers, floats, etc. Includes all construction necessary to complete the basins and equipment as depicted on the drawings. Includes all piping, fittings, valves, etc. within the basin or underneath the basin.

A.	Treatment & Maintenance Concrete Structure	1 LS	$ _____	$ _____
B.	Aqua Aerobics SBR & Equipment	1 LS	$ _____	$ _____
C.	Fibreglass Grating	340 SF	$ _____	$ _____
D.	3.5' Tall Aluminum Handrail	210 LF	$ _____	$ _____
E.	Aluminum Access Hatches with Aluminum Ladders	2 EA	$ _____	$ _____
F.	12' X 12' Aluminum Garage Door (Complete)	1 LS	$ _____	$ _____
G.	Standard Double Door Installation	1 LS	$ _____	$ _____
H.	Corrugated Metal Siding & Installation	480 SF	$ _____	$ _____
I.	6,000 CFM Louvered Exhaust Fan	1 EA	$ _____	$ _____
J.	3" D.I. Sludge Piping, Fittings, & Valves	15 LF	$ _____	$ _____
K.	4" D.I. Sludge Piping, Fittings, & Valves	70 LF	$ _____	$ _____
L.	4" D.I. Influent Piping, Fittings, & Valves	210 LF	$ _____	$ _____
M.	6" D.I. Decant Piping, Fittings, & Valves	10 LF	$ _____	$ _____
N.	10" D.I. Decant Piping, Fittings, & Valves	50 LF	$ _____	$ _____
O.	Concrete Pipe Supports	1 LS	$ _____	$ _____
P.	Fiberglass Wall & Ceiling Pipe Supports	1 LS	$ _____	$ _____

5 ULTRAVIOLET DISINFECTION. Includes the furnishing, installation, and/or construction of the concrete vault, associated piping, valves, fittings, Ultraviolet Treatment Chamber, control panel, power supply, wiring, etc. as depicted on the drawings. The concrete vault shall be complete with access hatch, steps, sump pumps, and waterproofing. This bid item includes all piping inside the vault.

ITEM & DESCRIPTION		ESTIMATED QUANTITY	UNIT PRICE	TOTAL
A.	Concrete Vault with Hatch	1 LS	$ _____	$ _____
B.	10" D.I. Piping & Fittings	1 LS	$ _____	$ _____
C.	Aquionics In-Line Chamber, or equal	2 EA	$ _____	$ _____
D.	Aquionics UV Control Panel, or equal	1 EA	$ _____	$ _____
E.	Power Supply, Conduit & Wiring	1 LS	$ _____	$ _____
F.	Sump Pump & Piping	1 LS	$ _____	$ _____

6 EFFLUENT METERING VAULT. Includes the furnishing and installation of the concrete vault, eletromagnetic flowmeter, power supply, piping and fittings necessary to complete the construction as depicted on the drawings. The concrete vault shall be complete with access hatch, steps, sump pump, and waterproofing. This bid item includes all piping inside the vault.

A.	Effluent Metering Vault	1 LS	$ _____	$ _____
B.	10" Ductile Iron Piping & Fittings	1 LS	$ _____	$ _____
C.	10" Plug Valves	3 EA	$ _____	$ _____
D.	6" Electromagnetic Flowmeter with Amplifier	1 EA	$ _____	$ _____
E.	Power Supply, Conduit & Wiring	1 LS	$ _____	$ _____
F.	Sump Pump & Piping	1 LS	$ _____	$ _____

7 POST AERATION. Includes the furnishing, installation, and/or construction of the concrete basin and pad, associated piping, valves, fittings, diffusers, blowers, blower enclosures, power supply, electrical conduit, non-potable water supply submerisble pump, control panel, etc. This bid item includes all piping within the

A.	Post Aeration Basin	1 LS	$ _____	$ _____
B.	Concrete Blower Pad & Steps	1 LS	$ _____	$ _____
C.	Aerzen Blowers with Enclosures	2 EA	$ _____	$ _____
D.	Fine Bubble Diffuser System (Complete)	1 LS	$ _____	$ _____
E.	3.5' Tall Aluminum Handrail	50 LF	$ _____	$ _____
F.	Concrete Blower Pad w/Enclosures	2 EA	$ _____	$ _____
G.	Blower Control Panel	1 EA	$ _____	$ _____
H.	Non-Potable Submersible Pump	1 EA	$ _____	$ _____
I.	Power Supply, Conduit & Wiring	1 LS	$ _____	$ _____

8 PLANT DISCHARGE. Includes the furnishing, installation, and/or construction of the effluent plant

ITEM & DESCRIPTION		ESTIMATED QUANTITY	UNIT PRICE	TOTAL
discharge as depicted on the drawings.				
A.	16" Sloped & Flared Headwall	1 EA	$ _____	$ _____
B.	Concrete Discharge Apron	1 LS	$ _____	$ _____
C.	Composite Sampler w/ Enclosure	1 LS	$ _____	$ _____
9 PLANT PIPING. Includes all pipe, fittings, valves, etc. located outside of basins or vaults.				
A.	1" PVC for Potable Water Plumbing	80 LF	$ _____	$ _____
B.	2" PVC for Nonpotable Water Plumbing	375 LF	$ _____	$ _____
C.	2" D.I. Sludge Transfer to Dewatering	165 LF	$ _____	$ _____
D.	4" PVC Sewer	125 LF	$ _____	$ _____
E.	6" D.I. Influent Line	40 LF	$ _____	$ _____
F.	8" PVC SDR 35 Sewer	155 LF	$ _____	$ _____
G.	10" D.I. Plant Effluent	45 LF	$ _____	$ _____
H.	16" D.I. Discharge	10 LF	$ _____	$ _____
I.	Nat. Gas Meter & Line for Generator	1 LS	$ _____	$ _____
10 SITE/ELECTRICAL WORK. Includes the furnishing, installation, and/or construction of the site accessories as depicted on the drawings.				
A.	Dense Graded Aggregate	875 TON	$ _____	$ _____
B.	CL 1 Asphalt Base 0.75D PG64-22	370 TON	$ _____	$ _____
C.	#57 Gravel for Access Road	35 TON	$ _____	$ _____
D.	8' Chain Link Fence w/Barbed Wire	725 LF	$ _____	$ _____
E.	8' Chain Link 20' Fence Gate	1 EA	$ _____	$ _____
F.	12' X 44' Mobile Lab/Office *** Includes delivery & set-up.	1 LS	$ _____	$ _____
G.	Non-Potable Hydrants	8 EA	$ _____	$ _____
H.	4' Diameter Manhole	1 EA	$ _____	$ _____
I.	Onsite Lift Station	1 LS	$ _____	$ _____
J.	Potable Water Meter Installation	1 LS	$ _____	$ _____
K.	Site Lighting	1 LS	$ _____	$ _____

BID SCHEDULE - Ball Creek WWTP & Sewer Collection Project -- Contract 1 (WWTP)

ITEM & DESCRIPTION		ESTIMATED QUANTITY	UNIT PRICE	TOTAL
L.	CCTV Security System	1 LS	$ _____	$ _____
M.	Plant Telemetry/Controls	1 LS	$ _____	$ _____
N.	Site Electrical	1 LS	$ _____	$ _____
O.	Nat. Gas Generator (Complete)	1 LS	$ _____	$ _____

Contract 1 BASE BID TOTAL (Items 1 thru 10) **$** _____

BID SCHEDULE - Ball Creek WWTP & Sewer Collection Project -- Contract 2 (Collection)

ITEM & DESCRIPTION	ESTIMATED QUANTITY	UNIT PRICE	TOTAL
1 GRAVITY SEWER. Includes all work associated with the complete installation of the gravity sewer system as depicted on the plans.			
A. 4' Diameter Manholes	25 EA	$ _____	$ _____
B. 12" PVC SDR 35 Sewer Pipe	4,520 LF	$ _____	$ _____
C. 6" PVC SDR 35 Sewer Laterals	350 LF	$ _____	$ _____
D. 6" PVC Sewer Cleanout	22 EA	$ _____	$ _____
E. 12" X 6" Tees	22 EA	$ _____	$ _____
F. Rainguard Manhole Inserts	25 EA	$ _____	$ _____
2 CHESTNUT RIDGE LIFT STATION. Includes the furnishing and installation of the lift station, valve vault, chain link fencing, electrical service, telemetry, hoist sockets, access roads, etc.			
A. 200 GPM Lift Station	1 LS	$ _____	$ _____
B. Telemetry & Controls	1 LS	$ _____	$ _____
C. Electrical Service	1 LF	$ _____	$ _____
D. 8' Chain Link Security Fence	70 LF	$ _____	$ _____
E. 8' Chain Link Security Gate	1 EA	$ _____	$ _____
3 TELEMETRY REPEATER STATION. Includes the furnishing and installation of the station, chain link fencing, electrical service, telemetry, access roads, etc.			
A. Repeater Station	1 LS	$ _____	$ _____
B. 8' Chain Link Security Fence	70 LF	$ _____	$ _____
C. 8' Chain Link Security Gate	1 EA	$ _____	$ _____
D. Electrical Service	1 LS	$ _____	$ _____
4 FORCE MAIN. Includes the furnishing, installation, and/or construction of the HDPE DR 11 force main from the Chestnut Ridge Lift Station to the Ball Creek WWTP. Includes all piping, fittings, valves, air valves, markers, etc. to complete the project as designed.			
A. 6" HDPE DR 11 Force Main	27,580 LF	$ _____	$ _____
B. 2" HDPE DR 11 Force Main	6,450 LF	$ _____	$ _____
C. Residential Grinder Lift Stations	40 EA	$ _____	$ _____
D. Sportsplex Lift Station	1 LS	$ _____	$ _____
E. Combination Air/Vacuum Release Valves	45 EA	$ _____	$ _____

BID SCHEDULE - Ball Creek WWTP & Sewer Collection Project -- Contract 2 (Collection)

ITEM & DESCRIPTION		ESTIMATED QUANTITY	UNIT PRICE	TOTAL
F.	Creek Crossings (Directional Bores)	950 LF	$ _____	$ _____
G.	12" Bored Steel Encasement	910 LF	$ _____	$ _____
H.	18" Bored Steel Encasement	330 LF	$ _____	$ _____
I.	Asphalt Replacement	250 SY	$ _____	$ _____
J.	Concrete Replacement	250 SY	$ _____	$ _____
k.	Gravel Replacement	500 SY	$ _____	$ _____
	Contract 2 BASE BID TOTAL (Items 1 thru 4)		$ _____	

ALTERNATES

A-1	Alternate Force Main Route 'B'	11,450 LF	$ _____	$ _____
A-2	Replace 8" PVC Waterline with HDPE DR 11	11,450 LF	$ _____	$ _____
A-3	Opposite-Side 6" PVC Sewer Laterals with 12" Steel Encasements	1900 LF	$ _____	$ _____

BID BOND

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

BIDDER (Name and Address):

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

OWNER (Name and Address):

BID
Bid Due Date:
Project (Brief Description Including Location):

BOND
Bond Number:
Date (Not later than Bid due date):
Penal sum _____ _____
(Words) (Figures)

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

BIDDER	SURETY
_____ (Seal)	_____ (Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature and Title	Signature and Title (Attach Power of Attorney)
Attest: _____	Attest: _____
Signature and Title	Signature and Title

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

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Surety's liability.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation shall be null and void if:
   3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
   3.2. All Bids are rejected by Owner, or
   3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default by Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

PART 1940 - GENERAL

Subpart Q - Restrictions on Lobbying

§1940.801 Purpose.

This subpart implements section 319 of Public Law 101-121, which prohibits applicants and recipients of Federal contracts, grants and loans from using appropriated funds for lobbying the Federal Government in connection with a specific award. Section 319 also requires that each person who requests or receives a Federal contract, grant, loan, or a Federal commitment to guarantee a loan, must disclose the expenditure of any funds, other than appropriated funds, for lobbying activities. This subpart provides administrative guidance regarding the information contained in U.S. Department of Agriculture's (USDA) 7 CFR part 3018 and Departmental Regulation (DR) 2400-5, which are attached as Exhibits A and B of this subpart. This subpart is inapplicable to Farm Service Agency, Farm Loan Programs. (Revised 01-09-08, PN 417.)

§1940.802 [Reserved] (Revised 07-31-96, PN 264.)

§1940.803 Definitions.

In addition to the following, refer to the definitions in §3018.105 of Exhibit A of this subpart.

Appropriated funds. Federal funds received from any Federal agency for a purpose or purposes authorized by such agency.

Communication. Includes written, oral, electronic or other means of communications.

Receiving office. The State, District, or County Office that is the primary office responsible for processing an application.

§§1940.804 - 1940.809 [Reserved]

§1940.810 Certification for contracts, grants and loans.

(a) The Certification for Contracts, Grants and Loans, contained in Exhibit A-1 of this subpart, must be completed at the time an application or bid proposal is submitted by a person requesting a contract or grant exceeding $100,000, or a loan exceeding $150,000.

(b) Any person who requests or receives a contract, subcontract or subgrant exceeding $100,000 at any tier under a covered contract, grant or loan, must complete and submit a certification to the next higher tier.

(c) The certification completed by a person referred to in paragraph (a) of this section will be collected by the receiving office and filed in the case folder.

(d) Recipients of contracts, grants or loans, or their subs, who receive certifications from lower tier applicants or recipients shall file the certifications with documents related to the subaward, and shall make them available for Agency examination upon request.

(e) Refer to §3018.110 of Exhibit A of this subpart for additional information.

§1940.811 Statement for loan guarantees.

(a) The Statement for Loan Guarantees, contained in Exhibit A-2 of this subpart, must be completed by the lender at the time an application is filed for each loan exceeding $150,000.

(b) The statement will be collected by the receiving office and filed in the case folder.

(c) Refer to §3018.110 of Exhibit A of this subpart for additional information.

§1940.812 Disclosure of lobbying activities.

(a) Standard Form (SF) LLL, "Disclosure of Lobbying Activities," which is part of Exhibit A of this subpart, must be completed by a person requesting or receiving a Agency contract, grant, loan, or a Agency commitment to guarantee a loan, and who meets the following conditions:

(1) the award amount exceeds the threshold stated in §1940.810(a) or §1940.811(a) of this subpart; and

(2) the person has made or has agreed to make any payment, using funds other than appropriated funds, to influence or attempt to influence a decision in connection with that specific award.

(b) SF-LLL must also be completed by any person who requests or receives a contract, subcontract or subgrant at any tier under a covered contract, grant or loan, and who meets the following conditions:

(1) the award amount exceeds $100,000; and

(2) the person has made or has agreed to make any payment, using funds other than appropriated funds, to influence or attempt to influence a decision in connection with that specific award.

(c) Each person who meets all conditions of paragraph (a) or (b) of this section will submit a disclosure form at the time of the application or bid proposal, and, at the end of each calendar quarter in which there occurs an event as specified in §3018.110 (c) of Exhibit A of this subpart.

(d) All disclosure forms, including quarterly updates, will be collected in the receiving office. The forms completed by persons under paragraph (a) of this section will be submitted directly to the receiving office. Forms completed by persons under paragraph (b) of this section will be submitted to the next higher tier. They will then be forwarded from tier to tier until they reach the receiving office. The original completed form will be retained in the case folder. One copy will be forwarded to the State Director, and a second copy will be sent immediately to the following address:

USDA, Office of Operations
Procurement Division
Policy and Review Team
14th and Independence Ave., S.W.
Room 1575-S
Washington, D.C. 20250

(e) The information provided on this form cannot be used by Rural Development as a basis for denying Federal assistance.

(f) Refer to Exhibit B of this subpart for additional information.

§§1940.813 - 1940.819 [Reserved]

§1940.820 Exceptions.

(a) The prohibition on the use of appropriated funds and disclosure requirements governing the use of funds, other than appropriated funds, do not apply to certain activities. These activities are described in Subparts B and C of Exhibit A of this subpart.

(b) Section 319 of P.L. 101-121 imposes no restrictions on the use of any funds for general lobbying; i.e., attempts to influence Congress or the Executive Branch with respect to a program, rather than a specific award. Such general lobbying need not be disclosed on SF LLL. However, Section 319 does not authorize lobbying otherwise restricted or prohibited by law.

§1940.821 Examples.

Several examples of activities addressed by this Instruction are contained in Exhibit C of this subpart. They are to be used for guidance purposes only.

§§1940.822 - 1940.839 [Reserved]

§1940.840 Penalties and enforcement.

(a) Failure to comply with the provisions of this subpart may result in civil penalties, as described in §3018.400 of Exhibit A of this subpart.

(b) The Under Secretary, Rural Development, shall take such actions as are necessary to ensure that the provisions in Section 319 of P.L. 101-121 are vigorously implemented and enforced.

§§1940.841 - 1940.850 [Reserved]

Attachments: Exhibits A, A-1, A-2, B, and C

oOo

CERTIFICATION FOR CONTRACTS, GRANTS AND LOANS

The undersigned certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant or Federal loan, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant or loan.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant or loan, the undersigned shall complete and submit Standard Form - LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including contracts, subcontracts, and subgrants under grants and loans) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

_____ _____

(name) (date)

_____

(title)

oOo

STATEMENT FOR LOAN GUARANTEES

The undersigned states, to the best of his or her knowledge and belief, that:

If any funds have been or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this commitment providing for the United States to guarantee a loan, the undersigned shall complete and submit Standard Form - LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.

Submission of this statement is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required statement shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

_____	_____
(name)	(organization)
_____	_____
(title)	(date)

oOo

U.S. DEPARTMENT OF AGRICULTURE

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

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

(BEFORE COMPLETING CERTIFICATION, READ INSTRUCTIONS ON REVERSE)

(1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

(2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Organization Name

PR/Award Number or Project Name

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

Signature(s)

Date

Instructions for Certification

1. By signing and submitting this form, the prospective lower tier participant is providing the certification set out on the reverse side in accordance with these instructions.

2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

3. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

4. The terms "covered transaction," "debarred," "suspended," "ineligible," " lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.

5. The prospective lower tier participant agrees by submitting this form that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

6. The prospective lower tier participant further agrees by submitting this form that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List.

8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

Form AD-1048 (1/92)

U.S GPO: 1996-757-776/201 07

USDA
Form RD 400-6
(Rev. 4-00)

Form Approved
OMB No. 0575-0018

COMPLIANCE STATEMENT

This statement relates to a proposed contract with _____

_____
(Name of borrower or grantee)

who expects to finance the contract with assistance from either the Rural Housing Service (RHS), Rural Business-Cooperative Service (RBS), or the Rural Utilities Service (RUS) or their successor agencies, United States Department of Agriculture (whether by a loan, grant, loan insurance, guarantee, or other form of financial assistance). I am the undersigned bidder or prospective contractor, I represent that:

1. ☐ I have, ☐ have not, participated in a previous contract or subcontract subject to Executive 11246 (regarding equal employment opportunity) or a preceding similar Executive Order.

2. If I have participated in such a contract or subcontract, ☐ I have, ☐ have not, filed all compliance reports that have been required to file in connection with the contract or subcontract.

If the proposed contract is for $50,000 or more and I have 50 or more employees, I also represent that:

3. ☐ I have, ☐ have not previously had contracts subject to the written affirmative action programs requirements of the Secretary of Labor.

4. If I have participated in such a contract or subcontract, ☐ I have, ☐ have not developed and placed on file at each establishment affirmative action programs as required by the rules and regulations of the Secretary of Labor.

I understand that if I have failed to file any compliance reports that have been required of me, I am not eligible and will not be eligible to have my bid considered or to enter into the proposed contract unless and until I make an arrangement regarding such reports that is satisfactory to either the RHS, RBS or RUS, or to the office where the reports are required to be filed.

I also certify that I do not maintain or provide for my employees any segregated facilities at any of my establishments, and that I do not permit my employees to perform their services at any location, under my control, where segregated facilities are maintained. I certify further that I will not maintain or provide for my employees any segregated facilities at any of my establishments, and that I will not permit my employees to perform their services at any location, under my control, where segregated facilities are maintained. I agree that a breach of this certification is a violation of the Equal Opportunity clause in my contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and wash rooms, restaurants and other eating areas time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. I further agree that (except where I have obtained identical certifications for proposed subcontractors for specific time periods) I will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause; that I will retain such certifications in my files; and that I will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods): (See Reverse).

NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENTS FOR CERTIFICATIONS OF NON-SEGREGATED FACILITIES

A certification of Nonsegregated Facilities, as required by the May 9, 1967, order (32F.R. 7439, may 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a subcontract exceeding $ 10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

Date _____

_____
(Signature of Bidder or Prospective Contractor)

_____
Address (including Zip Code)

NOTICE OF AWARD

To: _____

_____

_____

PROJECT Description: **Ball Creek WWTP & Sanitary Sewer Collection Project, Ph. I**

The OWNER has considered the BID submitted by you for the above described WORK in response to its Advertisement for Bids dated December18, 2009, and Information for Bidders.

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

You are required by the Information for Bidders to execute the Agreement and furnish the required CONTRACTOR's Performance Bond, Payment Bond and Certificates of Insurance within ten (10) calendar days from the date of this Notice to you.

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

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

Dated this _____day of _____, 20__.

Troublesome Creek Environmental Authority

Owner

By _____

Name/Title _____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged by _____

this the _____day of _____, 20__.

By _____

Name/Title _____

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

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly By

ACEC
American Council of Engineering Companies

National Society of Professional Engineers
Professional Engineers in Private Practice

ASCE American Society of Civil Engineers

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

AMERICAN COUNCIL OF ENGINEERING COMPANIES

AMERICAN SOCIETY OF CIVIL ENGINEERS

This document has been approved and endorsed by

The Associated General Contractors of America

and the

Construction Specification Institute

Knowledge for Creating and Sustaining the Built Environment

This document has been accepted by
United States Department of Agriculture
Rural Utilities Service, Water and Waste Programs

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

INTRODUCTION

This Suggested Form of Agreement between Owner and Contractor for Construction Contract, Funding Agency Edition (Stipulated Price) ("Agreement") has been prepared for use with the Guide to the Preparation of Instructions to Bidders ("Instructions")(C-200, 2002 Edition) and with the Standard General Conditions of the Construction Contract, Funding Agency Edition ("General Conditions")(C-710, 2002 Edition). Their provisions are interrelated, and a change in one may necessitate a change in the others. For guidance in the preparation of Supplementary Conditions and coordination with Instructions to Bidders, see Guide to the Preparation of Supplementary Conditions ("Supplementary Conditions")(C-800, 2002 Edition). See also Suggested Bid Form ("Bid Form") (C-410, 2002 Edition). The EJCDC has not prepared a suggested form of Advertisement or Invitation to Bid because such documents will vary widely to conform to statutory requirements.

This form and the other Bidding Documents prepared and issued by the EJCDC assume acceptance of the Project Manual concept of the Construction Specifications Institute which provides for an organizational format for location of all bound documentary information for a construction project, namely: Bidding Requirements (which term refers to the Advertisement or Invitation to Bid, the Instructions, and any Bid Form that may be suggested or prescribed, all of which provide information and guidance for all Bidders) and the Contract Documents (defined in Article 1 of the General Conditions), which include the Agreement, bonds and certificates, the General Conditions, the Supplementary Conditions, the Drawings, and the Specifications. The Bidding Requirements are not considered part of the Contract Documents because much of their substance pertains to the relationships prior to the award of the Contract and has little effect or impact thereafter and because many contracts are awarded without going through the bidding process. In some cases, however, the actual Bid may be attached as an exhibit to the Agreement to avoid extensive retyping. (The terms "Bidding Documents" and "Bidding Requirements" are defined in Article 1 of the General Conditions.) The Project Manual concept is explained in the Manual of Practice issued by the Construction Specifications Institute.

Suggested language is presented herein with "Notes to User" to assist in preparing the Agreement. Much of the language should be usable on most projects, but modifications and additional provisions will often be necessary. The suggested language has been coordinated with the other standard forms produced by the EJCDC. When modifying the suggested language or writing additional provisions, the user must check the other documents thoroughly for conflicts and coordination of language usage and make appropriate revisions in all affected documents.

Refer to the discussions in EJCDC's Recommended Competitive Bidding Procedures for Construction Projects ("Bidding Procedures") (No. 1910-9-D, 1987 Edition) on the particular paragraphs of which frequent reference is made below. For brevity, referenced paragraphs of the Instructions to Bidders are referenced with the prefix "I," those of the Bid Form are referenced with the prefix "BF," and those of this Agreement are referenced with the prefix "A."

NOTES:

1. EJCDC publications may be ordered from:

NSPE headquarters
1420 King Street
Alexandria VA 22314-2715
(703) 684-2800
www.nspe.org

ASCE headquarters
1801 Alexander Bell Drive
Reston, VA 20191-4400
(800) 548-2723
www.asce.org

ACEC headquarters
1015 15th Street NW
Washington DC 20005
(202) 347-7474
www.acec.org

2. CSI publications may be obtained from:

CSI
99 Canal Center Plaza, Suite 300
Alexandria, VA 22314
(703) 684-0300
www.csinet.org

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

THIS AGREEMENT is by and between Troublesome Creek Environmental Authority (TEA) ("Owner") and

_____ ("Contractor").

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

ARTICLE 1 – WORK

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

Contract 1 – Ball Creek WWTP Project, Phase I

and/or

Contract 2 – Ball Creek Sanitary Sewer Collection Project, Phase I

ARTICLE 2 – THE PROJECT

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

Contract 1 – Ball Creek WWTP Project, Phase I

and/or

Contract 2 – Ball Creek Sanitary Sewer Collection Project, Phase I

ARTICLE 3 – ENGINEER

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

ARTICLE 4 – CONTRACT TIMES

4.01 *Time of the Essence*

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

4.02 *Days to Achieve Substantial Completion and Final Payment*

A. The Work will be substantially completed within 330 days after the date when the Contract Times commence to run as provided in Paragraph 2.03 of the General Conditions, and completed and ready for final payment in accordance

with Paragraph 14.07 of the General Conditions within 365 days after the date when the Contract Times commence to run.

4.03 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay Owner $500.00 for each day that expires after the time specified in Paragraph 4.02 for Substantial Completion until the Work is substantially complete. After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by Owner, Contractor shall pay Owner $1,000.00 for each day that expires after the time specified in Paragraph 4.02 for completion and readiness for final payment until the Work is completed and ready for final payment.

ARTICLE 5 – CONTRACT PRICE

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

A. For all Unit Price Work, an amount equal to the sum of the established unit price for each separately identified item of Unit Price Work times the estimated quantity of that item as indicated in this paragraph 5.01.B:

As provided in Paragraph 11.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer as provided in Paragraph 9.07 of the General Conditions. Unit prices have been computed as provided in Paragraph 11.03 of the General Conditions.

B. For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

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

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment on or about the 15th day of each month during performance of the Work as provided in Paragraphs 6.02.A.1 and 6.02.A.2 below. All such payments will be measured by the schedule of values established as provided in Paragraph 2.07.A of the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements:

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Engineer may determine or Owner may withhold, including but not limited to liquidated damages, in accordance with Paragraph 14.02 of the General Conditions:

a. 95 percent of Work completed (with the balance being retainage); and

b. 95 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

2. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 95 percent of the Work completed, less such amounts as Engineer shall determine in accordance with Paragraph 14.02.B.5 of the General Conditions.

6.03 *Final Payment*

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

ARTICLE 7 – INTEREST

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

ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS

8.01 In order to induce Owner to enter into this Agreement Contractor makes the following representations:

A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.

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

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

D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in Paragraph 4.02 of the General Conditions and (2) reports and drawings of a Hazardous Environmental Condition, if any, at the Site which has been identified in the Supplementary Conditions as provided in Paragraph 4.06 of the General Conditions.

E. Contractor has obtained and carefully studied (or assumes responsibility for doing so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto.

F. Contractor does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.

G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

H. Contractor has correlated the information known to Contractor, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.

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

J. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 *Contents*

A. The Contract Documents consist of the following:

1. This Agreement (pages 1 to 6, inclusive).
2. Performance bond (pages 00610-3 to 00610-4, inclusive).
3. Payment bond (pages 00615-3 to 00615-4, inclusive).
4. General Conditions (pages 00710-1 to 00710-57, inclusive).
5. Supplementary Conditions
6. Specifications as listed in the table of contents of the Project Manual.
7. Drawings sheets bearing the following general title: Ball Creek WWTP & Sanitary Sewer Collection Project-Phase I.
8. Addenda
9. Exhibits to this Agreement (enumerated as follows):
    a. Contractor's Bid
    b. Documentation submitted by Contractor prior to Notice of Award
10. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
    a. Notice to Proceed
    b. Work Change Directives.
    c. Change Order(s).

B. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 9.

D. The Contract Documents may only be amended, modified, or supplemented as provided in Paragraph 3.04 of the General Conditions.

ARTICLE 10 – MISCELLANEOUS

10.01 *Terms*

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

10.02 *Assignment of Contract*

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

10.03 *Successors and Assigns*

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

10.04 *Severability*

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

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

This Agreement is dated _____.

OWNER:	CONTRACTOR
Troublesome Creek Environmental Authority (TEA)	_____
By: _____	By: _____
Title: _____	Title: _____
Attest: _____	Attest: _____
Title: _____	Title: _____
Address for giving notices:	Address for giving notices:
_____	_____
_____	_____
_____	_____

PERFORMANCE BOND
FOR PROCUREMENT CONTRACTS

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

SELLER (Name and Address):

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

BUYER (Name and Address):

CONTRACT
Date:
Amount:
Description (Name and Location):

BOND
Date (Not earlier than Contract Date):
Bond Number:
Amount:
Modifications to this Bond Form:

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

Seller as Principal
Company: (Corp. Seal)

Signature:
Name and Title:

Surety
Company: (Corp. Seal)

Signature:
Name and Title:
(Attach Power of Attorney)
Address:

Telephone Number:

(Space is provided below for signatures of additional parties, if required.)

Seller as Principal
Company: (Corp. Seal)

Signature:
Name and Title:

Surety
Company: (Corp. Seal)

Signature:
Name and Title:

Address:

Telephone Number:

1. Seller and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to Buyer for the performance of the Contract, which is incorporated herein by reference. For purposes of this bond, Buyer means Buyer's assigns, if and when Buyer has assigned the Contract.

2. If Seller performs the Contract, Surety and Seller have no obligation under this Bond, except to participate in conferences as provided in paragraph 3.1.

3. If there is no Buyer Default, Surety's obligation under this Bond shall arise after:

3.1. Buyer has notified Seller and Surety pursuant to paragraph 10 that Buyer is considering declaring a Seller Default and has requested and attempted to arrange a conference with Seller and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. (If Buyer, Seller and Surety agree, Seller shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Buyer's right, if any, subsequently to declare a Seller Default); and

3.2. Buyer has declared a Seller Default and formally terminated Seller's right to complete the Contract. Such Seller Default shall not be declared earlier than 20 days after Seller and Surety have received notice as provided in paragraph 3.1; and

3.3. Buyer has agreed to pay the Balance of the Contract Price to:

1. Surety in accordance with the terms of the Contract;

2. Another seller selected pursuant to paragraph 4.3 to perform the Contract.

4. When Buyer has satisfied the conditions of paragraph 3, Surety shall promptly and at Surety's expense take one of the following actions:

4.1. Arrange for Seller, with consent of Buyer, to perform and complete the Contract; or

4.2. Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or

4.3. Obtain bids or negotiated proposals from qualified sellers acceptable to Buyer for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Buyer and Seller selected with Buyer's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the Bonds issued on the Contract, and pay to Buyer the amount of damages as described in paragraph 6 in excess of the Balance of the Contract Price incurred by Buyer resulting from Seller Default; or

4.4. Waive its right to perform and complete, arrange for completion, or obtain a new seller, and with reasonable promptness under the circumstances, either:

1. determine the amount for which it may be liable to Buyer and, as soon as practicable after the amount is determined, tender payment therefor to Buyer; or

2. deny liability in whole or in part and notify Buyer citing reasons therefor.

5. If Surety does not proceed as provided in paragraph 4 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Buyer to Surety demanding that Surety perform its obligations under this Bond, and Buyer shall be entitled to enforce any remedy available to Buyer. If Surety proceeds as provided in paragraph 4.4, and Buyer refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Buyer shall be entitled to enforce any remedy available to Buyer.

6. After Buyer has terminated Seller's right to complete the Contract, and if Surety elects to act under paragraph 4.1, 4.2, or 4.3, then the responsibilities of Surety to Buyer shall not be greater than those of Seller under the Contract, and the responsibilities of Buyer to Surety shall not be greater than those of Buyer under the Contract. To a limit of the amount of this Bond, but subject to commitment by Buyer of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:

6.1. The responsibilities of Seller for correction or replacement of defective Goods and Special Services and completion of the Contract;

6.2. Additional legal, design professional and delay costs resulting from Seller's Default, and resulting from the actions or failure to act of Surety under paragraph 4; and

6.3. Liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of Seller.

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

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

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

10. Notice to Surety, Buyer or Seller shall be mailed or delivered to the address shown on the signature page.

11. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the Goods were to be delivered and the Special Services were to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

12. Definitions.

12.1. Balance of the Contract Price: The total amount payable by Buyer to Seller under the Contract after all proper adjustments have been made, including allowance to Seller of any amounts received or to be received by Buyer in settlement of insurance or other Claims for damages to which Seller is entitled, reduced by all valid and proper payments made to or on behalf of Seller under the Contract.

12.2. Contract: The agreement between Buyer and Seller identified on the signature page, including all Contract Documents and changes thereto.

12.3. Seller Default: Failure of Seller, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.

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

PAYMENT BOND
FOR PROCUREMENT CONTRACTS

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

SELLER (Name and Address):

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

BUYER (Name and Address):

CONTRACT
Date:
Amount:
Description (Name and Location):

BOND
Date (Not earlier than Contract Date):
Bond Number:
Amount:
Modifications to this Bond Form:

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

Seller as Principal
Company: (Corp. Seal)

Signature:
Name and Title:

Surety
Company: (Corp. Seal)

Signature:
Name and Title:
(Attach Power of Attorney)
Address:

Telephone Number:

(Space is provided below for signatures of additional parties, if required.)

Seller as Principal
Company: (Corp. Seal)

Signature:
Name and Title:

Surety
Company: (Corp. Seal)

Signature:
Name and Title:

Address:

Telephone Number:

1. Seller and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to Buyer to pay for labor, materials and equipment furnished for use in the performance of the Contract, which is incorporated herein by reference. For purposes of this bond, Buyer means Buyer's assigns, if and when Buyer has assigned the Contract.

2. With respect to Buyer, this obligation shall be null and void if Seller:

2.1. Promptly makes payment, directly or indirectly, for all sums due Claimants, and

2.2. Defends, indemnifies and holds harmless Buyer from all claims, demands, liens or suits by any person or entity who furnished labor, materials or equipment for use in the performance of the Contract, provided Buyer has promptly notified Seller and Surety (at the addresses described in paragraph 12) of any claims, demands, liens or suits and tendered defense of such claims, demands, liens or suits to Seller and Surety, and provided there is no Buyer Default.

3. With respect to Claimants, this obligation shall be null and void if Seller promptly makes payment, directly or indirectly, for all sums due.

4. Surety shall have no obligation to Claimants under this Bond until:

4.1. Claimants who are employed by or have a direct contract with Seller have given notice to Surety (at the addresses described in paragraph 12) and sent a copy, or notice thereof, to Buyer stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.

4.2. Claimants who do not have a direct contract with Seller:

1. Have furnished written notice to Seller and sent a copy, or notice thereof, to Buyer, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials were furnished or supplied or for whom the labor was done or performed; and

2. Have either received a rejection in whole or in part from Seller or not received within 30 days of furnishing the above notice any communication from Seller by which Seller had indicated the claim will be paid directly or indirectly; and

3. Not having been paid within the above 30 days, have sent a written notice to Surety and sent a copy, or notice thereof, to Buyer stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Seller.

5. If a notice required by paragraph 4 is given by Buyer to Seller or to Surety, that is sufficient compliance.

6. When a Claimant has satisfied the conditions of paragraph 4, Surety shall promptly and at Surety's expense take the following actions:

6.1. Send an answer to the Claimant, with a copy to Buyer, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.

6.2. Pay or arrange for payment of any undisputed amounts.

7. Surety's total obligation shall not exceed the amount of this Bond, and the amount of this bond shall be credited for any payments made in good faith by Surety.

8. Amounts owed by Buyer to Seller under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any Performance Bond. By Seller furnishing and Buyer accepting this Bond, they agree that all funds earned by Seller in the performance of the Contract are dedicated to satisfy obligations of Seller and Surety under this Bond, subject to Buyer's priority to use the funds for the completion of the furnishing the Goods and Special Services.

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

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

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

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

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

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

15. Definitions

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

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

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

NOTICE TO PROCEED

TO: _____ Date: _____

_____ Project: **Ball Ck. WWTP & Sanitary**

_____ **Sewer Collection Project, Phase I**

_____ _____

You are hereby notified to commence WORK in accordance with the Agreement dated _____ _____, 20__ , on or before _____, 20__ and you are to complete the WORK within **365** consecutive calendar days thereafter. The date of completion of all WORK is therefore _____, 20__.

Troublesome Creek Environmental Authority
Owner

By _____

Name/Title _____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF PROCEED is hereby acknowledged

by _____

this the _____day of _____, 20__.

_____
Contractor

_____
Signature

_____
Title

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT FUNDING AGENCY EDITION

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly By

ACEC
American Council of Engineering Companies

National Society of Professional Engineers
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ASCE American Society of Civil Engineers

PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
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AMERICAN SOCIETY OF CIVIL ENGINEERS

This document has been approved and endorsed by

The Associated General Contractors of America

and the

Construction Specification Institute

Knowledge for Creating
and Sustaining
the Built Environment

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

TABLE OF CONTENTS

GENERAL CONDITIONS

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda* – Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agency* – The Federal or state agency named as such in the Agreement.

3. *Agreement* – The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.

4. Application for Payment – The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

5. *Asbestos* – Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

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

7. *Bidder* – The individual or entity who submits a Bid directly to Owner.

8. *Bidding Documents* – The Bidding Requirements and the proposed Contract Documents (including all Addenda).

9. *Bidding Requirements* – The Advertisement or Invitation to Bid, Instructions to Bidders, bid security of acceptable form, if any, and the Bid Form with any supplements.

10. *Change Order* – A document recommended by Engineer which is signed by Contractor and Owner and Agency and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

11. *Claim* – A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

12. *Contract* – The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

13. *Contract Documents* – Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor's submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

14. *Contract Price* – The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).

15. *Contract Times* – The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any, (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.

16. *Contractor* – The individual or entity with whom Owner has entered into the Agreement.

17. *Cost of the Work* – See Paragraph 11.01.A for definition.

18. *Drawings* – That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

19. *Effective Date of the Agreement* – The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

20. *Engineer* – The individual or entity named as such in the Agreement.

21. *Field Order* – A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.

22. *General Requirements* – Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.

23. *Hazardous Environmental Condition* – The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto in connection with the Work.

24. *Hazardous Waste* – The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

25. *Laws and Regulations; Laws or Regulations* – Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens* – Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

27. *Milestone* – A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

28. *Notice of Award* – The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.

29. *Notice to Proceed* – A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.

30. *Owner* – The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

31. *PCBs* – Polychlorinated biphenyls.

32. *Petroleum* – Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

33. *Progress Schedule* – A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

34. *Project* – The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

35. *Project Manual* – The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

36. *Radioactive Material* – Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

37. *Related Entity* – An officer, director, partner, employee, agent, consultant, or subcontractor.

38. *Resident Project Representative* – The authorized representative of Engineer who may be assigned to the Site or any part thereof.

39. *Samples* – Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

40. *Schedule of Submittals* – A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

41. *Schedule of Values* – A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

42. *Shop Drawings* – All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

43. *Site* – Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

44. *Specifications* – That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

45. *Subcontractor* – An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.

46. *Substantial Completion* – The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

47. *Successful Bidder* – The Bidder submitting a responsive Bid to whom Owner makes an award.

48. *Supplementary Conditions* – That part of the Contract Documents which amends or supplements these General Conditions.

49. *Supplier* – A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or any Subcontractor.

50. *Underground Facilities* – All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

51. Unit Price Work – Work to be paid for on the basis of unit prices.

52. *Work* – The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

53. *Work Change Directive* – A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and Agency upon recommendation of the Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 *Terminology*

A. The following words or terms are not defined but, when used in the Bidding Requirements or Contract Documents, have the following meaning.

B. *Intent of Certain Terms or Adjectives*

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

C. *Day*

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

D. *Defective*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

   a. does not conform to the Contract Documents, or

   b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents, or

   c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.

F. Unless stated otherwise in the Contract Documents, words or phrases which have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

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

2.02 *Copies of Documents*

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

2.03 *Commencement of Contract Times; Notice to Proceed*

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

2.04 *Starting the Work*

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

2.05 *Before Starting Construction*

A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 *Preconstruction Conference*

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

2.07 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage

as being required to produce the intended result will be provided whether or not specifically called for at no additional cost to Owner.

C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 *Reference Standards*

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

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard, specification, manual or code, or any instruction of a Supplier shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, or Engineer, or any of their Related Entities, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. Reporting Discrepancies

1. *Contractor's Review of Contract Documents Before Starting Work*: Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor may discover and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.

2. *Contractor's Review of Contract Documents During Performance of Work*: If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code, or of any instruction of any Supplier, Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor knew or reasonably should have known thereof.

B. Resolving Discrepancies

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

a. the provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:

1. A Field Order;

2. Engineer's approval of a Shop Drawing or Sample; (Subject to the provisions of Paragraph 6.17.D.3) or

3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

A. Contractor and any Subcontractor or Supplier shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or Engineer's consultants, including electronic media editions; or

2. reuse any of such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaption by Engineer.

B. The prohibition of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

A. Copies of data furnished by Owner or Engineer to Contractor or Contractor to Owner or Engineer that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

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

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

4.01 *Availability of Lands*

A. Owner shall furnish the Site. See 01010 special provisions. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the

amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

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

4.02 *Subsurface and Physical Conditions*

A. *Reports and Drawings:* The Supplementary Conditions identify:

1. those reports of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Contract Documents; and

2. those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) that Engineer has used in preparing the Contract Documents.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their Related Entities with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 *Differing Subsurface or Physical Conditions*

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

1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by

Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

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

C. *Possible Price and Times Adjustments*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

   a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and

   b. with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:

   a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

   b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or

   c. Contractor failed to give the written notice as required by Paragraph 4.03.A.

3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, Owner and Engineer, and any of their Related Entities shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

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

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

   a. reviewing and checking all such information and data,

   b. locating all Underground Facilities shown or indicated in the Contract Documents,

c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction, and

d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site*

A. *Reports and Drawings:* Reference is made to the Supplementary Conditions for the identification of those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that have been utilized by the Engineer in the preparation of the Contract Documents.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their Related Entities with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any.

E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered to Contractor written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.

F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.

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

H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06. H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.

B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent must be accompanied by a certified copy of the agent's authority to act.

C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 *Certificates of Insurance*

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

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

5.04 *Contractor's Liability Insurance*

A. Contractor shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:

   a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or

   b. by any other person for any other reason;

5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

B. The policies of insurance required by this Paragraph 5.04 shall:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, partners, employees, agents, consultants and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

3. include completed operations insurance;

4. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;

5. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);

6. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and

7. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment.

   a. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

5.05 *Owner's Liability Insurance*

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

5.06 *Property Insurance*

A. Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (Contractor shall be responsible for any deductible or self-insured retention.). This insurance shall:

1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, consultants and subcontractors of any of them, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured;

2. be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions;

3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);

4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;

5. allow for partial utilization of the Work by Owner;

6. include testing and startup; and

7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other additional insured to whom a certificate of insurance has been issued.

B. Contractor shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured.

C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.

D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

5.07 *Waiver of Rights*

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

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Contractor and made payable to Contractor as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Contractor shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof.

B. Contractor as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Contractor's exercise of this power. If such objection be made, Contractor as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Contractor as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Contractor as fiduciary shall give bond for the proper performance of such duties.

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

A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of

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

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

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

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances. The superintendent will be Contractor's representative at the Site and shall have authority to act on behalf of Contractor. All communications given to or received from the superintendent shall be binding on Contractor.

6.02 *Labor; Working Hours*

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

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 *Services, Materials, and Equipment*

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

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

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

6.05 *Substitutes and "Or-Equals"*

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

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

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

1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) it has a proven record of performance and availability of responsive service; and

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

1) there will be no increase in cost to the Owner or increase in Contract Times, and

2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. Substitute Items

a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.

b. Contractor shall submit sufficient information as provided below to allow Engineer to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.

c. The procedure requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented in the General Requirements and as Engineer may decide is appropriate under the circumstances.

d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

1) shall certify that the proposed substitute item will:

a) will perform adequately the functions and achieve the results called for by the general design,

b) be similar in substance to that specified, and

c) be suited to the same use as that specified;

2) will state:

a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time;

b) whether or not use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

c) whether or not incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;

3) will identify:

a) all variations of the proposed substitute item from that specified , and

b) available engineering, sales, maintenance, repair, and replacement services;

4) and shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.

B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.

C. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by either a Change Order for a substitute or an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.

D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

E. *Engineer's Cost Reimbursement*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute item so proposed or submitted by Contractor, Contractor shall reimburse Owner for the charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

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

6.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.

C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity, nor

2. shall anything in the Contract Documents create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.

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

G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, and Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of Owner or Engineer its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 *Permits*

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

6.09 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's primary responsibility to make certain

that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 *Taxes*

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

6.11 *Use of Site and Other Areas*

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

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

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

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

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

6.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved

Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to Engineer for Owner.

6.13 *Safety and Protection*

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

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

C. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or , or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

D. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

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

6.15 *Hazard Communication Programs*

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

6.16 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract

Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 *Shop Drawings and Samples*

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

1. *Shop Drawings*

a. Submit number of copies specified in the General Requirements.

b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. *Samples*

a. Submit number of Samples specified in the Specifications.

b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Submittal Procedures*

1. Before submitting each Shop Drawing or Sample, Contractor shall have determined and verified:

a. all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

b. the suitability of all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;

c. all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto; and

d. shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations, that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. *Engineer's Review*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. *Resubmittal Procedures*

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

6.18 *Continuing the Work*

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

6.19 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its Related Entities shall be entitled to rely on representation of Contractor's warranty and guarantee.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;

6. any inspection, test, or approval by others; or

7. any correction of defective Work by Owner.

6.20 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer or any of their respective consultants, agents, officers, directors, partners, or employees by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve, maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.

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

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

A. Owner may perform other work related to the Project at the Site with Owner's employees, or via other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

1. written notice thereof will be given to Contractor prior to starting any such other work; and

2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.

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

C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;

2. the specific matters to be covered by such authority and responsibility will be itemized; and

3. the extent of such authority and responsibilities will be provided.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 *Legal Relationships*

A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.

B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's actions or inactions.

C. Contractor shall be liable to Owner and any other contractor for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's action or inactions.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

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

8.02 *Replacement of Engineer*

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

8.03 *Furnish Data*

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

8.04 *Pay When Due*

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

8.05 *Lands and Easements; Reports and Tests*

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

8.06 *Insurance*

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

8.07 *Change Orders*

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

8.08 *Inspections, Tests, and Approvals*

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

8.09 *Limitations on Owner's Responsibilities*

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

8.10 *Undisclosed Hazardous Environmental Condition*

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

8.11 *Evidence of Financial Arrangements*

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

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

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

9.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Project Representative*

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

9.04 *Authorized Variations in Work*

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

9.05 *Rejecting Defective Work*

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

9.06 *Shop Drawings, Change Orders and Payments*

A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.

B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.

C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.

D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

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

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

A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.

B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believe that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.

C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.

D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, subject to written approval by Agency at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

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

10.03 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:

1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 *Notification to Surety*

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

10.05 *Claims*

A. *Engineer's Decision Required*: All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.

B. *Notice:* Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Time shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).

C. *Engineer's Action*: Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:

1. deny the Claim in whole or in part,

2. approve the Claim, or

3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.

E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.

F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

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

11.01 *Cost of the Work*

A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items, and shall not include any of the costs itemized in Paragraph 11.01.B.

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time at the Site. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

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

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.

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

5. Supplemental costs including the following:

   a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

   b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are

consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

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

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, imposed by Laws and Regulations.

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

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, expressages, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

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

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

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A and 11.01.B.

C. Contractor's Fee: When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.

D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. Cash Allowances

1. Contractor agrees that:

a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance*

1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

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

11.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.

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

D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:

1. the Bid price of a particular item of Unit Price Work amounts to more than 5 percent of the Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by Contractor differs by more than 25 percent from the estimated quantity of such item indicated in the Agreement; and

2. there is no corresponding adjustment with respect to any other item of Work; and

3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

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

12.01 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).

C. Contractor's Fee: The Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;

b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;

c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraph 12.01.C.2.a is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 *Delays*

A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.B.

1. delays caused by or within the control of Contractor; or

D. Owner, Engineer and the Related Entities of each of them shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of Engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

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

13.01 *Notice of Defects*

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

13.02 *Access to Work*

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

13.03 *Tests and Inspections*

A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in said Paragraph 13.04.C; and

3. as otherwise specifically provided in the Contract Documents.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, it must, if requested by Engineer, be uncovered for observation.

F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

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

B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.

C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.

D. If, the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 *Owner May Stop the Work*

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

13.06 *Correction or Removal of Defective Work*

A. Promptly after receipt of notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 *Correction Period*

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

1. repair such defective land or areas; or

2. correct such defective Work; or

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

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

13.09 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

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

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

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

14.02 *Progress Payments*

A. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations on the Site of the executed Work as an experienced and qualified design professional and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and to any other qualifications stated in the recommendation); and

c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or

b. that there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

a. to supervise, direct, or control the Work, or

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:

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

b. the Contract Price has been reduced by Change Orders;

c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or

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

C. *Payment Becomes Due*

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

D. *Reduction in Payment*

1. Owner may refuse to make payment of the full amount recommended by Engineer because:

   a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;

   b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

   c. the Contractor's performance or furnishing of the Work is inconsistent with funding Agency requirements;

   d. there are other items entitling Owner to a set-off against the amount recommended; or

   e. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.

2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor corrects to Owner's satisfaction the reasons for such action.

3. If it is subsequently determined that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1.

14.03 *Contractor's Warranty of Title*

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

14.04 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.

B. Promptly after Contractor's notification, Owner, Agency, Contractor, and Engineer shall make a prefinal inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will within 14 days after submission of the tentative certificate to Owner notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will within said 14 days execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.

E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to complete or correct items on the tentative list.

14.05 *Partial Utilization*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions.

1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor will certify to Owner and Engineer that such part of the Work is substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

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

14.07 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.7;

   b. consent of the surety, if any, to final payment;

   c. a list of all Claims against Owner that Contractor believes are unsettled; and

   d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner or Owner's property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

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

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

C. *Payment Becomes Due*

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

14.08 *Final Completion Delayed*

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

14.09 *Waiver of Claims*

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

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

15.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);

2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;

3. Contractor's disregard of the authority of Engineer; or

4. Contractor's violation in any substantial way of any provisions of the Contract Documents.

B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:

1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion),

2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and

3. complete the Work as Owner may deem expedient.

C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by

Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph Owner shall not be required to obtain the lowest price for the Work performed.

D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.

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

F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B, and 15.02.C.

15.03 *Owner May Terminate For Convenience*

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. reasonable expenses directly attributable to termination.

B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

A. Owner and Contractor may mutually request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association. Timely submission of the request shall stay the effect of Paragraph 10.05.E.

B. Owner and Contractor shall participate in the mediation process in good faith. The process hall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

C. If the claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:

1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions, or

2. agrees with the other party to submit the Claim to another dispute resolution process, or

3. gives written notice to the other party of their intent to submit the Claim to a court of competent jurisdiction.

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

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

17.03 *Cumulative Remedies*

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

17.04 *Survival of Obligations*

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

17.05 *Controlling Law*

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

17.06 *Headings*

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

ARTICLE 18 – FEDERAL REQUIREMENTS

18.01 *Agency Not a Party*

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

18.02 *Contract Approval*

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

B. Concurrence by Agency in the award of the Contract is required before the Contract is effective.

18.03 *Conflict of Interest*

A. Contractor may not knowingly contract with a supplier or manufacturer if the individual or entity who prepared the plans and specifications has a corporate or financial affiliation with the supplier or manufacturer.

B. Owner's officers, employees, or agents shall not engage in the award or administration of this Contract if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when: (i) the employee, officer or agent; (ii) any member of their immediate family; (iii) their partner or (iv) an organization that employs, or is about to employ, any of the above, has a financial interest in Contractor. Owner's officers, employees, or agents shall neither solicit nor accept gratuities, favors or anything of monetary value from Contractor or subcontractors.

18.04 *Gratuities*

A. If Owner finds after a notice and hearing that Contractor, or any of Contractor's agents or representatives, offered or gave gratuities (in the form of entertainment, gifts, or otherwise) to any official, employee, or agent of Owner or Agency in an attempt to secure this Contract or favorable treatment in awarding, amending, or making any determinations related to the performance of this Contract, Owner may, by written notice to Contractor, terminate this Contract. Owner may also pursue other rights and remedies that the law or this Contract provides. However, the existence of the facts on which Owner bases such findings shall be an issue and may be reviewed in proceedings under the dispute resolution provisions of this Contract.

B. In the event this Contract is terminated as provided in paragraph 18.04.A, Owner may pursue the same remedies against Contractor as it could pursue in the event of a breach of this Contract by Contractor. As a penalty, in addition to any other damages to which it may be entitled by law, Owner may pursue exemplary damages in an

amount (as determined by Owner) which shall not be less than three nor more than ten times the costs Contractor incurs in providing any such gratuities to any such officer or employee.

18.05 *Audit and Access to Records*

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

18.06 *Small, Minority and Women's Businesses*

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

18.07 *Anti-Kickback*

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

18.08 *Clean Air and Pollution Control Acts*

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

18.09 *State Energy Policy*

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

18.10 *Equal Opportunity Requirements*

A. If this Contract exceeds $10,000, Contractor shall comply with Executive Order 11246, "Equal Employment Opportunity," as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and as supplemented by regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

B. Contractor's compliance with Executive Order 11246 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative active obligations required by the Standard Federal Equal Employment

Opportunity Construction Contract Specifications, as set forth in 41 CFR Part 60-4 and its efforts to meet the goals established for the geographical area where the Contract is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the Contract, and in each trade, and Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting Contractor's goals shall be a violation of the Contract, the Executive Order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

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

18.11 *Restrictions on Lobbying*

A. Contractor and each subcontractor shall comply with Restrictions on Lobbying (Public Law 101-121, Section 319) as supplemented by applicable Agency regulations. This Law applies to the recipients of contracts and subcontracts that exceed $100,000 at any tier under a Federal loan that exceeds $150,000 or a Federal grant that exceeds $100,000. If applicable, Contractor must complete a certification form on lobbying activities related to a specific Federal loan or grant that is a funding source for this Contract. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 USC 1352. Each tier shall disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Certifications and disclosures are forwarded from tier to tier up to the Owner. Necessary certification and disclosure forms shall be provided by Owner.

18.12 *Environmental Requirements*

A. When constructing a project involving trenching and/or other related earth excavations, Contractor shall comply with the following environmental constraints:

1. Wetlands – When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert wetlands.

2. Floodplains – When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert 100 year floodplain areas delineated on the latest Federal Emergency Management Agency Floodplain Maps, or other appropriate maps, i.e., alluvial soils on NRCS Soil Survey Maps.

3. Historic Preservation – Any excavation by Contractor that uncovers an historical or archaeological artifact shall be immediately reported to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the State Historic Preservation Officer (SHPO).

4. Endangered Species – Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of Contractor, Contractor will immediately report this evidence to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the U.S. Fish and Wildlife Service.

EXHIBIT GC-A

Certificate of Owner's Attorney

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

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

_____

Date: _____

Supplementary Conditions

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

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

TABLE OF CONTENTS

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

The Application for Payment form to be used on this Project is Form RD 1924-18.

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

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

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

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

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

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

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

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

1. N/A.

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

1. N/A.

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

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

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

a. N/A.

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

a. N/A.

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

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

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

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

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

C. The limits of liability for insurance required by Paragraph 5.04 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. Workers' Compensation, and related coverages under Paragraphs 5.04.A.1 and A.2 of the General Conditions:

a. State:	Statutory
b. Applicable Federal (e.g., Longshoremen's)	Statutory
c. Employer's Liability	*{$ 500,000}*

2. Contractor's General Liability under Paragraphs 5.04.A.3 through A.6 of the General Conditions which shall include completed operations and product liability coverages and eliminate the

exclusion with respect to property under the care, custody, and control of the Contractor:

a. General Aggregate	*{$ 2,000,000}*
b. Products - Completed Operations Aggregate	*{$ 1,000,000}*
c. Personal and Advertising Injury	*{$ 1,000,000}*
d. Each Occurrence (Bodily Injury and Property Damage)	*{$ 1,000,000}*
e. Property Damage liability insurance will provide Explosion, Collapse, and Underground coverages where applicable.	
f. Excess or Umbrella Liability	
1) General Aggregate	*{$ 5,000,000}*
2) Each Occurrence	*{$ 5,000,000}*

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

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

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

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

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

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

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

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

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

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

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

A. If this Contract exceeds $100,000, the Contractor shall comply with all applicable standards, orders, or requirements issued under Section 306 of the Clean Air Act (42 USC §1857(h)), Section 508 of the Clean

Water Act (33 USC §1368), Executive Order 11738, and Environmental Protection Agency regulations (40 CFR Part 15).

SUPPLEMENTAL GENERAL CONDITIONS

FOR

AMERICAN RECOVERY & REINVESTMENT ACT

(Drinking Water and Wastewater, State Revolving Funds)

Project Name: **BALL CREEK WWTP & SANITARY SEWER COLLECTION PROJECT**

Project Number: _____

The attached instructions and regulations as listed below shall be incorporated into the Specifications and comprise Special Conditions.

	Attachment No.
SRF Special Provisions	1
KRS Chapter 45A-Kentucky Model Procurement Code-loans only	2
Equal Employment Opportunity (EEO) Documents:	
Notice of Requirement for Affirmative Action	3
Contract Specifications (Executive Order 11246)	4
EEO Goals for Region 4 Economic Areas	5
Special Notice #1 - Check List of EEO Documentation	6
Employer Information Report EEO-1 (SF 100)	7
Labor Standards Provisions for Federally Assisted Construction, EPA Form 5720-4	8
Certifications	9
Debarment, Suspension and Other Responsibility Matters	10
Region 4 Disadvantaged Business Enterprise (DBE)	11
Negotiated Rates as of October 1, 2006	12
Bonds and Insurance	13
Outlay Management Schedule	14
Storm Water General Permit	15
Wage Rates	16
Buy American	17

SRF SPECIAL PROVISIONS

(a) Line crossings of all roads and streets shall be done in accordance with the Kentucky Transportation Cabinet requirements as may be set forth in the Special Conditions.

(b) Construction is to be carried out so as to prevent by-passing of flows during construction unless a schedule has been approved by the State or EPA, whichever is applicable.

(c) Siltation and soil erosion must be minimized during construction. All construction projects with surface disturbance of more than 1 acre during the period of construction must have a KPDES Storm Water General Permit. To apply, the contractor must submit the "Notice of Intent" form at least 48 hours prior to start of construction. See Attachment 16 for the "Notice of Intent" form.

(d) Restore disturbed areas to original or better condition.

(e) Use of Chemicals: All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of either DOW or EPA. Use of all such chemicals and disposal of residues shall be in conformance with instructions on the manufacturer's label.

(f) The construction of the project, including the letting of contracts in connection therewith, shall conform to the applicable requirements of state, territorial, and local laws and ordinances to the extent that such requirements do not conflict with Federal laws and this subchapter.

(g) The owner shall provide and maintain competent and adequate supervision and inspection.

(h) The Kentucky Infrastructure Authority and Kentucky Division of Water shall have access to the site and the project work at all times.

(i) In the event Archaeological materials (arrowheads, stone tools, stone axes, prehistoric and historic pottery, bottles, foundations, Civil War artifacts, and other types of artifacts) are uncovered during the construction of this project, work is to immediately cease at the location and the Kentucky Heritage Council shall be contacted. The telephone number is (502) 564-7005. Construction shall commence at this location until a written release is received from the Kentucky Heritage Council. Failure to report a find could result in legal action.

KRS Chapter 45A
Kentucky Model Procurement Code

45A.075 Methods of awarding state contracts.

Except as otherwise authorized by law, all state contracts shall be awarded by:
(1) Competitive sealed bidding, pursuant to KRS 45A.080; or
(2) Competitive negotiation, pursuant to KRS 45A.085 and 45A.090 or 45A.180; or
(3) Noncompetitive negotiation, pursuant to KRS 45A.095; or
(4) Small purchase procedures, pursuant to KRS 45A.100.
Effective: June 24, 2003
History: Amended 2003 Ky. Acts ch. 98, sec. 4, effective June 24, 2003. -- Created 1978 Ky. Acts ch. 110, sec. 16, effective January 1, 1979.

45A.080 Competitive sealed bidding.

(1) Contracts exceeding the amount provided by KRS 45A.100 shall be awarded by competitive sealed bidding unless it is determined in writing that this method is not practicable. Factors to be considered in determining whether competitive sealed bidding is not practicable shall include:
(a) Whether specifications can be prepared that permit award on the basis of best value; and
(b) The available sources, the time and place of performance, and other relevant circumstances as are appropriate for the use of competitive sealed bidding.
(2) The invitation for bids shall state that awards shall be made on the basis of best value. In any contract which is awarded under an invitation to bid which requires delivery by a specified date and imposes a penalty for late delivery, if the delivery is late, the contractor shall be given the opportunity to present evidence that the cause of the delay was beyond his control. If it is the opinion of the purchasing officer that there is sufficient justification for delayed delivery, the purchasing officer may adjust or waive any penalty that is provided for in the contract.
(3) Adequate public notice of the invitation for bids shall be given a sufficient time prior to the date set forth for the opening of bids. The notice may include posting on the Internet or publication in a newspaper or newspapers of general circulation in the state as determined by the secretary of the Finance and Administration Cabinet not less than seven (7) days before the date set for the opening of the bids. The provisions of this subsection shall also apply to price contracts and purchase contracts of state institutions of higher education.
(4) Bids shall be opened publicly at the time and place designated in the invitation for bids. At the time the bids are opened, the purchasing agency shall announce the agency's engineer's estimate, if applicable, and make it a part of the agency records pertaining to the letting of any contract for which bids were received. Each bid, together with the name of the bidder and the agency's engineer's estimate, shall be recorded and be open to public inspection. Electronic bid opening and posting of the required information for public viewing shall satisfy the requirements of this subsection.
(5) The contract shall be awarded by written notice to the responsive and responsible bidder whose bid offers the best value.
(6) Correction or withdrawal of bids shall be allowed only to the extent permitted by regulations issued by the secretary.
Effective: July 14, 2000
History: Amended 2000 Ky. Acts ch. 509, sec. 1, effective July 14, 2000. – Amended 1998 Ky. Acts ch. 120, sec. 10, effective July 15, 1998. -- Amended 1997 (1st Extra. Sess.) Ky. Acts ch. 4, sec. 27, effective May 30, 1997. -- Amended 1996 Ky.Acts ch. 60, sec. 2, effective July 15, 1996. -- Amended 1994 Ky. Acts ch. 278, sec. 1, effective July 15, 1994. -- Amended 1982 Ky. Acts ch. 282, sec. 1, effective July 15, 1982. -- Amended 1979 (1st Extra. Sess.) Ky. Acts ch. 9, sec. 1, effective February 10, 1979. -- Created 1978 Ky. Acts ch. 110, sec. 17, effective January 1, 1979.

45A.085 Competitive negotiation.
(1) When, under administrative regulations promulgated by the secretary or under KRS 45A.180, the purchasing officer determines in writing that the use of competitive sealed bidding is not practicable, and except as provided in KRS 45A.095 and 45A.100, a contract may be awarded by competitive negotiation.
(2) Adequate public notice of the request for proposals shall be given in the same manner and circumstances as provided in KRS 45A.080(3).
(3) Contracts other than contracts for projects utilizing an alternative project delivery method under KRS 45A.180 may be competitively negotiated when it is determined in writing by the purchasing officer that the bids received by competitive sealed bidding either are unreasonable as to all or part of the requirements, or were not independently reached in open competition, and for which each competitive bidder has been notified of the intention to negotiate and is given reasonable opportunity to negotiate.
(4) Contracts for projects utilizing an alternative project delivery method shall be processed in accordance with KRS 45A.180.
(5) The request for proposals shall indicate the relative importance of price and other evaluation factors.
(6) Award shall be made to the responsible offerer whose proposal is determined in writing to be the most advantageous to the Commonwealth, taking into consideration price and the evaluation factors set forth in the request for proposals.
(7) Written or oral discussions shall be conducted with all responsible offerers who submit proposals determined in writing to be reasonably susceptible of being selected for award. Discussions shall not disclose any information derived from proposals submitted by competing offerers. Discussions need not be conducted:
(a) With respect to prices, where the prices are fixed by law or administrative regulation, except that consideration shall be given to competitive terms and conditions;
(b) Where time of delivery or performance will not permit discussions; or
(c) Where it can be clearly demonstrated and documented from the existence of adequate competition or prior experience with the particular supply, service, or construction item, that acceptance of an initial offer without discussion would result in fair and reasonable best value procurement, and the request for proposals notifies all offerers of the possibility that award may be made on the basis of the initial offers.
Effective: June 24, 2003
History: Amended 2003 Ky. Acts ch. 98, sec. 5, effective June 24, 2003. – Amended 1997 (1st Extra. Sess.) Ky. Acts ch. 4, sec. 28, effective May 30, 1997. – Amended 1979 (1st Extra. Sess.) Ky. Acts ch. 9, sec. 2, effective February 10, 1979. -- Created 1978 Ky. Acts ch. 110, sec. 18, effective January 1, 1979.

45A.090 Negotiation after competitive sealed bidding when all bids exceed available funds.
(1) In the event that all bids submitted pursuant to competitive sealed bidding under KRS 45A.080 result in bid prices in excess of the funds available for the purchase, and the chief purchasing officer determines in writing:
(a) That there are no additional funds available from any source so as to permit an award to the responsive and responsible bidder whose bid offers the best value; and
(b) The best interest of the state will not permit the delay attendant to a resolicitation under revised specifications, or for revised quantities, under competitive sealed bidding as provided in KRS 45A.080, then a negotiated award may be made as set forth in subsections (2) or (3) of this section.
(2) Where there is more than one (1) bidder, competitive negotiations pursuant to KRS 45A.085(3) shall be conducted with the three (3) (two (2) if there are only two (2)) bidders determined in writing to be the most responsive and responsible bidders, based on criteria contained in the bid invitation. Such competitive negotiations shall be conducted under the following restrictions:

(a) If discussions pertaining to the revision of the specifications or quantities are held with any potential offerer, all other potential offerers shall be afforded an opportunity to take part in such discussions; and
(b) A request for proposals, based upon revised specifications or quantities, shall be issued as promptly as possible, shall provide for an expeditious response to the revised requirements, and shall be awarded upon the basis of best value.
(3) Where, after competitive sealed bidding, it is determined in writing that there is only one (1) responsive and responsible bidder, a noncompetitive negotiated award may be made with such bidder in accordance with KRS 45A.095.
Effective: June 24, 2003
History: Amended 2003 Ky. Acts ch. 98, sec. 6, effective June 24, 2003. – Amended 1997 (1st Extra. Sess.) Ky. Acts ch. 4, sec. 29, effective May 30, 1997. – Created 1978 Ky. Acts ch. 110, sec. 19, effective January 1, 1979.

45A.095 Noncompetitive negotiation.
(1) A contract may be made by noncompetitive negotiation only for sole source purchases, or when competition is not feasible, as determined by the purchasing officer in writing prior to award, under administrative regulations promulgated by the secretary of the Finance and Administration Cabinet or the governing boards of universities operating under KRS Chapter 164A, or when emergency conditions exist. Sole source is a situation in which there is only one (1) known capable supplier of a commodity or service, occasioned by the unique nature of the requirement, the supplier, or market conditions. Insofar as it is practical, no less than three (3) suppliers shall be solicited to submit written or oral quotations whenever it is determined that competitive sealed bidding is not feasible. Award shall be made to the supplier offering the best value. The names of the suppliers submitting quotations and the date and amount of each quotation shall be placed in the procurement file and maintained as a public record. Competitive bids may not be required:
(a) For contractual services where no competition exists, such as telephone service, electrical energy, and other public utility services;
(b) Where rates are fixed by law or ordinance;
(c) For library books;
(d) For commercial items that are purchased for resale;
(e) For interests in real property;
(f) For visiting speakers, professors, expert witnesses, and performing artists;
(g) For personal service contracts executed pursuant to KRS 45A.690 to 45A.725; and
(h) For agricultural products in accordance with KRS 45A.645.
(2) The chief procurement officer, the head of a using agency, or a person authorized in writing as the designee of either officer may make or authorize others to make emergency procurements when an emergency condition exists.
(3) An emergency condition is a situation which creates a threat or impending threat to public health, welfare, or safety such as may arise by reason of fires, floods, tornadoes, other natural or man-caused disasters, epidemics, riots, enemy attack, sabotage, explosion, power failure, energy shortages, transportation emergencies, equipment failures, state or federal legislative mandates, or similar events. The existence of the emergency condition creates an immediate and serious need for services, construction, or items of tangible personal property that cannot be met through normal procurement methods and the lack of which would seriously threaten the functioning of government, the preservation or protection of property, or the health or safety of any person.
(4) The Finance and Administration Cabinet may negotiate directly for the purchase of contractual services, supplies, materials, or equipment in bona fide emergencies regardless of estimated costs. The existence of the emergency shall be fully explained, in writing, by the head of the agency for which the purchase is to be made. The explanation shall be approved by the

secretary of the Finance and Administration Cabinet and shall include the name of the vendor receiving the contract along with any other price quotations and a written determination for selection of the vendor receiving the contract. This information shall be filed with the record of all such purchases and made available to the public. Where practical, standard specifications shall be followed in making emergency purchases. In any event, every effort should be made to effect a competitively established price for purchases made by the state.

Effective: July 15, 2002

History: Amended 2002 Ky. Acts ch. 344, sec. 9, effective July 15, 2002. – Amended 1997 (1st Extra. Sess.) Ky. Acts ch. 4, sec. 30, effective May 30, 1997. – Amended 1990 Ky. Acts ch. 496, sec. 4, effective July 13, 1990. -- Created 1978 Ky. Acts ch. 110, sec. 20, effective January 1, 1979.

45A.100 Small purchases.

(1) Procurements may be made in accordance with small purchase administrative regulations promulgated by the secretary of the Finance and Administration Cabinet, pursuant to KRS Chapter 13A, as follows:

(a) Up to ten thousand dollars ($10,000) per project for construction and one thousand dollars ($1,000) for purchases by any state governmental body, except for those state administrative bodies specified in paragraph (b) of this subsection; and

(b) Up to forty thousand dollars ($40,000) per project for construction or purchases by the Finance and Administration Cabinet, state institutions of higher education, and the legislative branch of government.

(2) Procurement requirements shall not be artificially divided so as to constitute a small purchase under this section. At least every two (2) years, the secretary shall review the prevailing costs of labor and materials and may make recommendations to the next regular session of the General Assembly for the revision of the then current maximum small purchase amount as justified by intervening changes in the cost of labor and materials.

(3) The secretary of the Finance and Administration Cabinet may grant to any state agency with a justifiable need a delegation of small purchasing authority, which exceeds the agency's small purchase limit, provided in subsection (1) of this section.

Delegations of small purchasing authority shall be granted or revoked by the secretary of the Finance and Administration Cabinet, in accordance with administrative regulations promulgated by the cabinet pursuant to KRS Chapter 13A. These administrative regulations shall establish, at a minimum, the criteria for granting and revoking delegations of small purchasing authority, including the requesting agency's past compliance with purchasing regulations, the level of training of the agency's purchasing staff, and the extent to which the agency utilizes the Kentucky Automated Purchasing System. The administrative regulations may permit the secretary of the Finance and Administration Cabinet to delegate small purchase procurements up to the maximum amount specified in subsection (1)(b) of this section.

Effective: July 15, 2002

History: Amended 2002 Ky. Acts ch. 320, sec. 2, effective July 15, 2002. – Amended 2000 Ky. Acts ch. 225, sec. 1, effective July 14, 2000. -- Amended 1996 Ky. Acts ch. 60, sec. 1, effective July 15, 1996. -- Amended 1994 Ky. Acts ch. 323, sec. 1, effective July 15, 1994. -- Amended 1990 Ky. Acts ch. 496, sec. 5, effective July 13, 1990. -- Amended 1986 Ky. Acts ch. 384, sec. 1, effective July 15, 1986. -- Amended 1984 Ky. Acts ch. 384, sec. 1, effective July 13, 1984. -- Amended 1982 Ky. Acts ch. 282, sec. 2, effective July 15, 1982. -- Amended 1980 Ky. Acts ch. 242, sec. 1, effective July 15, 1980; and ch. 250, sec. 19, effective April 9, 1980.-- Created 1978 Ky. Acts ch. 110, sec. 21, effective January 1, 1979.

NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)

The following excerpts are from 45 FR 65984 (October 3, 1980):

The minority and female goals apply to Federal and federally assisted construction contractors and subcontractors which have covered contracts. The goals are expressed as a percentage of the total hours worked by such a covered or subcontractor's entire onsite construction workforce, which is working on any construction site within a relevant area. The goal applies to each construction craft and trade in the contractor's entire workforce in the relevant area including those employees working on private non-federally involved projects.

Until further notice, the following goals for minority utilization in each construction craft and trade shall be included in all Federal or federally assisted construction contracts and subcontracts in excess of $10,000 to be performed in the respective geographic area. The goals are applicable to each nonexempt contractor's total onsite construction workforce, regardless of whether or not part of that workforce is performing work on a Federal, federally assisted or non-federally related project, contract or subcontract.

Construction contractors which are participating in an approved Hometown Plan (see 41 CFR 60-4.5) are required to comply with the goals of the Hometown Plan with regard to construction work they perform in the area covered by the Hometown Plan. With regard to all their other covered construction work, such contractors are required to comply as follows:

Goals for female participation in each trade.....6.9%
Goals for minority participation in each trade.....Insert goals for each year
(see Attachment Number 6)

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or Federally assisted) performed in the covered area.

The following excerpts are from 45 FR 65977 (October 3, 1980):

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

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

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

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION CONTRACT SPECIFICATIONS (EXECUTIVE ORDER 11246)

EEO Specifications

Following is the standard language, which must be incorporated into all solicitations for offers and bids on all Federal and Federally assisted construction contracts or subcontracts in excess of $10,000 to be performed in designated geographical areas:

1. As used in these specifications:
   (a) Covered Area means the geographical area described in the solicitation from which this contract resulted.

   (b) Director means Director, Office of Federal Contract Compliance Program, United States Department of Labor, or any person to whom the Director delegates authority;

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

   (d) Minority includes:

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

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

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

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

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

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

4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7-a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female

utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. The Contractor is expected to make substantially uniform progress toward its goals in each craft during the period specified.

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

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

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

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

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

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

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

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

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

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

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

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

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

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

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

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

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

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

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

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

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

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

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

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

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

14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation, if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

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

Attachment Number 5

EEO Goals for Economic Areas in Region 4

Source: Appendix B-80 in 45 FR 65984 (October 3, 1980)

Kentucky:

056 Paducah, KY:	
Non-SMSA Counties	5.2
IL Hardin; IL Massac; IL Pope; KY Ballard; KY Caldwell; KY Calloway. KY Carlisle; KY Crittenden; KY Fulton; KY Graves; KY Hickman; KY Livingston; KY Lyon. KY McCracken; KY Marshall.	
057 Louisville, KY:	
SMSA Counties:	
4520 Louisville, KY-IN	11.2
IN Clark; IN Floyd; KY Bullift; KY Jefferson; KY Oldham.	
Non-SMSA Counties	9.6
IN Crawford; IN Harrison; IN Jefferson; IN Orange; IN Scott; IN Washington; KY Breckinridge; KY Grayson; KY Hardin; KY Hart; KY Henry; KY Larue; KY Marion; KY Meade; KY Nelson; KY Shelby; KY Spencer; KY Trimble; KY Washington058 Lexington, KY	
SMSA Counties	
4280 Lexington-Fayette, KY	10.8
KY Bourbon; KY Clark; KY Fayette; KY Jessamine; KY Scott; KY Woodford.	
Non-SMSA Counties	7.0
KY Adair KY Anderson; KY Bath; KY Boyle; KY Breathitt; KY Casey; KY Clay; KY Estill; KY Franklin- KY Garrard; KY Green; KY Harrison- KY Jackson; KY Knott; KY Lee; KY Leslie; KY Letcher; KY Lincoln; KY Madison; KY Magoffin; KY Menifee; KY Mercer; KY Montgomery; KY Morgan. KY Nicholas; KY Owsley; KY Perry; KY Powell; KY Pulaski; KY Rockcastle; KY Russell; KY Taylor; KY Wolfe.	

CHECK LIST OF EEO DOCUMENTATION FOR BIDDERS ON LOAN CONSTRUCTION
(Required by Executive Order 11246 as amended)

The low, responsive responsible bidder must forward the following items, in duplicate, to the owner no later than ten (10) days after bid opening. The owner shall have one (1) copy available for inspection by the Office of Federal Contracts Compliance within 14 days after the bid opening. The web site for the OFCC is http://www.dol.gov/esa/ofcp_org.htm.

1. Project Number. Project Location. Type of Construction.

2. Proof of registration with the Joint Reporting Commission. (See Attachment Number 8.)

3. Copy of Affirmative Action Plan of contractor. Indicate company official responsible for EEO.

4. List of current construction contracts, with dollar amount. List contracting Federal Agency, if applicable.

5. Statistics concerning company percent workforce, permanent and temporary, by sex, race, trade, handicapped, and age. 40 CFR Part 7.

6. List of employment sources for project in question. If union sources are utilized, indicate percentage of minority membership within the union crafts.

7. Anticipated employment needs for this project, by sex, race and trade, with estimate of minority participation in specific trades.

8. List of subcontractors (name, address and telephone) with dollar amount and duration of subcontract. Subcontractor contracts over $10,000 must submit items 1- 8. The following information must be provided for all supplier contracts regardless of contract size: name of company, contact person, address, telephone number, dollar value of the contract, and a list of the materials to be supplied to the prime contractor.

9. List of any subcontract work yet to be committed with estimate of dollar amount and duration of contract.

10. Contract Price. Duration of prime contract.

11. DBE Documents - See special instructions regarding use of Minority, and Women Owned, and Small Businesses.

Employer Information Report EEO-1

Under the direction of the US Equal Employment Opportunity Commission, the Joint Reporting Committee is responsible for the full-length, multi-phase processing of employment statistics collected on the Employer Information Report EEO-1. This report, also termed Standard Form 100, details the sex and race/ ethnic composition of an employer's work force by job category.

The Employer Information EEO-1 survey is conducted annually under the authority of Public Law 88-352, Title VII of the Civil Rights Act of 1964, as amended by the Equal Employment Opportunity Act of 1972. All employers with 15 or more employees are covered by Public Law 88-352 and are required to keep employment records as specified by Commission regulations. Based on the number of employees and federal contract activities, certain large employers are required to file an EEO-1 Report on an annual basis.

The EEO-1 Report must be filed by:

(A) All private employers who are: (1) subject to Title VII of the Civil Rights Act of 1964 (as amended by the Equal Employment Opportunity Act of 1972) with 100 or more employees EXCLUDING State and local governments, primary and secondary school systems, institutions of higher education, Indian tribes and tax-exempt private memberships clubs other than labor organizations; OR (2)subject to Title VII who have fewer than 100 employees if the company is owned or affiliated with another company, or there is centralized ownership, control or management (such as central control of personnel policies and labor relations) so that the group legally constitutes a single enterprise and the entire enterprise employs a total of 100 or more employees.

(B) All federal contractors (private employers), who:(1) are not exempt as provided for by 41 CFR 60-1.5, (2) have 50 or more employees, and (a) are prime contractors or first-tier subcontractors, and have a contract, subcontract, or purchase order amounting to $50,000 or more; or (b) serve as depository of Government funds in any amount, or (c) is a financial institution which is an issuing an paying agent for U.S. Savings Bonds and Notes.

Only those establishments located in the District of Columbia and the 50 states are required to submit the EEO-1 Report. No Reports should be filed for establishments in Puerto Rico, the Virgin Islands or other American Protectorates.

When filing for the EEO-1 Rep ort for the first time, go to the web site at: http://www.mimdms.com/jrc.html and select "Filing for the first time" from the box labeled INFORMATION. File out the electronic questionnaire to enter your company into Joint Reporting Committee (JRC) system. One you have completed the registration process, you will be contacted on how to proceed with the EEO-1 Report. If you have previously registered with the JRC, follow their instructions to update your information.

Labor Standards Provisions for Federally Assisted Construction

Labor standards provisions applicable to contracts covering federally financed and assisted construction (29 CFR 5.5, Contract Provisions and Related Matters) that apply to EPA Special Appropriations Projects grants are:

(a)(4)(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

(a)(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR Part 3, which are incorporated by reference in this contract.

(a)(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5 (a) (1) through (10) and such other clauses as the U.S. Environmental Protection Agency may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(a)(7) Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(b) Contractor Work Hours and Safety Standards Act. The Administrator, EPA shall cause or require the contracting officer to insert the following clauses set forth in paragraph (b)(1),(2),(3), and (4) of this section in full in any contract subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by *Section 5.5(a) of this title. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any work week in which he or she is employed on such work to in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (b) (1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for unliquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The U.S. Environmental Protection Agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other Federally- assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such liabilities of such contractor or

subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b) (2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

(c) In addition to the clauses contained in paragraph (b), in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in section 5.1, the Administrator of EPA shall cause or require the contracting officer to insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly worked, deductions made, and actual wages paid. Further, the Administrator of EPA shall cause or require the contracting officer to insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the U.S. Environmental Protection Agency and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job. (Approved by the Office of Management and Budget under OMB control numbers 1215-0140 and 1215-0017.)

Debarred Firms

All prime Construction Contractors shall certify that Subcontractors have not and will not be awarded to any firm that is currently on the EPA Master List of Debarred, Suspended and Voluntarily Excluded Persons in accordance with the provisions of 40 CFR 32.500(c). Debarment action is taken against a firm for noncompliance with Federal Law.

All bidders shall complete the attached certification (Attachment Number 10) and submit to the owner with the bid proposal.

CERTIFICATION REGARDING DEBARMENT, SUSPENSION AND OTHER RESPONSIBILITY MATTERS

The prospective participant certifies to the best of its knowledge and belief that it and its principals:

(A) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(b) 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;

(c) 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)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

I understand that a false statement on this certification may be grounds for rejection of this proposal or termination of the award. In addition, under 18 USC Sec. 1001, a false statement may result in a fine of up to $10,000 or imprisonment for up to 5 years, or both.

_____

Typed Name & Title of Authorized Representative

_____

Signature of Authorized Representative Date

____ I am unable to certify to the above statements. My explanation is attached.

EPA DISADVANTAGED BUSINESS ENTERPRISE PROGRAM

EPA's Disadvantaged Business Enterprise Program rule applies to contract procurement actions funded in part by EPA assistance agreements awarded after May 27, 2008. The rule is found at Federal regulation Title 40, Part 33. Specific responsibilities are highlighted below.

Grant recipient responsibilities:

- Conduct an Availability Analysis and negotiate fair share objectives with EPA (§ 33.411), or adopt the fair share objectives of the oversight state agency revolving loan fund for comparable infrastructure. (§ 33.405(b)(3)).

- Include the Appendix A term and condition in each contract with a primary contractor (§ 3.106). The term and condition is included in the EPA Region 4 contract specifications insert *FEDERAL REQUIREMENTS AND CONTRACT PROVISIONS FOR SPECIAL APPROPRIATION ACT PROJECTS US ENVIRONMENTAL PROTECTION AGENCY, Region III, June 2008.*

- Employ the six Good Faith Efforts during prime contractor procurement (§ 33.301).

- Require prime contractor to comply with the following prime contractor requirements of Title 40 Part 33:

  - To employ the six Good Faith Efforts steps in paragraphs (a) through (e) of § 33.301 if the prime contractor awards subcontracts (§ 33.301(f)).

  - To provide EPA form 6100-2 – *DBE Subcontractor Participation Form* to all DBE subcontractors (§ 33.302(e)).

  - To submit EPA forms 6100-3 – *DBE Program Subcontractor Performance Form* and 6100-4 – *DBE Program Subcontractor Utilization Form* with bid package or proposal. (§ 33.302 (f) and (g)).

  - To pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the recipient (§ 33.302(a)).

  - To notify recipient in writing by its prime contractor prior to any termination of a DBE subcontractor for convenience by the prime contractor (§ 33.302(b)).

  - To employ the six good faith efforts described in § 33.301 if soliciting a replacement subcontractor after a DBE subcontractor fails to complete work under the subcontract for any reason. (§ 33.302(c)).

  - To employ the six good faith efforts described in § 33.301 even if the prime contractor has achieved its fair share objectives under subpart D of Part 33. (§33.302(d)).

- Semiannually complete and submit to Charles Hayes, EPA Region 4 DBE Coordinator EPA form 5700-52A summarizing DBE participation achieved during the previous six months (§ 33.502).

- Maintain records documenting its compliance with the requirements of Title 40 Part 33, including documentation of its, and its prime contractors', good faith efforts (§ 33.501(a)).

Prime Contractor Responsibilities:

- Employ the six Good Faith Efforts steps in paragraphs (a) through (e) of § 33.301 if the prime contractor awards subcontracts (§ 33.301(f)).

- Provide EPA form number 6100-2 – *DBE Program Subcontractor Participation Form* and form number 6100-3 – *DBE Program Subcontractor Performance Form* to each DBE subcontractor prior to opening of the contractor's bid or proposal (§ 33.302(e) and (f)).

- Complete EPA form number 6100-4 – *DBE Program Subcontractor Utilization Form* (§ 33.302(g).

- Submit to recipient with it bid package or proposal the completed EPA form number 6100-4, plus an EPA form number 6100-3 for each DBE subcontractor used in the contractor's bid or proposal (§ 33.302(f) and (g)).

- Pay subcontractors for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the recipient (§ 33.302(a)).

- Notify the recipient in writing prior to prime contractor termination of a DBE subcontractor for convenience (§ 33.302(b)).

- Employ the six good faith efforts described in § 33.301 if soliciting a replacement subcontractor after a DBE subcontractor fails to complete work under the subcontract for any reason. (§ 33.302(c)).

- Employ the six good faith efforts described in § 33.301 even if the prime contractor has achieved its fair share objectives under subpart D of Part 33. (§33.302(d)).

- Semiannually inform recipient of DBE participation achieved (§ 33.502).

- Maintain records documenting its compliance with the requirements of Title 40 Part 33, including documentation of its, and its prime contractors', good faith efforts (§ 33.501(a)).

Subcontractor Responsibilities:

- May submit EPA form 6100-2 – *DBE Subcontractor Participation Form* to Charles Hayes, EPA Region 4 DBE Coordinator (§ 33.302(e)).

- Must complete EPA form 6100-3 – *DBE Program Subcontractor Performance Form*, and submit it to the prime contractor soliciting services from the subcontractor prior to the opening of bids for the prime contract.

Form	Requirement	Provided By:	Completed By:	Submitted To:
EPA Form 6100-2	Grant Recipients required to have prime contractors provide form to Subcontractors	Prime Contractors	DBE Subcontractors	EPA Region 4 DBE Coordinator Charles Hayes
EPA Form 6100-3	Grant Recipients required to have prime contractors provide form to Subcontractors	Prime Contractors	DBE Subcontractors	Grant Recipients as part of a bid or proposal package
EPA Form 6100-4	Grant Recipients required to have prime contractors complete the form	Grant Recipients	Prime Contractors	Grant Recipients as part of a bid or proposal package

DISADVANTAGED ENTERPRISE PARTICIPATION POLICY

PROJECT NAME: _____ **BID DATE:** _____

1. Name, address and telephone number of contact person on all DBE matters:

   Prime Contractor's Name: _____
   Contact Person: _____
   Address: _____
   Phone: _____
   Cell Phone: _____
   Email: _____
   Total Contract Amount:
   _____

5. Total dollar amount/percent of contract of MBE participation:
   _____

6. Total dollar amount/percent of contract of WBE participation:
   _____

7. Certifications* for each subcontractor enclosed: ☐ Yes ☐ No

8. Subcontracts or letters of intent signed by both parties enclosed: ☐ Yes ☐ No

9. **List of MBE Subcontractors:**
   Name: _____
   Contact Person: _____
   Address: _____
   Phone: _____
   Cell Phone: _____
   Email: _____
   Type of Contract: _____
   Work to be Done: _____
   Amount: _____

10. **List of WBE Subcontractors:**
    Name: _____
    Contact Person: _____
    Address: _____
    Phone: _____
    Cell Phone: _____
    Email: _____
    Type of Contract: _____
    Work to be Done: _____
    Amount: _____

Attach Additional Sheets, If Necessary
*Self-certification: Self certification of MBE/WBE/DBE firms will NOT be accepted as a valid form of certification of MBE/WBE/DBE status.

Information concerning the efforts for obtaining subcontractor(s)

11. Information to be submitted by the bidder concerning good faith efforts taken

a. Advertisements, etc.: List each publication in which an announcement or notification was placed and attach the tear sheet of each announcement from each publication

Name of publication: _____

Address: _____

Dates of advertisement: _____

Specific subcontract areas announced: _____

b. List each DBE construction firm or supplier to which a letter of solicitation was sent or with whom negotiations were held.

Company name and phone number: _____

Area of Work Expertise: _____

Date of any follow-up call and person spoke to: _____

c. Copies of returned envelopes.

d. Copies of faxes sent.

e. Copies of certified mail return receipts.

f. Copies of letters or e-mails from solicited firms declining offer.

g. Copy of bidders list (see sheet below):

BIDDER'S LIST FORM

OWNER _____ **LOAN NO:**_____

PROJECT TITLE_____ **BID DATE:**_____

Instructions:

1. This list must include all firms that bid or quote on prime or subcontracts under EPA assisted projects (i.e. SRF Projects), included both MBE/WBE's and non MBE/WBE's
2. SRF loan participants must keep the Bidder's List until the project period for the identified loan has ended and no funds are remaining.
3. This list must be submitted to DOW in the ATA Package. Contract Award Approval cannot be given until this form has been received by SRF.
4. The following information must be obtained from all prime and sub-contractor's. Please complete the form below:

ENTITY'S NAME	MAILING ADDRESS	CONTACT PERSON	PHONE#	E-MAIL ADDRESS	M/WBE?

REGION 4 DISADVANTAGED BUSINESS ENTERPRISE (DBE) NEGOTIATED RATES

(Subject to change - refer to grant award for specific fair share objectives)

KENTUCKY	
SRF Construction:	0.70% MBE and 7.60% WBE
Equipment:	1.20% MBE and 1.10% WBE
Services:	1.20% MBE and 16.30% WBE
Supplies:*	3.70% MBE and 4.60% WBE

BONDS AND INSURANCE

The minimum requirements shall be as follows:

Bonding requirements for contracts of $100,000 or less are contained in 40 CFR 31.36(h).

Bond requirements for contracts in excess of $100,000 are:

- Bid guarantee equivalent to five percent of the bid price. The bid guarantee shall consist of a firm commitment such as a certified check or bid bond submitted with the bid;
- Performance bond equal to 100 percent of the contract price, and
- Payment bond equal to 100 percent of the contract price. Bonds must be obtained from companies holding Certificates of Authority as acceptable sureties, issued by the U.S. Treasury.

Insurance requirements are contained in the General Conditions of the contract. In addition to the other required insurance, the owner or the contractor, as appropriate, must acquire any flood insurance made available by the Federal Emergency Management Agency as required by 44 CFR Parts 59-79, if construction will take place in a flood hazard area identified by the Federal Emergency Management Agency. The owner's requirements on Flood Insurance are contained in the Special Conditions Section of the Contracts Documents.

OUTLAY MANAGEMENT

The contractor must provide a contract progress schedule of percentage of work in place and costs against time; and a schedule of projected payments (cumulative) for construction and for the architectural/ engineering contract when the contract is awarded. The payment schedule must be submitted, in a format similar to the attached sample, to the owner for forwarding to the State when the contract is awarded, and whenever actual payments on a project vary beyond -5 percent and +10 percent from the schedule, as determined by the grantee.

Contractor will be required to review each of these contract schedules during the month of June and to submit revised schedules, as necessary, no later that July 1st of each year.

THIS FORMAT IS A SAMPLE ONLY.

CONSTRUCTION AND OUTLAY SCHEDULE

Project No.: _____

Applicant: _____

Contract Identification: _____

Description of Contract: _____

_____

(INSTRUCTIONS FOR USE ON REVERSE SIDE)

SCHEDULE I - CONSTRUCTION SCHEDULE

Date for Advertisement: _____
Date for Opening Bids: _____
Pre-Construction Conference Date: _____
Date of Contract Award: _____
Contract Period: _____ days Projected Contract Completion Date: _____
Total Eligible Contract Amount: _____
Work Order Date: _____
Start Construction Date: _____
Contract Completed: _____

_____

SCHEDULE II - CUMULATIVE OUTLAY SCHEDULE (55% EPA Share) - Projection only for quarters that remain in the fiscal year (FY) plus cumulative annual amount for the next FY.

Cum EPA Amount thru 1st Qtr. Oct./Dec.: $ _____
Cum EPA Amount thru 2nd Qtr. Jan./Mar.: $ _____
Cum EPA Amount thru 3rd Qtr. Apr./June: $ _____
Cum EPA Amount thru 4th Qtr. July/Sept.: $ _____
Cum EPA Amount for Next Fiscal Year: $ _____

INSTRUCTIONS (Construction and Outlay Schedules)

To insure timely achievement of the loan objectives the owner must provide EEC/DEP/DOW with a loan activities schedule, contract construction schedules and corresponding payment outlay schedules for the loan and each contract under the loan. One copy of information similar to that showing the Construction and Outlay Schedule Form will be submitted for the loan schedule with the loan acceptance. A separate form will accompany each contract at time of contract award.

A. The loan activities schedule shall depict the period from loan award through loan closeout and cover all major milestone date. The loan activities schedule shall include Schedule I information items as well as other appropriate items necessary to monitor the loan. Schedule II shall be filled out to estimate the cumulative (all construction and architectural/engineering contracts) payment schedule to be requested by the borrower from KIA during the loan period, and whenever actual outlays vary beyond -5% and +10% from the schedule.

B. Individual contractor's construction schedules for each contract will be submitted to support the loan activities schedule. The Schedule I shall be submitted prior to date of advertisement of each contract and Schedule II along with the contractor's construction schedule shall be submitted seven (7) calendar days prior to the dates of the pre-construction conference. The contractor's construction schedule shall depict the contractor's plan for completing all contract requirements and show work placement in dollars versus contract time. Schedule II shall depict the contract payment outlay by month or quarter. The contract schedule will be coordinated with all parties at the pre-construction conference.

The loan activities schedule, contractor construction schedules, will be the basis for monitoring progress towards completion of the project. The schedules shall be maintained at the available for inspection and updated at least monthly. The schedules shall be revised to incorporate approved change orders as they occur.

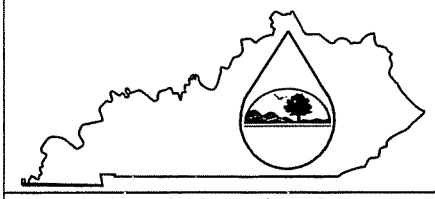
All of the schedules will be submitted to the State Division of Water.

NOTICE OF INTENT

All construction projects with surface disturbance of more than 1 acre during the period of construction must have a KPDES Storm Water General Permit. The contractor must complete and submit the attached form at least 48 hours prior to start of construction to the address below:

Section Supervisor
Permits Support Section
Surface Water Permits Branch
Kentucky Division of Water
200 Fair Oaks
Frankfort, Kentucky 40601

KPDES FORM NOI-SW



Kentucky Pollutant Discharge Elimination System (KPDES)
Notice of Intent (NOI)
for Storm Water Discharges
Associated with Industrial Activity Under the
KPDES General Permit

Submission of this Notice of Intent constitutes notice that the party identified in Section I of this form intends to be authorized by a KPDES permit issued for storm water discharges associated with industrial activity. Becoming a permittee obligates such discharger to comply with the terms and conditions of the permit.
ALL NECESSARY INFORMATION MUST BE PROVIDED ON THIS FORM (See Instructions on back)

I. Facility Operator Information

Name:		Phone:	
Address:		Status of Owner/Operator:	
City, State, Zip Code:			

II. Facility/Site Location Information

Name:			
Address:			
City, State, Zip Code:			
County:			
Site Latitude: (degrees/minutes/seconds)		Site Longitude: (degrees/minutes/seconds)	

III. Site Activity Information

MS4 Operator Name:							
Receiving Water Body:							
Are there existing quantitative data?	Yes ☐ If Yes, submit with this form. No ☐						
SIC or Designated Activity Code Primary		2nd		3rd		4th	
If this facility is a member of a Group Application, enter Group Application Number:							
If you have other existing KPDES Permits, enter Permit Numbers:							

IV. Additional Information Required FOR CONSTRUCTION ACTIVITIES ONLY

Project Start Date:		Completion Date:	
Estimated Area to be disturbed (in acres):			
Is the Storm Water Pollution Prevention Plan in Compliance with State and/or Local Sediment and Erosion Plans?		Yes ☐ No ☐	

Certification: I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Printed or Typed Name:			
Signature:		Date:	

Kentucky Pollutant Discharge Elimination System (KPDES)
Instructions
Notice of Intent (NOI) for Storm Water Discharges Associated with Industrial Activity

To Be Covered Under The KPDES General Permit

WHO MUST FILE A NOTICE OF INTENT (NOI) FORM

Federal law at 40 CFR Part 122 prohibits point source discharges of stormwater associated with industrial activity to a water body of the Commonwealth of Kentucky without a Kentucky Pollutant Discharge Elimination System (KPDES) permit. The operator of an industrial activity that has such a storm water discharge must submit a NOI to obtain coverage under the KPDES Storm Water General Permit. If you have questions about whether you need a permit under the KPDES Storm Water program, or if you need information as to whether a particular program is administered by the state agency, call the Storm Water Contact, Industrial Section, Kentucky Division of Water at (502) 564-3410.

NOIs must be sent to the following address:

Section Supervisor
Permits Support Section
Surface Water Permits Branch, Division of Water
200 Fair Oaks
Frankfort, KY 40601

COMPLETING THE FORM

Type or print legibly in the appropriate areas only. If you have any questions regarding the completion of this form call the Storm Water Contact, Industrial Section, at (502) 564-3410.

SECTION I - FACILITY OPERATOR INFORMATION

Give the legal name of the person, firm, public organization, or any other entity that operates the facility or site described in this application. The name of the operator may or may not be the same as the name of the facility. The responsible party is the legal entity that controls the facility's operation, rather than the plant or site manager. Do not use a colloquial name. Enter the complete address and telephone number of the operator.

Enter the appropriate letter to indicate the legal status of the operator of the facility.

F = Federal	M = Public (other than federal or state)
S = State	P = Private

SECTION II - FACILITY/SITE LOCATION INFORMATION

Enter the facility's or site's official or legal name and complete street address, including city, state, and ZIP code.

SECTION III - SITE ACTIVITY INFORMATION

If the storm water discharges to a municipal separate storm sewer system (MS4), enter the name of the operator of the MS4 (e.g., municipality name, county name) and the receiving water of the discharge from the MS4. (A MS4 is defined as a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) that is owned or operated by a state, city, town, borough, county, parish, district, association, or other public body which is designed or used for collecting or conveying storm water.)

If the facility discharges storm water directly to receiving water(s), enter the name of the receiving water.

Indicate whether or not the owner or operator of the facility has existing quantitative data that represent the characteristics and concentration of pollutants in storm water discharges.

If data is available submit with this form.

List, in descending order of significance, up to four 4-digit standard industrial classification (SIC) codes that best describe the principal products or services provided at the facility or site identified in Section II of this application.

If the facility listed in Section II has participated in Part 1 of an approved storm water group application and a group number has been assigned, enter the group application number in the space provided.

If there are other KPDES permits presently issued for the facility or site listed in Section II, list the permit numbers.

SECTION IV - ADDITIONAL INFORMATION REQUIRED FOR CONSTRUCTION ACTIVITIES ONLY
Construction activities must complete Section IV in addition of Sections I through III. Only construction activities need to complete Section IV.

Enter the project start date and the estimated completion date for the entire development plan.

Provide an estimate of the total number of acres of the site on which soil will be disturbed (round to the nearest acre).

Indicate whether the storm water pollution prevention plan for the site is in compliance with approved state and/or local sediment and erosion plans, permits, or storm water management plans.

SECTION V - CERTIFICATION
Federal statutes provide for severe penalties for submitting false information on this application form. Federal regulations require this application to be signed as follows:

For a corporation: by a responsible corporate officer, which means: (i) president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions, or (ii) the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

For a partnership or sole proprietorship: by a general partner or the proprietor; or

For a municipality, state, Federal, or other public facility: by either a principal executive officer or ranking elected official.

WAGE RATES

Federal Davis-Bacon rates **are** applicable to these funds. This determination applies to the entire project. Please contact the other funding sources, if applicable, for their requirements pertaining to federal wage rates. You must contact the Kentucky Labor Cabinet for determination of applicable state wages.

BUY AMERICAN

P.L. 111-5, the "American Recovery and Reinvestment Act of 2009" (ARRA) requires Clean Water State Revolving Fund and Drinking Water State Revolving Fund assistance recipients of these ARRA funds to use domestic iron, steel and manufactured goods that are produced in the United States.

Section 1605 of the ARRA requires assistance recipients to use American iron, Steel and manufactured goods throughout their ARRA funded projects. Section 1605 also, however, sets forth certain circumstances under which a federal agency may determine to waive Buy American requirements.

The approach described in the attached US EPA memorandum ARRA 09-1 dated April 28, 2009 describes how EPA will implement these provisions.

The memorandum includes sample Buy American contract language that must be completed and be part of your contract. It also includes a sample certification that you may require from your contractor or bidder to certify compliance with this requirement of the ARRA.

STANDARD TERMS AND CONDITIONS FOR CONTRACTS AND GRANTS USING ARRA FUNDS

May 8, 2009

To the extent that this contract or grant involves the use of American Recovery and Reinvestment Act of 2009, Pub. L. 111-5 ("ARRA") funds, the following terms and conditions apply. As used in this Section, "Contractor/Grantee" means the contractor or grantee receiving ARRA funds from the Commonwealth of Kentucky ("Commonwealth") under this agreement.

1. *The Contractor/Grantee specifically agrees to comply with each of the terms and conditions contained herein.*

2. *Contractor/Grantee understands and acknowledges that the federal stimulus process is still evolving and that new requirements for ARRA compliance may still be forthcoming from federal government and the Commonwealth of Kentucky. Accordingly, Contractor/Grantee specifically agrees that both it and subcontractors/subgrantees will comply with all such requirements during the contract period.*

AVAILABILITY OF FUNDING

Contractor/Grantee agrees that programs supported with temporary federal funds made available by the American Recovery and Reinvestment Act of 2009, Pub. L. 111-5, will not be continued with state financed appropriations once the temporary federal funds are expended.

BUY AMERICAN REQUIREMENT

Contractor/Grantee agrees that in accordance with ARRA, Section 1605, neither Contractor/Grantee or its subcontractors/subgrantees will use ARRA funds for a project for the construction, alternation, maintenance, or repair of a public building or public work unless all of the iron, steel and manufactured goods used in the project are produced in the United States in a manner consistent with United States obligations under international agreements. The Contractor/Grantee understands that this requirement may only be waived by the applicable federal agency in limited situations as set out in ARRA, Section 1605.

CONFLICTING REQUIREMENTS

Contractor/Grantee agrees that, to the extent ARRA requirements conflict with Commonwealth of Kentucky requirements, the ARRA requirements shall control.

FALSE CLAIMS ACT

Contractor/Grantee agrees that it shall promptly refer to an appropriate federal inspector general any credible evidence that a principal, employee, agent, subgrantee, subcontractor or other person has committed a false claim under the False Claims Act or has committed a criminal or civil violation of laws pertaining to fraud, conflict of interest, bribery, gratuity, or similar misconduct involving those funds.

ENFORCEABILITY

Contractor/Grantee agrees that if Contractor/Grantee of one of its subcontractors/subgrantees fails to comply with all applicable federal and state requirements governing the use of ARRA funds, the Commonwealth of Kentucky may withhold or suspend, in whole or in part, funds awarded under the program, or recover misspent funds following an audit. This provision is in addition to all other remedies available to the Commonwealth of Kentucky under all applicable state and federal laws.

INSPECTION OF RECORDS

Contractor/Grantee agrees that it shall permit the United States Comptroller General or his representative or the appropriate inspector general appointed under section 3 or 8G of the Inspector General Act of 1978 or his representative to: (1) examine any records that directly pertain to, and involve transactions relating to, this contract; and (2) interview any officer or employee of Contractor/Grantee or any of its subcontractors/subgrantees regarding the activities funded with funds appropriated or otherwise made available by the ARRA.

JOB POSTING REQUIREMENTS

Section 1512 of the ARRA requires states receiving stimulus funds to report on jobs created and retained as a result of the stimulus funds. Contractors/Grantees who receive ARRA funded contracts are required to post jobs created and retained as a result of stimulus funds on the Commonwealth of Kentucky Job Bank at: https://e3.ky.gov/

PROHIBITION ON USE OF ARRA FUNDS

Contractor/Grantee agrees that none of the funds made available under this contract may be used for any casino or other gambling establishment, aquarium, zoo, golf course, swimming pools, or similar projects.

REPORTING REQUIREMENTS

Pursuant to Section 1512 of the ARRA, state agencies receiving ARRA funds must submit a report to the federal government no later than ten (10) calendar days after the end of each calendar quarter. This report must contain the information outlined below.

Accordingly, Contractor/Grantee agrees to provide the Commonwealth with the following information in a timely manner:

a. The total amount of ARRA funds received by Contractor/Grantee during the Reporting Period;
b. The amount of ARRA funds that were expended or obligated during the Reporting Period;
c. A detailed list of all projects or activities for which ARRA funds were expending or obligated, including:
    i. the name of the project or activity;
    ii. a description of the project or activity;
    iii. an evaluation of the completion status of the project or activity; and

iv. an estimate of the number of jobs created and the number of jobs retained by the project or activity;

d. For any subcontracts or subgrants equal to or greater than $25,000:
   i. The name of the entity receiving the subaward;
   ii. The amount of the subaward;
   iii. The transaction type;
   iv. The North American Industry Classification System (NAICS) code or
   v. Catalog of Federal Domestic Assistance (CFDA) number;
   vi. Program source;
   vii. An award title descriptive of the purpose of each funding action;
   viii. The location of the entity receiving the subaward;
   ix. The primary location of the subaward, including the city, state, congressional district and country; and
   x. A unique identifier of the entity receiving the sub-award and the parent entity of Contractor/Grantee, should the entity be owned by another.
   xi. The names and total compensation of the five most highly compensated officers of the company if it received: 1) 80% or more of its annual gross revenues in Federal awards; and 2) $25M or more in annual gross revenue from Federal awards.

e. For any subcontracts or subgrants of less than $25,000 or to individuals, the information required in 4 may be reported in the aggregate and requires the certification of an authorized officer of Contractor/Grantee that the information contained in the report is accurate.
f. Any other information reasonably requested by the Commonwealth or required by state or federal law or regulation.

Standard data elements and federal instructions for use in complying with reporting requirements under Section 1512 of the ARRA, are pending review by the federal government, and were published in the Federal Register on April 1, 2009 [74 FR 14824], and are to be provided online at www.FederalReporting.gov.

SEGREGATION OF FUNDS

Contractor/Grantee agrees that it shall segregate obligations and expenditures of Recovery Act funds from other funding. No part of funds made available under the American Recovery and Reinvestment Act of 2009, Pub. L. 111-5, may be comingled with any other funds or used for a purpose other than that of making payments for costs allowable under the ARRA.

SUBRECEIPIENT REQUIREMENTS

Contractor/Grantee agrees that it shall include these standard terms and conditions, including this requirement, in any of its subcontracts or subgrants in connection with projects funded in whole or in part with funds available under the American Recovery and Reinvestment Act of 2009, Pub. L. 111-5.

WAGE REQUIREMENTS

Contractor/Grantee agrees that, in accordance with Section 1606 of the ARRA, both it and its subcontractors shall fully comply with this section in that, notwithstanding any other provision of law, and in a manner consistent with the other provisions of the ARRA, all laborers and mechanics employed by contractors and subcontractors on projects funded in whole or in part with funds available under the ARRA shall be paid wages at rates not less than those prevailing on projects of a character similar in the locality, as determined by the United States Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40 of the United States Code. The Secretary of Labor's determination regarding the prevailing wages applicable in the Commonwealth of Kentucky are located at: http://www.gpo.gov/davisbacon/ky.html

WHISTLEBLOWER PROTECTION

Contractor/Grantee agrees that both it and its subcontractors/subgrantees shall comply with Section 1553 of the ARRA, which prohibits all non-federal Contractor/Grantees of ARRA funds, including the Commonwealth of Kentucky, and all contractors and grantees of the Commonwealth of Kentucky, from discharging, demoting or otherwise discriminating against an employee for disclosures by the employee that the employee reasonably believes are evidence of (1) gross mismanagement of a contract or grant relating to ARRA funds; (2) a gross waste of ARRA funds; (3) a substantial and specific danger to public health or safety related to the implementation or use of ARRA funds; (4) an abuse of authority related to implementation or use of ARRA funds; or (5) a violation of law, rule, or regulation related to an agency contract (including the competition for or negotiation of a contract) or grant, awarded or issued relating to ARRA funds. Contractor/Grantee agrees that it and its subcontractors/subgrantees shall post notice of the rights and remedies available to employees under Section 1553 of Title XV of Division A of the ARRA.

Steven L. Beshear
Governor

Daniel Mongiardo
Lieutenant Governor

KENTUCKY LABOR CABINET
DEPARTMENT OF WORKPLACE STANDARDS
DIVISION OF EMPLOYMENT STANDARDS,
APPRENTICESHIP & MEDIATION
1047 US Hwy 127 S - Suite 4
Frankfort, Kentucky 40601
Phone: (502) 564-3534
Fax (502) 564-2248
www.labor.ky.gov

J. R. Gray
Secretary

Mark S. Brown
Deputy Secretary

Michael L. Dixon
Commissioner

August 24, 2009

Steve Harris
R M Johnson Engineering
POB 444
Hindman KY 41822

Re: Troublesome Creek Environmental Authority, Ball Creek WWTP & Sanitary Sewer Collection Project Phase 1

Advertising Date as Shown on Notification: March 1, 2010

Dear Steve Harris:

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

I am enclosing a copy of the current prevailing wage determination number CR 4-30, dated September 19, 2008 for KNOTT County. This schedule of wages shall be attached to and made a part of the specifications for the work, printed on the bidding blanks, and made a part of the contract for the construction of the public works between the public authority and the successful bidder or bidders.

The determination number assigned to this project is based upon the advertising date contained in your notification. There may be modifications to this wage determination prior to the advertising date indicated. In addition, if the contract is not awarded within 90 days of this advertising date or if the advertising date is modified, a different set of prevailing rates of wages may be applicable. It will be the responsibility of the public authority to contact this office and verify the correct schedule of the prevailing rates of wages for use on the project. Your project number is as follows: 060-H-00071-08-4, Heavy/Highway

Sincerely,

Michael L. Dixon
Commissioner

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

Project No. 060-H-00071-08-4
Type: _____ **Bldg** _xx___ **HH**

Determination No. CR-4-030

Date of Determination: September 19, 2008

This schedule of the prevailing rate of wages for Locality No. 030, which includes Breathitt, Floyd, Knott and Letcher Counties, has been determined in accordance with the provisions of KRS 337.505 to 337.550. This determination shall be referred to as Prevailing Wage Determination No. CR-4-030.

Apprentices shall be permitted to work as such subject to Administrative Regulations adopted by the Commissioner of Workplace Standards. Copies of these regulations will be furnished upon request to any interested person.

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

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

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

BUILDING CONSTRUCTION

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

CR-4-030
September 19, 2008

HIGHWAY CONSTRUCTION

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

HEAVY CONSTRUCTION

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

Michael L. Dixon

Michael L. Dixon, Commissioner
Department of Workplace Standards
Kentucky Labor Cabinet

CR-4-030
September 19, 2008

CLASSIFICATIONS		RATE AND FRINGE BENEFITS	
BREATHITT, FLOYD, KNOTT & LETCHER			
ASBESTOS/INSULATION WORKERS:			
Mechanics:		BASE RATE	$26.22
		FRINGE BENEFITS	12.90
Insulation removers & hazardous waste handlers:		BASE RATE	$11.13
		FRINGE BENEFITS	3.40
BREATHITT, FLOYD, KNOTT & LETCHER			
BOILERMAKERS:		BASE RATE	$24.65
		FRINGE BENEFITS	12.59
BREATHITT, FLOYD, KNOTT & LETCHER			
BRICKLAYERS:		BASE RATE	$12.00
BREATHITT, FLOYD & KNOTT COUNTIES:			
CARPENTERS:			
Carpenters:	BUILDING	BASE RATE	$24.71
		FRINGE BENEFITS	11.17
Piledriver:	BUILDING	BASE RATE	$25.11
		FRINGE BENEFITS	11.17
LETCHER COUNTY:			
CARPENTERS:			
Carpenters:	BUILDING	BASE RATE	$11.90
		FRINGE BENEFITS	1.42
Piledriver:	BUILDING	BASE RATE	$14.87
		FRINGE BENEFITS	2.35

CR-4-030
September 19, 2008

CLASSIFICATIONS		RATE AND FRINGE BENEFITS	

BREATHITT, FLOYD, KNOTT & LETCHER

LABORERS:

LABORERS:	BUILDING	BASE RATE	$8.00
		FRINGE BENEFITS	1.28

BREATHITT, FLOYD, KNOTT & LETCHER

LABORERS/HEAVY HIGHWAY

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

	HEAVY & HIGHWAY	BASE RATE	$17.43
		FRINGE BENEFITS	8.23

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

	HEAVY & HIGHWAY	BASE RATE	$17.68
		FRINGE BENEFITS	8.23

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

	HEAVY & HIGHWAY	BASE RATE	$17.73
		FRINGE BENEFITS	8.23

CR-4-030
September 19, 2008

CLASSIFICATIONS		RATE AND FRINGE BENEFITS	
CARPENTERS/ HEAVY HIGHWAY: (Continued)			
BREATHITT, FLOYD, KNOTT & LETCHER			
Carpenters:	HEAVY & HIGHWAY	BASE RATE FRINGE BENEFITS	$23.60 9.05
Piledriver:	HEAVY & HIGHWAY	BASE RATE FRINGE BENEFITS	$23.85 9.05
Divers:	HEAVY & HIGHWAY	BASE RATE FRINGE BENEFITS	$35.77 9.05
BREATHITT, FLOYD & KNOTT COUNTIES:			
CEMENT MASONS:		BASE RATE FRINGE BENEFITS	$12.00 1.28
LETCHER COUNTY:			
CEMENT MASONS & PLASTERERS:		BASE RATE	$ 14.00
BREATHITT, FLOYD, KNOTT & LETCHER			
ELECTRICIANS:		BASE RATE FRINGE BENEFITS	$29.32 17.93
BREATHITT, FLOYD, KNOTT & LETCHER			
ELEVATOR CONSTRUCTORS:		BASE RATE FRINGE BENEFITS	$26.00 7.59
BREATHITT, FLOYD, KNOTT & LETCHER			
GLAZIERS:		BASE RATE	$8.43
BREATHITT, FLOYD, KNOTT & LETCHER			
IRONWORKERS:		BASE RATE FRINGE BENEFITS	$27.12 17.19

CR-4-030
September 19, 2008

CLASSIFICATIONS		RATE AND FRINGE BENEFITS	

BREATHITT, FLOYD, KNOTT & LETCHER

LABORERS/HEAVY & HIGHWAY: (Continued)

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

	HEAVY & HIGHWAY	BASE RATE	$18.33
		FRINGE BENEFITS	8.23

BREATHITT, FLOYD, KNOTT & LETCHER

MARBLE, TILE & TERRAZZO:

Workers:		BASE RATE	$19.88
		FRINGE BENEFITS	6.30
Finishers:		BASE RATE	$13.68
		FRINGE BENEFITS	2.41

BREATHITT, FLOYD, KNOTT & LETCHER

MILLWRIGHTS:		BASE RATE	$18.73
		FRINGE BENEFITS	10.22

BREATHITT, FLOYD, KNOTT & LETCHER

OPERATING ENGINEERS

OPERATING ENGINEERS:	BUILDING	BASE RATE	$14.00
		FRINGE BENEFITS	1.28

CR-4-030
September 19, 2008

CLASSIFICATIONS RATE AND FRINGE BENEFITS

BREATHITT, FLOYD, KNOTT & LETCHER

OPERATING ENGINEERS/ HEAVY HIGHWAY:

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

HEAVY & HIGHWAY	BASE RATE	$23.60
	FRINGE BENEFITS	12.40

Operators on cranes with booms one hundred fifty feet (150') and over including jib shall receive $.50 above base rate.

HEAVY HIGHWAY CLASS B:
All Air Compressors (over 900 cu. ft. per min.), Bituminous Mixer, Boom Type Tamping Machine, Bull Float, Concrete Mixer (under 21 cu. ft.), Electric Vibrator Compactor/Self-Propelled Compactor, Elevator (one drum or buck hoist), Elevator (regardless of ownership when used to hoist building material), Finish Machine, Firemen, Flex-Plane, Forklift (regardless of lift height), Form Grader, Hoist (one drum), Joint Sealing Machine, Mechanic Helper, Outboard Motor Boat, Power Sweeper (riding type), Roller (rock), Ross Carrier, Skid Mounted or Trailer Mounted Concrete Pumps, Switchman or Brakeman, Throttle Valve Man, Tractair and Road Widening Trencher, Tractor (50 HP and over), Truck Crane Oiler, Tugger, Welding Machine, Well Points, and Whirley Oiler:

HEAVY & HIGHWAY	BASE RATE	$21.18
	FRINGE BENEFITS	12.40

CR-4-030
September 19, 2008

CLASSIFICATIONS		RATE AND FRINGE BENEFITS	

BREATHITT, FLOYD, KNOTT & LETCHER
OPERATING ENGINEERS/ HEAVY HIGHWAY: (Continued)

HEAVY HIGHWAY CLASS B2:
Greaser on Grease Facilities servicing Heavy Equipment:

HEAVY & HIGHWAY	BASE RATE	$21.56
	FRINGE BENEFITS	12.40

HEAVY HIGHWAY CLASS C:
Bituminous Distributor, Burlap and Curing Machine, Caisson Drill and Core Drill Helper (track or skid mounted), Cement Gun, Concrete Saw, Conveyor, Deckhand Oiler, Grout Pump, Hydraulic Post Driver, Hydro Seeder, Mud Jack, Oiler, Paving Joint Machine, Power Form Handling Equipment, Pump, Roller (earth), Steermen, Tamping Machine, Tractors (under 50 H.P.) and Vibrator:

HEAVY & HIGHWAY	BASE RATE	$20.92
	FRINGE BENEFITS	12.40

All Heavy Highway operators assigned to work below ground level are to be paid ten percent (10%) above base wage rate. This does not apply to open cut work.

BREATHITT, FLOYD & KNOTT COUNTIES:

PAINTERS:

Painters:	BUILDING	BASE RATE	$13.42
		FRINGE BENEFITS	1.28
	HEAVY & HIGHWAY	BASE RATE	$17.30
		FRINGE BENEFITS	3.80

LETCHER COUNTY:

PAINTERS:

Painters:	BUILDING	BASE RATE	$12.00
	HEAVY & HIGHWAY	BASE RATE	$17.30
		FRINGE BENEFITS	3.80

CR-4-030
September 19, 2008

CLASSIFICATIONS		RATE AND FRINGE BENEFITS	
BREATHITT, FLOYD, KNOTT & LETCHER			
PLUMBERS & STEAMFITTERS:		BASE RATE	$25.70
		FRINGE BENEFITS	17.91
BREATHITT, FLOYD, KNOTT & LETCHER			
ROOFERS: (Excluding Metal Roofs) BASE RATE		$9.30	
		FRINGE BENEFITS	1.28
BREATHITT, FLOYD, KNOTT & LETCHER			
SHEETMETAL WORKERS: (Including Metal Roofs)		BASE RATE	$10.97
		FRINGE BENEFITS	1.28
BREATHITT, FLOYD, KNOTT & LETCHER			
SPRINKLER FITTERS:		BASE RATE	$27.80
		FRINGE BENEFITS	13.80
BREATHITT, FLOYD, KNOTT & LETCHER			
TRUCK DRIVERS:	BUILDING	BASE RATE	$10.50
BREATHITT, FLOYD, KNOTT & LETCHER			
TRUCK DRIVERS/HEAVY & HIGHWAY:			
Truckhelper and warehouseman:			
	HEAVY & HIGHWAY	BASE RATE	$16.65
		FRINGE BENEFITS	5.80
Driver, winch truck and A-Frame when used in transporting materials:			
	HEAVY & HIGHWAY	BASE RATE	$16.75
		FRINGE BENEFITS	5.80
Driver, (semi-trailer or pole trailer), driver (dump truck, tandem axle), driver of distributor:			
	HEAVY & HIGHWAY	BASE RATE	$16.85
		FRINGE BENEFITS	5.80

CLASSIFICATIONS		RATE AND FRINGE BENEFITS	
BREATHITT, FLOYD, KNOTT & LETCHER			
TRUCK DRIVERS/HEAVY & HIGHWAY: (Continued)			
Driver on mixer trucks (all types):	HEAVY & HIGHWAY	BASE RATE	$16.90
		FRINGE BENEFITS	5.80
Truck mechanic:	HEAVY & HIGHWAY	BASE RATE	$16.95
		FRINGE BENEFITS	5.80
Driver (3 tons and under), tire changer and truck mechanic helper:	HEAVY & HIGHWAY	BASE RATE	$16.98
		FRINGE BENEFITS	5.80
Driver on pavement breakers:	HEAVY & HIGHWAY	BASE RATE	$17.00
		FRINGE BENEFITS	5.80
Driver (over 3 tons), driver (truck mounted rotary drill):	HEAVY & HIGHWAY	BASE RATE	$17.19
		FRINGE BENEFITS	5.80
Driver, Euclid and other heavy earth moving equipment and Low Boy:	HEAVY & HIGHWAY	BASE RATE	$17.76
		FRINGE BENEFITS	5.80
Greaser on greasing facilities:	HEAVY & HIGHWAY	BASE RATE	$17.85
		FRINGE BENEFITS	5.80

END OF DOCUMENT CR-4-030
SEPTEMBER 19, 2008

FEDERAL WAGE RATE DETERMINATION FOR KNOTT COUNTY
August 26, 2009

GENERAL DECISION: KY20080026 02/08/2008 KY26

Date: February 8, 2008
General Decision Number: KY20080026 02/08/2008

Superseded General Decision Number: KY20070026

State: Kentucky

Construction Types: Heavy and Highway

Counties: Adair, Barren, Bell, Breathitt, Casey, Clay, Clinton, Cumberland, Estill, Floyd, Garrard, Green, Harlan, Hart, Jackson, Johnson, Knott, Knox, Laurel, Lawrence, Lee, Leslie, Letcher, Lincoln, Magoffin, Martin, McCreary, Menifee, Metcalfe, Monroe, Morgan, Owsley, Perry, Pike, Powell, Pulaski, Rockcastle, Russell, Taylor, Wayne, Whitley and Wolfe Counties in Kentucky.

Heavy and Highway Construction Projects

Modification Number	Publication Date
0	02/08/2008

* SUKY2002-001 05/16/2006

	Rates	Fringes
Boilermaker	$ 24.65	12.94
Bricklayer	$ 20.35	7.80
Carpenter	$ 18.85	7.80
Cement Mason	$ 18.70	7.80
Electrician	$ 22.60	6.97

When workmen are required to work from bosum chairs, trusses, stacks, tanks, scaffolds, catwalks, radio and TV towers, structural steel (open, unprotected, unfloored raw steel), and bridges or similar hazardous locations where workmen are subject to a direct fall, except where using JLG's and bucket trucks up to 75 feet: Add 25% to workmen's base rate for 50 to

75 feet, and add 50% to workmen's base rate for over 75 feet

Ironworkers:

Reinforcing	$ 18.75	7.80
Structural	$ 18.95	7.80

Laborers:

GROUP 1	$ 16.90	7.80
GROUP 2	$ 17.15	7.80
GROUP 3	$ 17.25	7.80
GROUP 4	$ 17.30	7.80
GROUP 5	$ 17.40	7.80
GROUP 6	$ 17.45	7.80
GROUP 7	$ 17.50	7.80
GROUP 8	$ 17.65	7.80
GROUP 9	$ 17.85	7.80
GROUP 10	$ 18.40	7.80
GROUP 11	$ 18.50	7.80
GROUP 12	$ 19.70	7.80

Painters:

All Excluding Bridges	$ 19.92	9.57
Bridges	$ 23.92	10.07

Piledriver	$ 18.50	7.80

Plumber	$ 22.52	7.80

Power Equipment Operator

GROUP 1	$ 20.25	7.80
GROUP 2	$ 18.50	7.80
GROUP 3	$ 18.35	7.80
GROUP 4	$ 17.76	7.80

Sheet Metal Worker	$ 20.40	7.80

Stonemason	$ 18.95	7.80

Truck drivers:

GROUP 1	$ 17.25	7.80
GROUP 2	$ 17.35	7.80
GROUP 3	$ 17.40	7.80
GROUP 4	$ 17.45	7.80
GROUP 5	$ 17.48	7.80
GROUP 6	$ 17.50	7.80
GROUP 7	$ 17.69	7.80
GROUP 8	$ 18.26	7.80

GROUP 9.....$ 18.35 7.80

LABORER CLASSFICATIONS

GROUP 1 - General; Flagperson; & Steam Jenny

GROUP 2 - Batch Truck Dumper; & Deck Hand or Scow Man

GROUP 3 - Power Driven Tool Operator of the following: Wagon Drill, Chain Saw, Sand Blaster, Concrete Chipper, Pavement Breaker, Vibrator, Power Wheelbarrow & Power Buggy; Sewer Pipe Layer; Bottom Man; Dry Cement Handler; Concrete Rubber; & Mason Tender

GROUP 4 - Asphalt Lute & Rakerman; Side Rail Setter

GROUP 5 - Gunnite Nozzle Man

GROUP 6 - Tunnel Laborer (Free Air)

GROUP 7 - Tunnel Mucker (Free Air); Gunite operator

GROUP 8 - Hand Blade Operator

GROUP 9 - Tunnel Miner, Blaster & Driller (Free Air)

GROUP 10 - Caisson Worker

GROUP 11 - Powderman

GROUP 12 - Drill Operator of Percussion Type Drills which are both powered & propelled by an independent air supply

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1 - Auto Patrol; Batcher Plant; Bituminous Paver; Cableway; Clamshell; Concrete Mixer (21 cu. ft. or over); Concrete Pump; Crane; Crusher Plant; Derrick; Derrick Boat; Ditching & Trenching Machine; Dragline; Dredge Engineer; Elevator (When used to hoist building materials); Elevating Grader; Loader All Types; Hoe-Type Machine; Hoisting Engine; Locomotive; LeTourneau or Carry-all Scoop; Bulldozer; Mechanic; Orange peel Bucket; Piledriver; Power Blade; Roller (Bituminous); Roller (Earth); Roller (Rock); Scarifier; Shovel; Tractor Shovel; Truck Crane; Well Points; Winch Truck; Push Dozer; Grout Pump; High Lift;

Fork Lift (Regardless of Lift Height); Boom Cat All Types; Multiple Operator; Core Drill; Tow or Push Boat; A-Frame Winch Truck; Concrete Paver; Gradeall; Hoist; Hyster; Material Pump; Pumpcrete; Ross Carrier; Sheep Foot; Sideboom; Throttle-Valve Man; Rotary Drill; Power Generator; Mucking Machine; Rock Spreader attached to equipment; Scoopmobile; KeCal Loader; Tower Crane (French, German & other types); Hydrocrane; Tugger; Backfiller Gurry; Self Propelled Compactor, Self Contained Hydraulic Percussion Drill

GROUP 2 - Air Compressor (200 cu. ft. per min. or greater capacity); Bituminous Mixer; Concrete Mixer (Under 21 cu. ft.); Welding Machine; Form Grader; Tractor (50 H.P. & Over); Bull Float; Finish Machine; Outboard Motor Boat; Brakeman; Whirley Oiler; Tractair & Road Widening Trencher; & Articulating Truck

GROUP 3 - Greaser on Grease Facilities Servicing Heavy Equipment

GROUP 4 - Bituminous Distributor; Cement Gun; Conveyor; Mud Jack; Paving Joint Machine; Pump; Tamping Machine; Tractor (Under 50 H.P.); Vibrator; Oiler; Air Compressor (Under 200 cu. ft. per min. capacity); Concrete Saw; Burlap & Curing Machine; Hydro Seeder; Power Form Handling Equipment; Deckhand Oiler; & Hydraulic Post Driver

TRUCK DRIVER CLASSIFICATIONS

GROUP 1 - Winch; A-Frame when used in transporting materials

GROUP 2 - Tandem Axle; Dump; Distributor; Semi-Trailer or Pole Trailer

GROUP 3 - Mixer

GROUP 4 - Truck Mechanic

GROUP 5 - 3 Tons & Under; Tire Changer

GROUP 6 - Pavement Breaker

GROUP 7 - Over 3 Tons; Truck Mounted Rotary Drill

GROUP 8 - Euclid & Other Heavy Earth Moving Equipment; Lowboy

GROUP 9 - Greaser on Greasing Facilities

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

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

In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

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

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

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

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

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

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

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

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

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

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

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

END OF GENERAL DECISION

FORM APPROVED
OMB NO. 0575-0042

Form RD 1924-7
(Rev. 2-97)

UNITED STATES DEPARTMENT OF AGRICULTURE
RURAL DEVELOPMENT AND
FARM SERVICE AGENCY

CONTRACT CHANGE ORDER

ORDER NO.	
DATE	
STATE	Kentucky
COUNTY	Knott

CONTRACT FOR: Ball Creek WWTP & Sewer, Ph. I

OWNER: Troublesome Creek Environ. Authority

To _____
(Contractor)

You are hereby requested to comply with the following changes from the contract plans and specifications:

Description of Changes (Supplemental Plans and Specifications Attached)	DECREASE in Contract Price	INCREASE in Contract Price
	$	$
TOTALS	$ 0.00	0.00
NET CHANGE IN CONTRACT PRICE	$ 0.00	0.00

JUSTIFICATION:

The amount of the Contract will be (Decreased) (Increased) By The Sum Of: _____

_____ Dollars ($_____).

The Contract Total Including this and previous Change Orders Will Be: _____

_____ Dollars ($ _____).

The Contract Period Provided for Completion Will Be (Increased) (Decreased) (Unchanged) : _____ Days.

This document will become a supplement to the contract and all provisions will apply hereto.

Requested _____ _____
(Owner) *(Date)*

Recommended _____ _____
(Owner's Architect/Engineer) *(Date)*

Accepted _____ _____
(Contractor) *(Date)*

Approved by Agency _____ _____
(Name and Title) *(Date)*

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0575-01042. The time required to complete this information collection is estimated to average 15 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

☐ ORIGINAL-BORROWER'S CASE FOLDER
☐ COPY-CONTRACTOR
☐ COPY-BORROWER

POSITION 6

FORM APPROVED
OMB NO. 0575-0042

Form RD 1924-18
(Rev. 6-97)

UNITED STATES DEPARTMENT OF AGRICULTURE
RURAL DEVELOPMENT
FARM SERVICE AGENCY

PARTIAL PAYMENT ESTIMATE

CONTRACT NO.

PARTIAL PAYMENT ESTIMATE NO.

PAGE

OWNER:	CONTRACTOR:	PERIOD OF ESTIMATE
Troublesome Creek Environ. Authority		FROM _____ TO _____

CONTRACT CHANGE ORDER SUMMARY

No.	Agency Approval Date	Amount Additions	Amount Deductions
TOTALS		$0.00	$0.00
NET CHANGE		$0.00	$0.00

ESTIMATE

1. Original Contract	
2. Change Orders	$0.00
3. Revised Contract (1 + 2)	$0.00
4. Work Completed*	
5. Stored Materials*	
6. Subtotal (4 + 5)	$0.00
7. Retainage*	
8. Previous Payments	
9. Amount Due (6-7-8)	$0.00

** Detailed breakdown attached*

CONTRACT TIME

Original (days) _____
Revised _____
Remaining _____

On Schedule ☐ Yes ☐ No

Starting Date _____
Projected Completion _____

CONTRACTOR'S CERTIFICATION:

The undersigned Contractor certifies that to the best of their knowledge, information and belief the work covered by this payment estimate has been completed in accordance with the contract documents, that all amounts have been paid by the contractor for work for which previous payment estimates was issued and payments received from the owner, and that current payment shown herein is now due.

Contractor _____

By _____

Date _____

APPROVED BY OWNER:

Owner _____

By _____

Date _____

ARCHITECT OR ENGINEER'S CERTIFICATION:

The undersigned certifies that the work has been carefully inspected and to the best of their knowledge and belief, the quantities shown in this estimate are correct and the work has been performed in accordance with the contract documents.

Architect or Engineer _____

By _____

Date _____

ACCEPTED BY AGENCY:

The review and acceptance of this estimate does not attest to the correctness of the quantities shown or that the work has been performed in accordance with the contract documents.

By _____

Title _____

Date _____

TYPICAL UNIT PRICE BREAKDOWN *

ITEM	DESCRIPTION	CONTRACT *(revised)*			THIS PERIOD		TOTAL TO DATE		% COM-PLETE
		QUANTITY	UNIT PRICE	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT	
				$0.00		$0.00		$0.00	0
				$0.00		$0.00		$0.00	0
				$0.00		$0.00		$0.00	0
				$0.00		$0.00		$0.00	0
				$0.00		$0.00		$0.00	0
				$0.00		$0.00		$0.00	0
				$0.00		$0.00		$0.00	0
				$0.00		$0.00		$0.00	0
				$0.00		$0.00		$0.00	0
				$0.00		$0.00		$0.00	0
				$0.00		$0.00		$0.00	0
	TOTALS			$0.00		$0.00		$0.00	0

TYPICAL LUMP SUM PRICE BREAKDOWN *

ITEM	DESCRIPTION	SCHEDULED VALUE	WORK COMPLETED		% COM-PLETE
			THIS PERIOD	TO DATE	
					0
					0
					0
					0
					0
					0
					0
					0
					0
					0
	TOTALS	$0.00	$0.00	$0.00	0

TYPICAL STORED MATERIALS
AND RETAINAGE BREAKDOWN *

MATERIALS STORED AT END OF THIS PAYMENT PERIOD			
DESCRIPTION	QUANTITY	UNIT VALUE	AMOUNT
			$0.00
			$0.00
			$0.00
			$0.00

RETAINAGE			
	THIS ESTIMATE	PERCENT	RETAINED
WORK COMPLETED:		%	
STORED MATERIALS:			
OTHER (explain)			
TOTAL			$0.00

* As a minimum, detailed breakdowns should contain this information.

TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

CONTRACT 2 – ELECTRICAL SPECIFICATIONS

Section-01000

Scope of Work

SECTION 01000

SCOPE OF WORK

PART 1: GENERAL

1.01 LOCATION OF WORK

A. The work of this Contract is located in the community of Softshell in Knott County, Kentucky.

1.02 WORK TO BE DONE

The Contractor shall furnish all materials, labor, equipment and incidentals required and install, complete and ready for operation, the Ball Creek WWTP & Sanitary Sewer Collection Project, as shown on the Drawings and/or specified herein. The work shall include but is not necessarily limited to the items of work as set forth on the Bid Schedule.

1.03 ABBREVIATIONS AND REFERENCES

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AFBM	Anti-Friction Bearing Manufacturers' Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute
AREA	American Railway Engineering Association
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials

AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers' Association
AWPB	American Wood Preservers' Bureau
AWS	American Welding Society
AWWA	American Waterworks Association
BHMA	Builders' Hardware Manufacturers' Association
CBMA	Certified Ballast Manufacturers Association
CDA	Copper Development Association
CISPI	Cast Iron Soil Pipe Institute
CMAA	Crane Manufacturers' Association of America
CRSI	Concrete Reinforcing Steel Institute
Fed.Spec.	Federal Specifications
FM	Factory Mutual
HI	Hydraulic Institute
HMI	Hoist Manufacturers' Institute
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IPCEA	Insulated Power Cable Engineers' Association
JIC	Joint Industry Conferences of Hydraulic Manufacturers
MMA	Monorail Manufacturers' Association
NBHA	National Builders' Hardware Association
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electric Safety Code
NEPA	National Fire Protection Association
NLMA	National Lumber Manufacturers' Association
NWWA	National Woodwork Manufacturers' Association
OECI	Overhead Electrical Crane Institute
OSHA	Occupational Safety and Health Act (both Federal and State)
PS	Product Standards Sections - U.S. Department of Commerce
IRMA	Rubber Manufacturers' Association
SAE	Society of Automotive Engineers
SSPC	Steel Structures Painting Council
TCA	Tile Council of America
TEMA	Tubular Exchanger Manufacturers' Association
UBC	Uniform Building Code
UL	Underwriters' Laboratories, Inc.
WWPA	Western Wood Products Association

Where reference is made to a specification by one of the above mentioned or other associations, it is understood that the latest revisions thereof shall apply.

END OF SECTION

Section-01010

Special Provisions

SECTION 01010

SPECIAL PROVISIONS

PART 1: GENERAL

1.01 EASEMENTS, ALTERNATE ROUTES, & STRUCTURAL DRAWINGS

A. The easements for the PREFERED force main route shown on Sheets C-3 through C-13 on Contract 2 are currently being acquired or negotiated with the residents. An alternate route is APPROVED and shown on sheets C-3B through C-11B of the Contract 2 plans. Alternate Route "B" shall be included on the Bid Schedule as an alternate. All easements and rights-of-way for the preferred route will be acquired prior to beginning any construction along the route.

B. The Contract 2 contractor shall post the **$87,800.00** bond for the Kentucky Transportation Cabinet Encroachment Permit and have the Encroachment Permit issued in the name of the Owner.

C. Updated Structural Drawings will be provided approximately 1 week before the Bid Opening date of January 7th, 2010. These drawings will include the full structural design of the overhead and floor concrete slabs between the two-cell concrete basins.

1.02 PROTECTION AGAINST ELECTROLYSIS

A. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other acceptable materials.

1.03 OPERATING INSTRUCTIONS AND PARTS LISTS

A. Where reference is made in the Specifications to Operating Instructions and spare parts lists, the Contractor shall furnish, for each piece of equipment, complete sets giving the information listed below:

1. Clear and concise instructions for the operation, adjustment, and lubrication and other maintenance of the equipment. These instructions shall include a complete lubrication chart.

2. List of all parts for the equipment, with catalog numbers and other data necessary for ordering replacement parts. Include a detailed exploded view of all major equipment or components.

B. Such instructions and parts lists shall be annotated to indicate only the specific equipment furnished. Reference to other sizes and types or models of similar equipment shall be deleted.

C. Such operating instructions and parts lists shall be delivered to the Engineer at the same time that the equipment to which they pertain is delivered to the Site.

1.04 SPARE PARTS

A. Spare parts shall be provided for specified equipment items as specified in the respective technical sections of these Specifications. Required spare parts to be provided are listed therein.

B. As a minimum the Contractor shall provide the following: all parts shall be coated to protect them from a moist atmosphere; the parts shall be crated in containers suitable for handling with hoisting equipment and designed for prolonged storage; the following information must be stenciled on the containers: Contractor's name, name of manufacturer or supplier of equipment; name of unit for which the part is intended; name of the spare part; name of the supplier of spare part; manufacturer's catalogue numbers; precautionary information; part and model numbers and other identifying information deemed appropriate. Each individual part shall also be identified. In addition, the unit cost for each spare part required under this Contract must also be furnished. The unit cost for each component part of an assembly supplied under this Contract must be furnished if the component part can be ordered separately from a supplier.

C. Where oil or grease lubricated equipment is used, sufficient oil or grease of types approved by the equipment manufacturer shall be supplied for one years operation. Oil and grease shall be identified as identified as detailed in paragraph B above.

1.05 SPECIAL TOOLS

A. For each type of equipment furnished by him the Contractor shall provide a complete set of all special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation, maintenance, and disassembly of such equipment. Tools shall be high-grade, smooth, forged, alloy, tool steel. Grease guns shall be lever type suitable for the grease fittings provided.

B. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment.

C. Special tools shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such special tools until completion of the Work, at which time they shall be delivered to the Owner.

1.06 BOLTS, ANCHOR BOLTS AND NUTS

A. All necessary bolts, anchor bolts, nuts, washers, plates and bolt sleeves shall be furnished by the Contractor in accordance herewith unless otherwise specified. Anchor bolts shall be amply sized for the conditions imposed and have suitable washers and, where so required, their nuts shall be hexagonal.

B. All anchor bolts, nuts, washers, plates, and bolt sleeves unless otherwise indicated or specified shall be 316SS. Materials of construction shall be consistent unless otherwise indicated or specified.

C. Unless otherwise specified, stud, tap, and machine bolts, and nuts shall conform to the requirements to the latest ASTM Standard Specification for Carbon Steel Externally and Internally Threaded Standard Fasteners, Designation A307. Hexagonal nuts of the same quality of metal as the bolts shall be used. All threads shall be clean cut and shall conform to the latest AN Standard Bl.l for Unified Inch Screw Threads (UN and UNR Thread Form).

D. Bolts, anchor bolts, nuts and washers, specified to be galvanized, shall be zinc coated, after being threaded, by the hot-dip process in conformity with the latest ASTM Standard Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates; Bars, and Strip, Designation A123, or the latest ASTM Standard Specifications for Zinc Coating (Hot Dip) on Iron and Steel Hardware, Designation A153, as is appropriate.

E. The Contractor shall submit with the shop drawings anchor bolt location plans showing location and depth of embedment for all anchor bolts supplied.

1.07 SLEEVES AND OPENINGS

A. The Contractor shall provide all openings, channels, chases, etc., and furnish and install anchor bolts and other items to be embedded in concrete, as required to complete the Work under this Contract, and shall do all cutting and patching required.

1.08 SCHEDULE

A. The Contractor shall submit a planned schedule of operation as indicated in the Proposal and described in the General Requirements and shall make every effort to complete the Work in accordance with the timetable delineated in the schedule of operation subject also to the time limit stipulated in the Proposal.

1.09 CONSTRUCTION PHOTOGRAPHS

A. The Contractor shall have photographs of the undisturbed site taken prior to the start of construction. The same views shall be rephotographed upon completion of all construction activities.

B. Prior to construction of additions or modifications to existing structures, there shall be taken for each existing structure to be used for indicating the condition of existing structure. These photographs shall be in addition to those specified above.

1.10 GREASE, OIL, AND FUEL

A. All grease, oil, and fuel required for testing of equipment shall be furnished with the respective equipment. The Owner shall provide electric energy for testing. The Owner shall be furnished with a year's supply of required lubricants including grease and oil of the type recommended by the manufacturer with each item of equipment supplied under the respective divisions.

1.11 VALVE INDICES

A. The Contractor shall be responsible for field locating all new installed valves and tagging with 316 stainless steel tags. Each valve's tag shall be stamped with a number and words to identify the valve's function and normal operating position. The coding System shall be provided to the Owner for review at least fourteen (14 days) prior to start-up of the equipment. The size of the non-corrosive tag shall be 2 inches in diameter and 19 gage thick or approved equal. Each tag shall be securely attached to each valve by non-corrosive metal wire. All letters and/or numbers shall be enamel filled unless otherwise specified.

1.12 NAMEPLATES

A. With the exceptions mentioned below, each piece of equipment shall be provided with a substantial stainless steel nameplate, securely fastened in place and clearly and permanently inscribed with the manufacturer's name, year of manufacture, model or type designation, serial number, principal rated capacities, electrical or other power characteristics, and similar information as appropriate. The NAMEPLATES shall not be painted.

B. This requirement shall not apply to gate, globe, check, and plug valves.

1.13 EQUIPMENT DRIVE GUARDS

A. All equipment driven by open shafts, belts, chains, or gears shall be provided with acceptable all-metal guards enclosing the drive mechanism. Guards shall be constructed of galvanized sheet steel or galvanized woven wire or expanded metal set in a frame of galvanized steel members unless specified to be stainless steel. Guards shall be secured in position by steel braces or straps which will permit easy removal for servicing the equipment. The guards shall conform in all respects to all applicable safety codes and regulations.

1.14 EQUIPMENT INSTALLATION AND ALIGNMENT

A. Special care shall be taken to ensure proper alignment of all equipment with particular reference to the pumps and other electrical drive units. The units shall be carefully aligned on their foundations by qualified millwrights after their sole plates have been shimmed to true alignment at the anchor bolts. The anchor bolts shall be set in place and the nuts tightened against the shims.

B. All wedges, shims, filling pieces, keys, packing, red or white lead grout, test equipment and precision instruments, or other materials necessary to properly align, level, and secure apparatus in place shall be furnished by the CONTRACTOR and/or MANUFACTURE/SUPPLIER. All parts intended to be plumb or level must be proven exactly so. Any grinding necessary to bring parts to proper bearing after erection shall be done at the expense of the CONTRACTOR.

1.15 PROGRESS MEETINGS

A. The Engineer shall schedule and administer the progress meetings. The Engineer will record the meeting minutes and distribute copies of minutes within ten (10) days after each meeting. Regular meetings shall be scheduled at a time mutually agreed upon by the Contractor and the Engineer. The Engineer shall call special meetings as progress of work dictates.

B. The meetings will be attended by the Owner's representatives, the Contractor, and/or subcontractors as pertinent to agenda.

END OF SECTION

Section-01055

Construction Staking

SECTION 01055

CONSTRUCTION STAKING

1.01 SCOPE

The CONTRACTOR shall furnish all necessary personnel and equipment to provide all customary construction surveys including, but not limited to, the following:

a) Establish right-of-way and construction easement limits.

b) Establish the project construction centerlines

c) Provide adequate reference points to permit prompt re-establishment of the construction centerline throughout the construction.

d) Grade staking

e) Structure staking

f) Establish final "as-built" plan and profile location of all completed facilities and depict same on record drawings.

The CONTRACTOR'S staking (survey) party shall be under the general supervision of an SURVEYOR licensed in the State of Kentucky. IT SHALL BE UNDERSTOOD THAT SUPERVISION OF THE CONSTRUCTION STAKING PARTY IS SOLELY THE RESPONSIBILITY OF THE CONTRACTOR AND ANY ERRORS AND INACCURACIES RESULTING FROM THE OPERATIONS OF THE CONSTRUCTION STAKING PARTY SHALL BE CORRECTED AT NO COST TO THE OWNER.

END OF SECTION

Section-01056

Quality Control

SECTION 01056

QUALITY CONTROL

1.01 CODES, STANDARDS AND INDUSTRY SPECIFICATIONS

A) Material or operations specified by reference to published specifications of a manufacturer, testing agency, society, association or other published standards shall comply with requirements in latest revisions thereof and amendments or supplements thereto in effect on date of Advertisement for Bidders.

B) Discrepancies between referenced codes, standards, specifications and Contract Documents shall be governed by the latter unless written interpretation is obtained from ENGINEER.

1.02 MANUFACTURER'S DIRECTIONS

Utilize manufactured articles, materials and equipment as directed by manufacturers unless herein specified to contrary. Discrepancy between an installation required by Contract Documents and manufacturer's instructions and recommendations shall be resolved by ENGINEER before work may proceed. In all cases, the more stringent requirements shall govern.

1.03 TESTING

A) All testing (when required) will be in accordance with the pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.

B) The CONTRACTOR will bear the cost of all testing unless directed otherwise.

END OF SECTION

Section-01100

Control of Work

SECTION 01100

CONTROL OF WORK

PART 1: GENERAL

1.01 PIPE & CONDUIT LOCATIONS

A. Pipelines and conduits shall be located substantially as indicated on the Contract Drawings, but the Engineer reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings are noted on the Contract Drawings, such notation is for the Contractor's convenience and does not relieve him from laying and jointing different or additional items where required.

1.02 OPEN EXCAVATIONS

A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The length of open trench will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the Engineer. If the excavation becomes a hazard the Engineer may require special construction procedures such as limiting the length of open trench, prohibiting stacking excavated material in the roadway, and requiring that the trench shall not remain open overnight.

B. The Contractor shall take precautions to prevent injury to the public and to the Owner's personnel due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be well lighted at night.

1.03 TEST PITS

A. Test pits for the purpose of locating underground pipelines or structures in advance of the construction may be excavated and backfilled by the Contractor. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Engineer.

1. 04 MAINTENANCE OF TRAFFIC

A. All excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the Contractor's operations cause traffic hazards, he shall

repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety satisfactory to the Engineer.

B. Where detours are permitted the Contractor shall provide all necessary barricades and signs as required to divert the flow of traffic. While traffic is detoured the Contractor shall expedite construction operations. Periods when traffic is being detoured will be strictly controlled by the Engineer.

C. The Contractor shall take precautions to prevent injury to the public or Owner's personnel due to open trenches. The Contractor shall be fully responsible for damage or injuries.

1.05 CARE AND PROTECTION OF PROPERTY

A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the Work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar to that existing before the damage was done, or he shall make good the damage in other manner acceptable to the Engineer.

B. All roadways and walkways which are disturbed by the Contractor's operations shall be restored as directed by the Engineer.

C. Along the location of this Work all fences, walks, bushes, trees, shrubbery, and other physical features shall be protected and restored in a thoroughly workmanlike manner. Fences and other features removed by the Contractor shall be replaced in the location indicated by the Engineer as soon as conditions permit. All grass areas beyond the limits of construction which have been damaged by the Contractor shall be regraded and seeded or sodded as directed by the Engineer.

D. Trees close to the Work shall be boxed or otherwise protected against injury. The Contractor shall trim all branches that are liable to damage because of his operations, but in no case shall any tree be cut or removed without prior notification of the Engineer. All injuries to bark, trunk, limbs, and roots of trees shall be repaired by dressing, cutting, painting according to approved methods, using only approved tools and material.

E. The protection, removal, and replacement of existing physical features along the line of Work shall be a part of the Work under the Contract, and all costs in connection therewith shall be included in the unit and/or lump sum prices established under the items in the Proposal.

1.06 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. The Contractor shall assume full responsibility for the protection of all buildings, Structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the roadway, process piping, gas pipes, water pipes, hydrants, sewers, drains, and electric and telephone cables, whether or not they are shown on the Contract Drawings. The Contractor shall carefully Support and protect all such structures and utilities from injury of any kind. Any damage resulting from the Contractor's operations shall be repaired by him at his expense.

1.07 CLEANUP

A. During the course of the Work, the Contractor shall keep the site clean and neat. Upon demolition contractor shall leave the entire Site of the Work in a neat and orderly condition.

END OF SECTION

Section-01110

Control of Materials

SECTION 01110

CONTROL OF MATERIALS

PART 1: GENERAL

1.01 APPROVAL OF MATERIALS

A. Only new materials and equipment shall be incorporated in the work. All materials and equipment furnished by the Contractor shall be subject to the inspection and approval of the Engineer.

B. As soon as possible after the Contract has been executed, the Contractor shall submit to the Engineer, data relating to materials and equipment he proposes to furnish for the work. Such data shall be in sufficient detail to enable the Engineer to identify the particular product and to form an opinion as to its conformity to the Specifications.

C. The Contractor shall submit data and samples sufficiently early to permit consideration and approval before materials are necessary for incorporation in the Work.

1.02 HANDLING AND STORAGE OF MATERIALS

A. All mechanical equipment shall be stored in a building to prevent injury. The building may be a temporary structure on the Site or elsewhere, but it must be satisfactory to the Engineer.

B. All materials which, in the opinion of the Engineer, have become so damaged as to be unfit for the use intended or specified shall be promptly removed from the Site, and the Contractor shall receive no compensation for the damaged material or its removal.

C. All equipment requiring Special storage or handling such as protection from freezing, moisture and heat shall be clearly marked on the outside of the shipping container.

D. Storage and demurrage charges by transportation Companies and vendors shall be borne by the Contractor.

END OF SECTION

Section-01300

Submittals

SECTION 01300

SUBMITTALS

PART 1: GENERAL

1.01 SHOP DRAWINGS

A. The Contractor shall submit for the review of the Engineer Shop Drawings for all fabricated work and for all manufactured items required to be furnished in the Contract in accordance with the General provisions and as specified herein. Shop Drawings shall be submitted in sufficient time to allow at least fourteen (14) calendar days after receipt of the Shop Drawings from the Contractor for checking and processing by the Engineer.

B. Unless otherwise stated elsewhere in the Contract Drawings, a total of five (5) copies of all reviewed Shop Drawings shall be furnished to the Engineer for his use.

1.02 RECORD DRAWINGS

A. The Record Drawings shall consist of the Contract Drawings and the approved Shop Drawings in reproducible form and shall be submitted to the Engineer at any time upon request during construction. The reproducible form of the Record Drawings shall be submitted to the Engineer upon completion of the construction.

B. Contract Drawings shall be legibly marked to record actual construction including:

1. All deviations in location or elevation of any underground installation from that shown on the Contract Drawings.

2. Any significant changes in above ground installations from approved Shop Drawings or Contract Drawings.

C. Shop Drawings shall be legibly annotated to record changes made after review.

D. Reproducible Record Drawings shall be submitted in accordance with the General Conditions, Supplementary Conditions, and General Requirements.

1.03 OPERATION AND MAINTENANCE MANUALS

A. Specific instruction for the submittal of Operation and Maintenance Manuals is defined in the equipment technical specifications and Division

1 specifications, specifically including Section 01600 Special Provisions For Materials and Equipment.

END OF SECTION

Section-01310

Construction Scheduling

SECTION 01310

CONSTRUCTION SCHEDULING

PART 1: GENERAL

1.01 GENERAL

A. Construction under this contract must be coordinated to assure construction completion within the time allowed by the Contract Documents. The Contractor will also coordinate his activities with the Owner's operations and maintenance staff to enable proper access to all functioning areas of the plant, including providing for temporary access if required. The Contractor must submit to the Engineer a description and schedule as to how the common areas will be utilized, recognizing the required coordination with the Owner.

1.02 CONSTRUCTION SCHEDULING GENERAL PROVISIONS

A. Promptly after award of the Contract and within 10 calendar days after the effective date of the Agreement, prepare and submit to the Engineer estimated construction progress schedules for the work.

B. No partial payments shall be approved by the Engineer until there is an acceptable construction progress schedule submittal on hand.

C. The Contractor shall designate an authorized representative of his firm who shall be responsible for development and maintenance of the schedule and of progress and payment reports. This representative of the Contractor shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the commitments of the Contractor's schedule.

1.03 PROGRESS OF THE WORK

A. The work shall be executed with such progress as may be required to prevent any delay 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, materials and equipment to assure completion of the work in the time established by the Contract.

PART 2: PROGRESS SCHEDULE SUBMITTALS

2.01 CONSTRUCTION PERIOD

A. The Contractor's attention is directed to the form of Agreement which specifies for Contract times for the Work.

B. Whenever it becomes apparent from the current monthly progress evaluation and

updated schedule data that any milestone and/or Contract completion date will not be met, the Contractor shall take some or all of the following actions:

1. Increase construction manpower in such quantities and crafts as shall subsequential eliminate the backlog of work;
2. Increase the number of working hours per shift, shifts per work day, work days per week, or the amount of construction equipment, or any combination of the foregoing sufficient to substantially eliminate the backlog of work; and
3. Reschedule work items to achieve concurrence of accomplishment.

C. The addition of equipment or construction forces, increasing the working hours or any other method, manner, or procedure to return to the current Detailed Schedule shall be at the Contractor's own cost and shall not be considered justification for a Change Order or treated as an acceleration order.

END OF SECTION

Section-01600

Special Provisions for

Materials and Equipment

SECTION 01600

SPECIAL PROVISIONS FOR MATERIALS AND EQUIPMENT

1.01 SERVICES OF MANUFACTURERS' REPRESENTATIVE AND OPERATING MANUALS

A. Bid prices for equipment furnished under other sections of these specifications shall include the cost of written operation and maintenance instructions and the cost of a competent representative of the manufacturers of all equipment to supervise the installation, adjustment, and testing of the equipment and to instruct the OWNER'S operating personnel and the ENGINEER'S representative on operation and maintenance.

B. Unless otherwise specified with the equipment, equipment manufacturers shall provide a training session for the OWNER'S staff. No training will be scheduled until the equipment has been installed, satisfactorily tested, and is ready for operation.

C. The manufacturer's representative shall have complete knowledge of the proper installation, lubrication, operation and maintenance of the equipment provided and shall be capable of instructing the representatives of the OWNER and ENGINEER on proper start-up, shut-down, on-line operations, lubrication and preventive maintenance of the equipment.

D. For equipment furnished under other Divisions, the CONTRACTOR, unless otherwise specified, shall furnish the services of accredited representatives of the manufacturer only when some evident malfunction or over-heating makes such services necessary.

E. Four complete sets of operation and maintenance instructions covering all equipment furnished under Divisions 11, 13, 15 and 16, shall be delivered directly to the ENGINEER.

1. The manual for each piece of equipment shall be a separate document with the following specific requirements:

a. Contents:

Table of contents and index

Brief description of each system and components

Starting and stopping procedures

Special operating instructions

Routine maintenance procedures

Manufacturer's printed operating and maintenance instructions, parts list, illustrations, and diagrams. These shall be specific to the material supplied under the Contract, and not a manufacturer general brochure.

One copy of each wiring diagram

One final accepted copy of each shop drawing and each CONTRACTOR'S coordination and layout drawing

List of spare parts, manufacturer's price, and recommended quantity

Manufacturer's name, address, and telephone number

Name, address, and telephone number of manufacturer's local representative

1.02 INSTALLATION OF EQUIPMENT

A. Special care shall be taken to ensure proper alignment of all equipment with particular reference to the pumps, blowers and electric drives. The units shall be carefully aligned on their foundations by qualified millwrights after their sole plates have been shimmed to true alignment at the anchor bolts. The CONTRACTOR shall be responsible for the exact alignment of equipment with associated piping, and under no circumstances, will "pipe springing" be allowed.

B. All wedges, shims, filling pieces, keys, packing, red or white lead grout, or other materials necessary to properly align, level, and secure apparatus in place shall be furnished by the CONTRACTOR. All parts intended to be plumb or level must be proven exactly so. Any grinding necessary to bring parts to proper bearing after erection shall be done at the expense of the CONTRACTOR.

1.03 GREASE, OIL AND FUEL

A. All grease, oil, and fuel required for testing of equipment shall be furnished with the respective equipment. The OWNER shall be furnished with a one year's supply of required lubricants including grease and oil of the type recommended

by the manufacturer with each item of equipment supplied under other sections of these specifications.

B. All lubricants and fuels shall be properly labeled, using an indelible marker and writing on the lubricant container or drum, specifying the type and brand name of the lubricant supplied. A Master Lubrication list must be submitted to the ENGINEER for approval clearly stating which lubricants are to be used in the various pieces of plant equipment and the quantity supplied for one years' use by each unit.

1.04 TOOLS AND SPARE PARTS

A. Any special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation, and maintenance of any equipment shall be furnished with the respective equipment.

B. All spare parts shall be properly protected for long periods of storage (contained in plastic bags or cardboard containers) and labeled for easy identification without opening.

1.05 MAINTENANCE AND LUBRICATION SCHEDULES

A. The CONTRACTOR'S attention is directed to the General Conditions and Section 01300 for all requirements relative to the submission of shop drawings for the mechanical equipment. For all mechanical and electrical equipment furnished, the CONTRACTOR shall provide a list including the equipment name, and address and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained. In addition, a maintenance and lubrication schedule for each piece of equipment shall be submitted along with shop drawings. Submission shall be in 4 copies.

1.06 STORAGE AND HANDLING OF EQUIPMENT

A. Special attention shall be given to the storage and handling of equipment. As a minimum, the procedure outlined below shall be followed:

1. Equipment shall not be shipped until all pertinent shop drawings are reviewed by the ENGINEER.

2. All equipment having moving parts such as gears, electric motors, etc., and/or instruments shall be properly stored until such time as the equipment is to be installed.

3. All equipment shall be stored fully lubricated with oil, grease, etc. unless otherwise instructed by the manufacturer.

4. Manufacturer's storage instructions shall be carefully studied by the CONTRACTOR and reviewed with the ENGINEER. These instructions shall be followed and a written record of this kept by the CONTRACTOR.

5. Moving parts shall be rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal "welding." Upon installation of the equipment, the CONTRACTOR shall start the equipment, at least half load, once weekly for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.

6. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants shall be put into the equipment at the time of acceptance.

7. Prior to acceptance of the equipment, the CONTRACTOR shall have the manufacturer inspect the equipment and certify in writing that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guarantee the equipment equally in both instances. If such a written certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the CONTRACTOR'S expense.

B. The OWNER reserves the right to withhold payment for any materials improperly stored and maintained.

1.07 PARTIAL UTILIZATION

A. During the course of construction partial occupation and utilization of completed portions of the work may be required.

B. When deemed necessary, the OWNER or the CONTRACTOR may request use of completed work.

1.08 EQUIPMENT WARRANTY

A. The CONTRACTOR shall provide the OWNER a minimum 1 year warranty on all equipment, or a warranty of the length as is specified in the specific

equipment section of the Specifications, in accordance with the General Conditions. The warranty period for each item of equipment shall be a minimum of 1 year, or as specified otherwise, from the date of the OWNER'S acceptance of the equipment item.

1.09 ADJUSTMENTS AND CORRECTIONS OF EQUIPMENT AND APPURTENANCES DURING OPERATION

A. Some items of functional nature included in this Contract cannot be tested as to performance and quality at the time of completion of their installation. They must wait for necessary testing and proper performance until such functions are possible during later portions of this Contract. Such testing, specified performance and proper instructions to the OWNER's operators (as to their maintenance and operation) is deemed a portion of this Contract, and payment shall be retained by the OWNER for equipment delivered to the site and for Work completed to cover such service. Such service replacements and performance shall take precedence over expiration of the one year guarantee period.

B. The CONTRACTOR shall expedite the completion of such service by all Suppliers and Subcontractors and shall render competent supervision of such service. The CONTRACTOR shall also expedite the replacement of defective and unaccepted parts and equipment. Unnecessary delay in delivery and installation of corrective parts and equipment may constitute damage to the OWNER for which the CONTRACTOR can be held liable.

1.10 INSTALLING NEW EQUIPMENT IN EXISTING STRUCTURES

A. Where new equipment is planned and/or specified as being installed in existing structures, the CONTRACTOR shall verify all dimensions and locations of existing facilities prior to ordering the new equipment. Existing anchor bolts shall be used when possible, and new equipment shall be fabricated to conform to the existing dimensions, shapes, and locations as required.

END OF SECTION

Section-01700

Contract Closeout

SECTION 01700

CONTRACT CLOSEOUT

PART 1: GENERAL

1.01 SCOPE OF WORK

A. This Section outlines the procedure to be followed in closing out the Contract.

1.02 SUBSTANTIAL COMPLETION

A. The substantial completion date shall be established as stated in the AGREEMENT.

1.03 FINAL CLEANING

A. At the completion of work and immediately prior to final inspection, cleaning of the entire project shall be accomplished according to the following provisions:

1. The Contractor shall thoroughly clean, sweep, wash, and polish all work and equipment provided under the Contract, including finishes. The cleaning shall leave the structures and site in a complete and finished condition to the satisfaction of the Engineer.

2. All Subcontractors shall similarly perform, at the same time, an equivalent thorough cleaning of all work and equipment provided under their contracts.

3. The Contractor shall remove all temporary structures and all debris, including all dirt, sand, gravel, rubbish and waste material. All disposal must be off the Owner's property.

4. Should the Contractor not remove rubbish or debris or not clean the buildings and site as specified above, the Owner reserves the right to have the cleaning done at the expense of the Contractor.

B. Employ experienced workers for final cleaning.

C. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

D. Use cleaning materials only on surfaces recommended by cleaning material

manufacturers.

E. In preparation for Substantial Completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.

F. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces.

1.04 FINAL INSPECTION

A. After final cleaning and restoration and upon written notice from the Contractor that the work is completed, the Engineer will make a preliminary inspection with the Owner and Contractor present. Upon completion of this preliminary inspection, the Engineer will notify the Contractor, in writing, of any particulars in which this inspection reveals that the work is defective or incomplete.

B. Upon receiving written notice from the Engineer, the Contractor shall immediately undertake the work required to remedy deficiencies and complete the work to the satisfaction of the Engineer.

C. When the Contractor has corrected or completed the items as listed in the Engineer's written notice, he shall inform the Engineer, in writing, that the required work has been completed. Upon receipt of this notice, the Engineer, in the presence of the Owner and Contractor, will make his final inspection of the project.

D. Should the Engineer find all work satisfactory at the time of his inspection, the Contractor will be allowed to make application for final payment in accordance with the provisions of the GENERAL CONDITIONS. Should the Engineer still find deficiencies in the work, the Engineer will inform the Contractor of the deficiencies and will deny the Contractor's request for final payment until such time as the Contractor has satisfactorily completed the required work.

1.05 FINAL SUBMITTAL

A. No application for final payment will be accepted until all submittals have been made and approved by the Engineer, including, but not limited to, the following:

1. Final shop drawings.

2. All information required to prepare record drawings.

3. All Operation and Maintenance Manuals (as required).

4. All required indices and schedules.

5. All Manufacturers' Certificates of Proper Installation.

6. All construction photographs, including those of the completed project.

1.06 ACCESSORY ITEMS

A. The Contractor shall provide to the Owner, upon acceptance of the equipment, all special accessories required to place each item of equipment in full operation. These special accessory items include, but are not limited to, the specified spare parts, adequate oil and grease as required for the first lubrication of the equipment, and other expendable items as required for initial startup and operation of all equipment.

1.07 GUARANTEES, BONDS, AND AFFIDAVITS

A. No application for final payment will be accepted until all guarantees, bonds, certificates, licenses, and affidavits required for work or equipment as specified are satisfactorily filed with the Engineer.

1.08 RELEASE OF LIENS OR CLAIMS

A. No application for final payment will be accepted until satisfactory evidence of release of liens has been submitted to the Owner as required by the GENERAL CONDITIONS.

1.09 FINAL PAYMENT

A. Final payment will be made to the Contractor in accordance with the GENERAL CONDITIONS.

END OF SECTION

Section-02100

Site Preparation

SECTION 02100

SITE PREPARATION

PART 1: GENERAL

1.01. CONTRACTOR shall verify existing grades prior to beginning site preparation. If existing grades are at variance with the Drawings, notify the OWNER's Site Representative and receive instructions prior to proceeding. No additional compensation resulting from grade variances will be considered once site clearing has commenced.

1.02. All bench marks and monuments shall be protected during construction. If disturbed or destroyed, replace in original position.

1.03 Construction stakeout shall be by a licensed surveying firm provided by the CONTRACTOR. Exact locations and grade points are to be staked or fixed by the surveying firm.

1.04 Protect areas outside limits of construction from encroachment by outside construction personnel or equipment, regardless of property ownership. Access shall be by specific, written permission or easement only.

1.05 Existing utilities are indicated on the Drawings at approximate locations and reflect general ground surface observation. CONTRACTOR shall notify utility companies and coordinate exact location of all utilities prior to beginning site preparation.

1.06 Remove from the OWNER's property and legally dispose of all waste material in accordance to all federal, state, and local laws.

-- END OF SECTION --

Section-02110

Site Clearing

SECTION 02110

SITE CLEARING

PART 1: GENERAL

1.01 SITE CLEARING

A. All trees and shrubs not designated "to remain" within the property limits, whether shown or not on the Drawings, shall be cut and the stumps shall be completely dug out. Materials of clearing shall be disposed off site. There shall be no on site burning.

B. All vegetation shown "to remain" shall be barricaded and protected during the construction process.

C. Strip topsoil to full depth encountered in areas indicated to be graded. Stockpile topsoil for redistribution during final grading.

-- END OF SECTION --

Section-02201

Unclassified Excavation

And Grading

SECTION 02201

UNCLASSIFIED EXCAVATION AND GRADING

PART 1: GENERAL

1.1 SCOPE OF WORK

1.1.1 Perform all work required to bring site to grade as indicated on Drawings.

PART 2: PRODUCTS

2.1 DEFINITIONS

2.1.1 Rough Grading - Performance of the earthwork phase to accomplish site grading to within plus or minus .1 of a foot those elevations as shown on the Drawings, along with achieving required compaction.

2.1.2 Fine Grading - Finish grading of subgrade to levels noted on the Drawings which shall present a neat finished appearance upon completion, with no places where water pools.

2.1.3 Unclassified Excavation - All site excavation shall be unclassified regardless of nature of materials encountered.

2.1.4 Satisfactory Fill Material - Clean subsoil or fine fragments of sandstone, siltstone, or shale. Material shall be free of debris, roots, topsoil, lumps and rocks with any dimension larger than 6 inches.

2.1.5 Select Fill Material - Clean subsoil free of debris, roots, topsoil, lumps and rocks with any dimension larger than 6 inches.

2.1.6 Unsuitable Soil Materials - Soil material not capable of being compacted to required density, as determined by a Geotchnical Engineer, oversize rock material, and organic matter.

2.1.7 Rock

1) General Excavation - Any material which cannot be excavated with a single-toothed ripper drawn by a crawler tractor having a minimum draw bar pull rated at not less than 56,000 lbs. (D-8 or equivalent), and occupying an original volume of at least one cubic yard or more.

2) Trench Excavation - Any material which cannot be excavated with a backhoe having a break out force rated at not less than 26,000 lbs. (JD 93 series backhoe or equivalent), and occupying an original volume of at least one-half (1/2) cubic yard.

2.2 UNCLASSIFIED EXCAVATION

2.2.1 Unclassified Excavation - All site excavation shall be unclassified, regardless of the nature of the materials encountered. All excavation materials which are not required or suitable for fills shall be considered as waste and shall be disposed of at the direction from the Engineer.

2.2.2 All site excavation of previously stockpiled or buried construction, clearing or demolition debris or any other refuse shall be properly disposed of off-site at the CONTRACTOR's expense.

2.2.3 The CONTRACTOR shall provide all sheeting, shoring, underpinning and bracing required to hold the sides of the excavation and for the protection of all adjacent structures. The CONTRACTOR shall be held responsible for any damages to any part of the work by failure of excavated sides or bottoms.

PART 3: FILL CONSTRUCTION

3.1 PREPARATION OF SURFACES TO RECEIVE FILL

3.1.1 Stripping - A ll topsoil, vegetation, debris and surface fill material shall be stripped from the project surface prior to beginning any new construction. Stripping operations should not be performed too far in advance of placing embankment, resulting in exposure of large areas of subsoil to softening and erosion effects of rainfall. Stripped materials shall be stockpiled in designated areas as directed by OWNER's Site Representative

3.1.2 Undercutting – Soft, yielding areas shall be undercut and stabilized with No. 2 stone.

3.1.3 Proofrolling - Stripped and undercut areas shall be proofrolled with a loaded 20 ton dump truck or similar weight construction equipment following stripping operation. Areas that pump or rut excessively shall be undercut to stable ground as directed by OWNER's Site Representative.

3.2. PROOFROLLING

3.2.1 Proofrolling shall be under the observation of a Geotechnical Engineer.

3.2.2 Immediately following stripping, areas to receive fill shall be proofrolled as indicated in 3.1.3.

3.2.3 Immediately following the completion of excavation to proposed subgrades in cut areas, proofrolling shall be performed as specified.

3.2.4 Immediately prior to stone base course placement in pavement areas and following final floor slab preparation, all subgrade areas will be proofrolled. Any areas which deflect, rut or pump under the roller shall be undercut and replaced with compacted fill material as specified herein.

3.3 FILL PLACEMENT

3.3.1 Place fill material in horizontal uniform layers not exceeding 8 inches.

3.3.2 Moisture content of the compacted fill material shall be maintained within two percent of optimum content.

3.3.3 Fill material shall not be placed on surfaces that are muddy or frozen.

3.4 COMPACTION

3.4.1 Provide 98 percent compaction of soil's maximum dry density.

3.4.2 Perform compaction of soil materials for fills using mechanical soil compaction equipment appropriate for type and size materials to be compacted. Hand compact materials in areas inaccessible to machinery and within 5'-0" of below grade walls.

3.4.3 Moisture Control - Where subgrade or soil layer must be moisture conditioned before compaction, apply water to surface of subgrade or soil layer. Scarify and air dry material that is too wet to permit compaction to specified density.

3.4.4 Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread where directed by OWNER's Site Representative and permitted to dry. Assist drying by disking, harrowing or pulverizing, until moisture content is reduced to satisfactory value, as determined by moisture-density relation tests. When accepted by a Geotechnical Engineer, soil material may be used in compacted backfill or fill.

PART 4: FILL PLACEMENT INSPECTION

4.1 INSPECTION

4.1.1 All excavated and fill material shall be removed, selected, placed and compacted under supervision of a Geotechnical Engineer or his representative as selected and paid for by the contractor. The Geotechnical Engineer shall have the authority to approve or disapprove the condition of the subgrade on which fill is to be placed, filled material, placement methods, compaction methods, and shall make compaction density tests as necessary to determine that the specified density is obtained. A Geotechnical Engineer shall be notified before any cut is made or fill is placed, to insure a representative is present during all grading operations. The CONTRACTOR shall remove, replace and recompact all fills failing to meet the density requirements at the CONTRACTOR's expense.

4.2 FIELD TESTING

4.2.1 At a minimum, two field density tests shall be performed for each 8" lift of fill material placed at the frequency of 10,000 sf..

4.2.2 Prior to OWNER's final acceptance, a Geotechnical Engineer shall provide certification specifying the project meets compaction criteria.

PART 5: FINE GRADING

5.1 CRITERIA

5.1.1 Grade areas to lines and elevations indicated including adjacent transition area. Smooth finished surface within specified tolerances, compact and bring to uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

5.1.2 Finish surfaces shall be free from irregular surface changes, and as follows:

1) Surfaces Under Walks and Pavements: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10' above or below required subgrade elevation.

2) Surface Under Building Slabs and Foundations: Grade level, free of voids, compacted as specified, and within 0.1" of required elevation.

3) Grassed Areas: Shape areas to receive topsoil to within 0.10' above or below required subgrade elevation.

5.1.3 Grade areas adjacent to building lines to drain away from building and to prevent ponding. Finish grades shall be within 0.1" of indicated elevations.

5.1.4 Where compacted areas are disturbed by construction operations, scarify

surface, reshape and recompact to required density.

5.1.5 Redistribute stockpiled topsoil to uniform depth over graded areas shown to be landscaped or seeded.

5.1.6 At completion of finish grading operations, site shall be ready for landscaping.

5.1.7 Where finish grading meets or abuts curbs, walks or pavements, uphill grades shall be slightly higher than pavements to permit drainage.

5.1.8 Protection of Graded Areas: Protect newly graded surfaces from traffic and erosion. Keep free of debris. Where graded or compacted surfaces are damaged by subsequent operations, return to indicated grade and state of compaction.

END OF SECTION

Section-02220

Structure Excavation

And Backfilling

SECTION 02220

STRUCTURE EXCAVATION AND BACKFILLING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals necessary to perform all excavation, backfill, fill, and grading required to complete the work shown on the Drawings and specified herein. The work shall include, but not necessarily be limited to, excavation for structures, all backfilling and fill, disposal of waste and surplus materials, and all related work such as pumping.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Trench excavation, backfilling, and compacting are included in Section 02221.

1.03 PROTECTION

A. Lateral Support of Excavation for Structures

1. Sheeting and bracing, if required, shall be as specified in Section 02221.

B. Control of Groundwater Level

1. The Contractor shall furnish, install, maintain, operate and remove a temporary dewatering system as required to lower and control the groundwater level so that the structures may be constructed in the dry. The Contractor shall, at his own expense, correct all damage resulting from inadequacy of the dewatering System or from flooding of the construction Site from other causes.

2 The dewatering system shall be adequate to drain any excavated area, to maintain the water at such a level as to permit construction in the dry, and to maintain the lowered watertable until the Structure has been completed to the required stages and has attained the design strength to support both the backfill material and hydrostatic forces from groundwater.

3. The Contractor shall maintain the water level below the specified elevations for the various phases of the work continuously and shall make such provisions as may be necessary to avoid interruptions due to weather, labor strikes, power failures, or other delays. He shall provide and have ready for immediate use at all times diesel or gasoline powered standby pumping units to serve the system in case of failure of the normal pumping units.

4. Drainage water shall be disposed of in a manner acceptable to the Engineer so that flow or seepage back into the excavated area will be prevented.

5. Piping and boiling, or any form of uncontrolled seepage, in the bottom or sides of the excavation, shall be prevented at all times. If for any reason the dewatering system is found to be inadequate to meet the requirements set forth herein, the Contractor shall, at his own expense, make such additions, changes and/or replacements as necessary to provide a satisfactory dewatering system.

6. The depth of dewatering shall be limited in sand/gravel soil or in soil of high permeability to one (1) foot below the foundation subgrade of the proposed structure.

7. Groundwater control shall be provided in expansive clay soils to maintain the natural state (wet or dry) of the clay below foundation slabs. For structures founded in clay below the groundwater table, the Contractor shall dewater a maximum of 6 inches below subgrade. For structures founded in clay above natural groundwater level, the Contractor shall maintain the dry state of the clay throughout construction period.

8. Removal of dewatering system shall be accomplished after the dewatering System is no longer required. The material and equipment constituting the system, shall be removed by the Contractor.

PART 2: PRODUCTS

2.01 MATERIALS

A. Compacted granular fill, which will provide support for building or structure foundations, will be referred to as structural fill. Backfill, which is placed against the exterior side of the building walls, will be referred to as common fill.

B. Structural fill shall be #57 crushed stone where shown on the plans, or unfrozen, sandy gravel or gravelly sand free of organic material, loam, trash, snow, ice, or other objectionable material with a plasticity index between three and fifteen and shall be well graded within the following limits:

Sieve No. or Size	Percent Finer by Weight
3 inches	100
1-1/2 inches	80 to 100
# 4	50 to 100
# 16	40 to 90
# 50	10 to 60

#200	0 to 10

C. Crushed rock shall be as specified in ASTM C-33 for "coarse aggregate" and shall consist of crushed stone or gravel having hard, strong durable pieces free from adherent coatings, well graded and conforming to the following requirements:

Sieve No. or Size	Total Percent Passing by Weight
4"	100%
3"	90-100%
2-1/2"	25-60%
1-1/2'	0-15%
3/4"	0-5%

D. Screened pea gravel shall consist of hard, durable particles of proper size and gradation, and it shall be free from sand, loam, clay, excess fine, and deleterious material. The size of the particle shall be uniformly graded gravel in the following sizes:

Sieve No. or Size	Total Percent Passing by Weight
½"	100%
3/8"	85-100%
No. 4	10-30%
No. 8	0-10%
No. 16	0-5%

E. Common Fill shall be crushed #57 stone or consist of native soil free from organic materials, loam, wood, trash, and other objectionable materials which may be compressible or which cannot be properly compacted. Common fill shall not contain stones larger than four (4) inches in largest diameter, granite blocks, broken concrete, masonry rubble, or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling. Snow, ice, or soil shall not be permitted.

F. Lean Concrete fill used for a working mat or seal slab shall be cast-in-place concrete meeting requirements of Section 03300, CAST-IN-PLACE CONCRETE, with the concrete compressive strength equal to a minimum of 4,000 psi.

G. Structural and common fills indicated to be #57 stone shall be coarse aggregate as specified in the Kentucky Department of Highways Standard Specifications for

Road and Bridge Construction.

PART 3: EXECUTION

3.01 EXCAVATION BELOW GRADE

A. If the bottom of any excavation is taken below the limits shown on the Drawings, specified or directed by the Engineer, it shall be refilled at the Contractor's expense with concrete, 8-inch layers of compacted structural fill or other material satisfactory to the Engineer. The type of material to be used shall be at the Engineer's option.

B. If the Contractor does not maintain groundwater levels properly, or fails to postpone final excavation immediately above the subgrade until Shortly before placing of the new work thereon, or otherwise fails or neglects to conduct the excavation work properly so that the surface of the subgrade is in proper condition when he is ready for construction, the Contractor shall remove the unsuitable material and replace it with concrete, compacted structural fill, or other acceptable material at his own expense. The condition of the replaced subgrade shall be acceptable to the Engineer before any work is placed thereon.

C. Once excavation is complete, the base of the excavation shall be tested to determine its maximum dry density in accordance with ASTM Designation D-1557. The test results shall be submitted to the Engineer. If, in the opinion of the Engineer, the material, in its undisturbed natural condition at or below the normal grade of the excavation, as indicated on the Drawings, is unsuitable for foundations, it shall be removed to such depth and width as he may direct and replaced with suitable material as directed by the Engineer. Over excavation required as stated in this paragraph will be paid in accordance with the General Conditions of this Specification.

3.02 STRUCTURE EXCAVATION AND COMPACTION PROCEDURES:

A. Excavation shall be made to such widths as will give suitable room for construction of the structures including bracing, supporting, pumping, and draining. The bottom of the excavations shall be rendered firm and dry and in all respects acceptable to the Engineer.

B. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. Subgrade soils which become soft, loose, "quick,' or otherwise unsatisfactory for support of structures as a result of inadequate excavation, dewatering, or other construction methods shall be removed and replaced with structural fill as required by the Engineer at the

Contractor's expense.

C. Dewatering shall be such as to prevent boiling or detrimental underseepage at the base of the excavation as specified above.

D. Excavation equipment shall be satisfactory for carrying out the work in accordance with the Specifications. In no case shall the earth be plowed,scraped, or dug with machinery so near to the finished subgrade as to result in excavation of, or disturbance of material below finished subgrade. The last of the excavated material shall be removed with pick and shovel just before placement of concrete floor slab or working mat.

E. During final excavation to subgrade level, take whatever precautions are required to prevent disturbance and remolding. Material which has become softened and mixed with water, shall be removed. Hand excavation of the final 3" to 6" will be required to obtain a satisfactory undisturbed bottom

F. Place structural fill in layers having a maximum thickness of 8" measured before compaction. Each layer of structural fill shall be compacted to a minimum of 98 percent of maximum dry density as determined by ASTM Compaction Test.

H. Structural fill shall not be placed on a frozen surface or one covered by snow or ice, nor shall snow, ice, or frozen earth be incorporated in the compacted fill.

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3.03 EXCAVATION AND BACKFILLING FOR FOOTINGS

A. Excavation for all pipe lines beneath structures and excavation for all footings shall be carried out with the excavating equipment operating from the subgrade for the structure. The excavation shall be carried cut 'in-the-dry' and in a manner which will preserve the undisturbed state of the subgrade Soils. The excavations may be completed with shoring and bracing of open cuts as required.

B. Where it is impractical to use large equipment for compaction or -when such methods, in the opinion of the Engineer, are disturbing the surrounding natural subgrade, the fill shall be placed using hand-operated mechanical compactors. The lift thickness shall not exceed six (6) inches measured before compaction when hand-operated equipment is used.

3.04 BACKFILLING - COMMON FILL:

A. Common fill may be used as backfill against the exterior walls of the structures or in other areas as designated by the Engineer. Material conforming to the requirements of common fill shall be placed in layers having a maximum thickness of eight (8) inches

measured before compaction.

B. Common fill shall be compacted to a minimum of ninety-five (98) percent of standard proctor density with ±2 percent of optimum moisture content as determined by ASTM Compaction tests, taking care to avoid over-compaction. Backfill behind walls shall be compacted by hand-operated tampers or light compaction equipment. Heavy roller compaction equipment shall not be allowed closer than six (6) feet from the wall of any structure.

C. Materials placed in fill areas shall be deposited to the lines and grades shown on the Drawings making due allowance for settlement of the material and for the placement of loam.

D. The surfaces of filled areas shall be graded to smooth true lines strictly conforming to grades indicated on the grading plan. No soft spots or uncompacted areas will be allowed in the work.

E. No compacting shall be done when the material is too wet either from rain or from excess application of water. At such times, work shall be suspended until the previously placed and new materials have dried sufficiently to permit proper Compaction.

Section-02221

Trenching, Backfilling

And Compacting

SECTION 02221

TRENCHING, BACKFILLING, AND COMPACTING

PART 1: GENERAL

1.01 SCOPE OF WORK

A Furnish all labor, materials, equipment, and incidentals necessary to perform all excavation, backfill, fill, and grading required to complete the work shown on the Drawings and specified herein. The work shall include, but not necessarily be limited to, excavation for pipelines below structures and footings, yard piping, vaults, ducts, pipes; all backfilling and fill of these excavations; disposal of waste and surplus materials; and, all related work such as sheeting, bracing, and dewatering.

1.02 RELATED WORK

A. Structure excavation and backfilling is included in Section 02220.

1.03 PROTECTION

A. Sheeting and Bracing in Trenches

1. Furnish, put in place, and maintain such sheeting and bracing as may be required to Support the sides of excavations to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect workmen and adjacent property and structures from undermining or other damage. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed they shall be immediately filled with sand or other suitable material and rammed.

B. Control of Groundwater Level

1. The Contractor shall maintain the groundwater level at, or below, the subgrade level so that all bedding material and pipe can be placed on a dry, firm subgrade.

2. Flotation shall be prevented by the Contractor by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of this system.

3. Drainage water shall be disposed of in a manner approved by the Engineer so that flow or seepage back into the excavated area will be prevented.

4. Removal of dewatering system shall be accomplished after the dewatering System is not longer required: The material and equipment constituting the System, including observation wells, shall be removed by the Contractor.

PART 2: PRODUCTS

2.01 MATERIALS

A. Crushed Stone

1. Pipe bedding material shall be crushed stone chips made from crushing sound limestone. The material shall be hard, tough and durable.

2. Crushed stone bedding for piping 18-in diameter or less shall conform to the grading requirements of ASTM C-33, Size No. 8.

B. Backfill, which is placed as fill over pipelines, will be referred to as common fill. Common fill shall consist of mineral soil free from organic materials, loam, wood, trash, and other objectionable materials which may be compressible or which cannot be properly compacted. Common fill shall not contain stones larger than two (2) inches in largest diameter, granite blocks, broken concrete, masonry rubble, or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling. Snow, ice, and frozen soil shall not be permitted.

PART 3: EXECUTION

3.01 EXCAVATING AND BACKFILLING PIPE TRENCHES UNDER STRUCTURES

A. Excavation for all pipe lines beneath structures shall be carried out with the excavating equipment operating from the subgrade for the structure. The excavation shall be carried out 'in-the-dry' and in a manner which will preserve the undisturbed state of the subgrade soils. The excavations may be completed with shoring and bracing of open cuts.

B. All pipelines beneath structures, not encased in concrete, shall be bedded in crushed stone and backfilled with common fill compacted as specified below. Where it is impractical to use large equipment for compaction or when such

methods, in the opinion of the Engineer, are disturbing the surrounding natural subgrade, the fill shall be compacted using hand-operated mechanical compactors. The lift thickness shall not exceed six (6) inches measured before compaction when hand-operated 02221-3 equipment is used. Backfill shall be compacted to 98% Standard Proctor Density at optimum moisture content.

3.02 TRENCH EXCAVATION AND BACKFILLING FOR YARD PIPING

A. Excavation for all trenches required for the installation of pipes and ducts shall be made to the depths indicated on the Drawings and in such a manner and to such widths as will give suitable room for laying the pipe or installing the ducts within the trenches, for bracing and supporting, and for pumping and drainage facilities; and shall render the bottom of the excavation firm and dry and in all respects acceptable to the Engineer.

B. Rock shall be removed to a minimum clearance of six inches around the bottom and sides of all the pipe being laid.

C. Where pipe or ducts are to be laid in bedding or encased in concrete, the trench may be excavated by machinery to, or just below the designated subgrade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

D. Where pipes or ducts are to be laid directly on the trench bottom, the lower part of the trenches shall not be excavated to grade by machinery, the last of the material being excavated manually in such a manner that will give a rounded, smooth bottom true to grade so that pipe or duct can be evenly supported on undisturbed material. Bell holes shall be made as required.

E. Backfilling over ducts shall begin not less than three days after placing concrete encasement.

F. Where pipe is to be installed in fill of any type, fill shall be placed and compacted to the total depth required (rough grade elevation) and then re-excavated for pipe installation.

G. As soon as practicable after the pipe has been laid and jointed, backfilling shall begin and thereafter be prosecuted expeditiously. As the material is placed, it shall be compacted by suitable tools.

H. After the bedding has been placed common fill shall be placed to a minimum depth of 2 ft. over the top of the bedding material. Common fill shall be thoroughly compacted by hand-tamping lifts not deeper than 6 inches to 90% of standard proctor density optimum moisture content.

I. The method and degree of compacting backfill will be governed by the type of material and the extent to which any subsequent settlement can be permitted.

END OF SECTION

Section-02230

Erosion Control

SECTION 02230

EROSION CONTROL

PART 1: GENERAL

1.1 EROSION CONTROL

1.1.1 The Project and the CONTRACTOR shall comply with all applicable state and local erosion and sedimentation control laws and ordinances.

1.1.2 The CONTRACTOR is responsible for maintaining all sediment and erosion control measures on the project site during construction. The CONTRACTOR is responsible for any damage caused due to failure to implement these requirements. The CONTRACTOR shall implement and maintain a BMP Plan (if required).

PART 2: REQUIREMENTS

1.2 REQUIREMENTS

1.2.1 The CONTRACTOR shall incorporate the following principles in his work:

1) The disturbed area and the duration of exposure to erosion elements should be minimized.

2) Stabilize disturbed areas immediately.

3) Detain run-off.

4) Retain sediment.

5) Do not encroach upon water courses.

1.2.2 All disturbed areas not receiving pavement shall be grassed by sodding or seeding, fertilizing, mulching and watering to obtain a ground cover which will prevent soil erosion.

1.2.3 A temporary construction egress pad shall be installed and maintained at any point where construction vehicles enter a public right-of-way, street or parking area. The pad shall be used to eliminate mud from the construction area onto public rights-of-way. Any mud or debris tracked on streets shall be cleaned up immediately.

1.2.4 All measures installed for sediment control shall be checked at the beginning and end of each day when construction is occurring to ascertain that the measures

are in place and functioning properly. Any damage observed will be repaired by the end of that working day. Measures shall be maintained throughout the duration of the contract.

-- END OF SECTION --

Section-02480

Seeding

SECTION 02480

SEEDING

PART I - GENERAL

1.01 WORK INCLUDED

A. The work covered by this Section includes furnishing all materials, equipment and labor necessary for the grassing of the following area:

1. All existing grassed areas left disturbed by construction, whether these be county-owned property, public or private right-of-ways. These areas shall be restored to a condition equal to that found prior to start of work.

2. All other non-paved construction areas to prevent erosion along right-of-way and adjacent property.

1.02 RELATED WORK

A. Division 1: General Requirements
B. Section 02200: Earthwork
C. Section 02270: Slope Protection and Erosion Control

PART 2 - PRODUCTS

2.01 MATERIALS

A. Seed: All seed shall conform to the current rules and regulations of the state where it is being used and from the latest crop available. Purity and germination of seed shall conform to the following requirements:

Seed Species	Purity Percent	Germination Percent
Bahiagrass, Pensacola	80	70
Bermudagrass, Common	97	85
Fescue, Tall	98	90
Lespedeza, Sericea	98	85
Lovegrass, Weeping	95	80
Millet, Browntop	98	85
Rye	97	85
Ryegrass, Annual	98	90
Wheat	99	90
Legume seed shall be treated with inoculant.		

Seed shall be labeled in accordance with the state laws and the U.S. Department of

Agriculture Rules and Regulations under the Federal Seed Act in effect on the date of invitations for bids. Bag tag figures will be evidence on purity and germination. No seed will be accepted with a date of test of more than 9 months prior to the date of delivery to the site.

Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be accepted. The percent of noxious weed seed allowable shall be as defined in the current state laws relating to agricultural seeds. Each type of seed shall be delivered in separate sealed containers and fully tagged unless exception is granted in writing by the Engineer.

B. Fertilizer: Unless otherwise specified, the fertilizer shall be a commercial grade fertilizer. The fertilizer shall meet the standard for grade and quality specified by state law. Where fertilizer is furnished from bulk storage, the Contractor shall furnish a supplier's certification of analysis and weight. When required by the contract, a representative sample of the fertilizer shall be furnished to the Engineer for chemical analysis.

C. Inoculants: The inoculant for treating legume seeds shall be a pure culture of nitrogen-fixing bacteria prepared specifically for the species and shall not be used later than the date indicated on the container or as otherwise specified. A mixing medium, as recommended by the manufacture, shall be used to bond the inoculant to the seed. Two times the amount of the inoculant recommended by the manufacturer shall be used, except four times the amount of inoculant recommended by the manufacturer shall be used when seed is applied by use of a hydraulic seeder. Seed shall be sown within 24 hours of treatment and shall not remain in the hydraulic seeder longer than 4 hours.

D. Soil Amendments: Lime shall consist of Standard Ground Agricultural Limestone, or approved equivalent. Standard Ground Agricultural Limestone is defined as ground limestone meeting current requirements of the State Department of Agriculture.

E. Mulch Tackifiers: Asphalt emulsion tackifiers shall conform to the requirements of ASTM D977, Specification for Emulsified Asphalt. The emulsified asphalt may be rapid setting medium setting or slow setting. If a tackifier is used for stabilizing mulch, a suitable tackifier shall be a mixture of 100 gallons of asphalt emulsion and 100 gallons of water per ton of mulch; or approved polyvinyl resin tackifier, 45 gallons Curasol AE per acre or equal, appropriately colored to allow visual metering of application.

F. Straw Mulch Materials: Straw mulch materials shall consist of wheat, oat, or rye, straw, hay, grass cut from native grasses or other plants approved by the Engineer. The mulch material shall be air dry, reasonably light in color, and shall not be musty, moldy, caked, or otherwise of low quality. The use of mulch that contains noxious weeds will not be permitted. The Contractor shall provide a method satisfactory to the Engineer for determining weight of mulch furnished.

G. Other Mulch Materials: Mulching materials, such as wood cellulose fiber mulch, mulch tackifiers, synthetic fiber mulch, netting, and mesh are other mulching materials that may be required for specialized locations and conditions. These materials, when specified, must be accompanied by the manufacturers' recommendations for methods of application.

PART 3 - EXECUTION

3.01 Seed Bed Preparation And Treatment

A. Areas to be treated shall be dressed to a smooth, firm surface.

B. On sites where equipment can safely operate, (generally slopes 2:1 or flatter), the seed bed shall be adequately loosened (4 to 6 inches deep) and smoothed. Disking or cultipacking or both may be necessary.

C. On sites where equipment cannot operate, the seed bed shall be prepared by hand by scarifying to provide a roughened surface so that broadcast seed will stay in place.

D. If seeding is to be done immediately following construction, seed bed preparation may not be required except on compacted, polished, or freshly cut areas.

E. Rocks larger than 6 inches in diameter, trash, weeds and other debris that will interfere with seeding or maintenance shall be removed or disposed of as directed by the Engineer.

F. Seed bed preparation shall be discontinued when soil moisture conditions are not suitable for the preparation of a satisfactory seed bed as determined by the Engineer.

3.02 Seeding, Sprigging, Fertilizing and Liming

A. All seeding or sprigging operations shall be performed in such a manner that the seed or springs are applied in the specified quantities uniformly on the designated areas. Unless otherwise specified, seeding or sprigging shall be done within 2 days after final grading is complete. Seed mixtures appropriate to the season shall be used in conformance with the following:

Seed Species	Application Rate/Acre	Planting Dates
Mixture of:		3/1 to 6/15
Bermudagrass, Common (Hulled)	10 lbs.	
Lespedeza, Sericea, (Scarified)	60 lbs.	
Mixture of:		6/15 to 9/1
Bermudagrass, Common (Hulled)	10 lbs.	
Lespedeza, Servicea, (Scarified)	60 lbs.	
Millet, Browntop	10 lbs.	
Fescue, Tall	40 lbs.	
Lespedeza, Serices, (Unscarified)	75 lbs	
Mixture of:		9/1 to 11/15
Bermudagrass, Common (Hulled)	10 lbs.	
Lespedeza, Servica (Scarified)	60 lbs.	
Millet, Browntop	10 lbs.	

Seed Species	Application Rate/Acre	Planting Dates
Mixture of:		11/15 to 3/1
Fescue, Tall	40 lbs.	
Lespedeza, Servica (Unscarified)	75 lbs.	
Rye or Wheat	½ bu.	
No rye or wheat allowed from 9/1 to 11/15.		

Lime, seed and fertilizer shall be applied by either of the following methods:

a. Conventional Seeding Method: Lime and fertilizer shall be applied uniformly in separate operations immediately prior to seed bed preparation. Legume seed shall be inoculated prior to seeding. Seed shall be broadcast uniformly on the freshly prepared seed bed using a cultipacker seeder; a cyclone type seeder followed by a cultipacker; or, other methods as approved by the Engineer. The work shall not be performed when the soil is too wet or too dry for proper tillage operations.

b. Hydraulic Seeding Method: Lime shall be applied uniformly in a separate operation. Lime may be applied by tractor or truck spreading equipment and mixed into the soil by disking or other methods as approved by the Engineer prior to seeding; or, lime (agricultural No. 75 or finer) may be mixed with water and applied in a slurry. This will be spray applied immediately after seeding and mulching is completed. Fertilizer, seed, inoculant, and 500 pounds of wood cellulose or cane fiber per acre shall be mixed with water and applied in a slurry to the prepared earth surfaces. The mixture shall be proportioned and spread so that fertilizer, seed, and wood cellulose or cane fiber are applied at the specified rates. The slurry shall be applied within one hour after the mixture is made.

c. Lime shall be applied at a rate of 4,000 pounds per acre.

d. Fertilizer (5-10-15) shall be applied at a rate of 1,500 pounds per acre. If fertilizer analysis required is not available, equivalent rates of different analysis may be used as approved by the Engineer.

3.03 Mulching and Stabilizing

A. Mulches shall be applied uniformly and shall be applied to the seeded areas not later than 2 work days after seeding has been performed. Straw mulch materials shall be stabilized by the use of a disk or by a suitable tackifier. A disk harrow of adequate weight shall be used. It shall have the disks set straight and the harrow shall be used to anchor the straw mulch in to soil. Harrow shall have disks 20 inches or more in diameter and 8 to 12 inches apart. The edges of the disks must be dull enough to press the mulch into the ground without cutting it. If a tackifier is used for stabilizing mulch, a suitable tackifier shall be a mixture of 100 gallons of asphalt emulsion and 100 gallons of water per ton of mulch; or approved polyvinyl resin tackifier, 45 gallons Curasol AE per acre or equal, appropriately colored to allow visual metering of application.

The tackifier shall be applied uniformly over the mulch material at the specified rate, or

by injecting it into the mulch material as it is being applied. The mesh or netting stabilizing materials shall be applied smoothly but loosely on areas with a slope greater than 2:1, and the edges shall be buried or securely anchored by means of spikes or staples.

The Contractor shall maintain the mesh or netting areas until all work on the entire contract has been completed and accepted. Maintenance shall consist of the repair of areas damaged by erosion, wind, fire, or other causes. Such areas shall be repaired to reestablish the condition and grade of the soil and shall be refertilized, reseeded, and remulched prior to the new application of the mesh or netting.
Areas to be treated shall be dressed to a reasonably smooth surface graded to prevent ponding of water.

Mulch shall be applied to earth surfaces disturbed by construction operations.

Mulch shall be 2 tons per acre small-grain straw or 2-1/2 tons per acre grass hay.

Mulch shall not be removed until construction on the treated area requires it.

Mulch shall then be removed and disposed of by the Contractor.

3.04 Established Lawns

A. If directed by the Engineer, where excavation is on private property in established lawns, sod shall be cut, removed, stacked and maintained in suitable condition until replacement is approved by the Engineer. Topsoil underlying lawn areas shall likewise be removed and kept separate from general excavated materials. Removal and replacement of sod shall be directed by an experienced nurseryman. Seed mixtures should be adjusted to comply with established lawns.

3.05 Protection of Vegetation

A. The Contractor shall take reasonable care during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

3.06 Maintenance and Inspection

A. Grassed area shall be protected against any damage and maintained by watering, mowing and replanting as may be necessary to produce a satisfactory stand of grass. A satisfactory stand of grass is defined as a full cover, over the area seeded, of live and growing grass with no bare spots. Any damaged area shall be promptly repaired without additional cost to the Owner.

B. After completion of work covered under the contract, the grassed area shall be inspected as to condition and coverage and shall be free from erosion and other damage prior to

being accepted. Upon written approval of the Engineer, grassed area shall be accepted, and the Owner shall assume responsibility for maintenance.

END OF SECTION

Section-02511

Hot-Mixed Asphalt Paving

SECTION 02511

HOT-MIXED ASPHALT PAVING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. This Section includes provisions for hot-mixed asphalt paving over prepared subbase and includes the following:

1. Marking lanes and parking spaces as shown.

B. Prepared subbase is specified in Section 02200 - Earthwork.

C. Proofrolling of prepared subbase is included in this section.

1.02 SUBMITTALS

A. Submit certificates signed by supplier certifying that each material item meets or exceeds specified requirements.

1.03 SITE CONDITIONS

A. Weather Limitations: Apply prime and tack coats when ambient temperature is above 50 degrees F (10° C) and when temperature has not been below 35 degrees F (1° C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

B. Construct hot-mixed asphalt surface course when atmospheric temperature is above 40 degrees F (4° C) and when base is dry. Base course may be placed when air temperature is above 30 degrees F (-1° C) and rising.

C. Grade Control: Establish and maintain required lines and elevations.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Comply with State Department of Transportation standard specifications, latest edition, and with local governing regulations if more stringent than herein specified.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Use locally available materials and gradations that exhibit a satisfactory record of previous installations.

B. Coarse Aggregate: Sound, angular crushed stone, crushed gravel or properly cured crushed blast furnace slag, complying with ASTM D 692-88.

C. Fine Aggregate: Sharp-edged natural sand or sand prepared from stone, properly cured blast furnace slag, gravel, or combinations thereof, complying with ASTM D 1073.

D. Asphalt Cement: ASTM D 3381 for viscosity-graded material; ASTM D 946 for penetration-graded material.

E. Prime Coat: Cut-back asphalt type, ASTM D 2027; MC-30, MC-70 or MC-250.

F. Tack Coat: Emulsified asphalt, ASTM D 977.

G. Subgrades shall be in accordance with applicable provisions of "Kentucky Standard Specifications for Road & Bridge Construction," Section 208, Paragraphs 208.01 through 208.06.

H. Dense Graded Aggregate Base shall be in accordance with Section 303 of "Kentucky Standard Specifications for Road and Bridge Construction."

I. Lane Marking Paint: Chlorinated rubber-alkyd type, ready-mixed, complying with AASHTO M 248, (FS TT-P-115), Type III. Color shall be White, Blue (Handicapped Zones) or Yellow, as shown.

J. Wheel Stops: Precast of 3000 PSI air-entrained concrete approximately 6" high, 8" wide and 6' long, with chamfered corners and drainage slots on underside. Stops shall be reinforced with three #3 rebar continuous full length.

PART 3 - EXECUTION

3.01 SYSTEMS DEFINED

A. Refer to the Drawings for thickness of base and surfacing.

3.02 SURFACE PREPARATION

A. General: Remove loose material from compacted subbase surface immediately before applying herbicide treatment or prime coat.

B. Proofroll prepared subbase surface to check for unstable areas and areas requiring additional compaction.

C. Notify Contractor of unsatisfactory conditions. Do not begin paving work until deficient subbase areas have been corrected and are ready to receive paving.

D. Exercise care in applying bituminous materials to avoid smearing of adjoining concrete surfaces. Remove and clean damaged surfaces.

3.03 PLACING MIX

A. General: Place hot-mixed asphalt mixture on prepared surface, spread, and strike off.

Spread mixture at minimum temperature of 225 degrees F (107 deg. C). Place areas inaccessible to equipment by hand. Place each course to required grade, cross-section and compacted thickness.

B. Paver Placing: Place in strips not less than 10 feet wide, unless otherwise acceptable to Architect. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete base course for a section before placing surface course.

C. Immediately correct surface irregularities in finish course behind paver. Remove excess material forming high spots with shovel or lute.

D. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of hot-mixed asphalt course. Clean contact surfaces and apply tack coat. At joining of new paving with existing, cut out and trim existing paving to straight lines. Prime or seal existing edges prior to placement of new material so as to produce bonded, watertight joining.

3.04 ROLLING

A. General: Begin rolling when mixture will bear roller weight without excessive displacement.

B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling and repair displaced areas by loosening and filling, if required, with hot material.

D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been evenly compacted.

E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained 95 percent laboratory density.

F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot, hot-mixed asphalt. Compact by rolling to specified surface density and smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.05 TRAFFIC AND LANE MARKINGS

A. Cleaning: Sweep and clean surface to eliminate loose material and dust.

B. Striping: Use chlorinated-rubber base traffic lane-marking paint, factory-mixed, quick-drying, and non-bleeding. Color shall be White, Blue (Handicapped Zones) or Yellow, as shown.

C. Do not apply traffic and lane marking paint until layout and placement have been verified with Engineer.

D. Apply paint with mechanical equipment to produce uniform, straight edges. Apply at manufacturer's recommended rates to provide minimum 12 to 15 mils. dry thickness.

3.06 WHEEL STOPS

A. General: Secure wheel stops to asphalt concrete surface with not less than two 3/8" diameter galvanized steel dowels embedded in precast concrete at 12" from each in. Size length of dowel to penetrate at least 6" into asphalt concrete. Drill placement holes oversized and embed dowels in hot, bituminous grout material.

3.07 FIELD QUALITY CONTROL

A. General: Test in-place hot-mixed asphalt courses for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by Architect.

B. Thickness: In-place compacted thickness tested in accordance with ASTM D 3549 will not be acceptable if in excess of the following variations:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus or minus 1/4 inch.

END OF SECTION

Section-02513

Asphaltic Concrete

Paving

SECTION 02513

ASPHALTIC CONCRETE PAVING

PART 1: GENERAL

1.1 SCOPE OF WORK

1.1.1 Provide labor, material, equipment and services necessary for proper and complete bituminous paving.

1.2 QUALITY ASSURANCE

1.2.1 All standards, materials methods of installation, equipment and construction shall be in accordance with the current edition of the Kentucky Department of Highways (KYDOH) publication "Standard Specifications for Road and Bridge Construction," except as modified herein.

1.3 GUARANTEES

1.3.1 Asphalt Paving Guarantee: Provide the OWNER with an unconditional guarantee, covering the workmanship and materials for the pavement base and asphaltic topping for a period of one (1) year after the date of acceptance. The actual starting of the work shall be construed to mean that the condition of the sub-base is acceptable and will fulfill all guaranteed requirements. Also maintain the paving including ordinary normal wear and tear for period of one (1) year after the date of acceptance. The OWNER shall be provided with one (1) year maintenance free guarantee from date of final acceptance of the asphalt pavement by the OWNER.

1.4 SUBMITTALS

1.4.1 Submit CONTRACTOR's guarantee.

1.4.2 Submit copies of all reports of testing performed pursuant to these specifications.

1.5 JOB CONTROL

1.5.1 Weather Limitations:

Apply tack coats only when the ambient temperature in the shade has been at least 50 degrees F for 12 hours immediately prior to application.

Do not conduct paving operations when surface is wet or contains excess of moisture which would prevent uniform distribution and required penetration.

Construct asphaltic surface courses only when atmospheric temperature is above 55

degrees F for 1" lift or 45 degrees F for 2" lift, when the underlying base is dry and when weather is not rainy.

Place base course when temperature is above 35 degrees F and rising.

1.5.2 Grade Control:

Maintain vehicular and pedestrian traffic during paving operations, as required, for other construction activities.

Provide flagmen, barricades, warning signs and warning lights as required for movement of traffic and safety and to cause the least interruption of work.

PART 2: PRODUCTS

2.1 MATERIALS

2.1.1 All materials indicated on the drawings, specified or required shall be in accordance with 1.2.1 unless specified otherwise hereafter.

2.1.2 Asphalt Paving Material

The aggregate base course shall be Dense Graded Aggregate (DGA) or Crushed Stone Base meeting the requirements of Sections 302 and 303 of the KYDOH.

Bituminous base shall be Bituminous Concrete Base Class I. Bituminous Concrete Base Class I shall meet the requirements of Sections 401 and 402 of the KYDOH.

Rock Roadbed (when required) shall meet the requirements of Section 204 of the KYDOH.

PART 3: EXECUTION

3.1 INSPECTION

3.1.1 Establishing of Grade: The CONTRACTOR shall be responsible for his grade control.

3.1.2 Protection of Work by Others: Protect all work installed by others such as manholes, catch basins, sewer cleanouts, lighting posts and bases, sidewalks, etc. Damage to same shall be repaired at paving CONTRACTOR's expense.

3.2 INSTALLATION, APPLICATIONS

3.2.1 All materials shall be installed using equipment and procedures in accordance with the current Kentucky Department of Highway specifications as indicated in 1.2.1, except as hereafter specified.

3.2.2. Asphalt Pavement

Asphalt pavement shall consist of layered construction as indicated in the Paving Details provided in the Drawings.

3.2.3. Conditioning Existing Surface

The surface on which the bituminous plant mix is to be placed shall be cleaned and maintained free of accumulations of materials that would, in the judgement of the OWNER's Site Representative, contaminate the mixture, prevent bonding or interfere with the spreading operations. Where approved subgrade or pavement courses previously constructed under the contract become loosened, rutted or otherwise defective, the deficiency shall be corrected in accordance with the requirements for the item or items involved prior to the spreading of bituminous plant mix for a subsequent pavement course.

When a quantity of bituminous plant mix is specified for use in spot leveling or patching an existing pavement surface, the material needed to effect the corrections shall be spread and compacted as directed by the OWNER's Site Representative.

Contact surfaces of curbing, gutters, manholes, and other structures shall be painted with a thin, uniform coating of bituminous material prior to the bituminous mixture being placed against them.

Where mixture is to be placed against the vertical face of an existing pavement structure, the vertical face shall be cleaned of foreign material and given an application of bituminous material in a manner which results in a coating of approximately 0.25 gallon per square yard.

When the surface course is not placed within 10 days after completion of the intermediate course, the CONTRACTOR shall provide a tack coat, at this own expense, as directed by the OWNER's Site Representative.

Preparation of Surface: The surface to be primed shall be shaped to the required grade and section, shall be free from all ruts, corrugations, segregated material or other irregularities and shall be smooth and uniformly compacted at the time of application of the bituminous material. The cleaning shall be done in such manner as to thoroughly remove all mud, earth and other foreign material. The sweeping on a waterbound surface shall be just sufficient to expose the pattern of the coarse aggregate. Special care shall be taken to clean the edges of road to be primed in order to insure uniform application of the bituminous material directly on the existing base or pavement surface. Material cleaned from the surface shall be removed and disposed of as directed by the Engineer.

Application of Bituminous Material: Bituminous material shall be applied in a uniform continuous spread to the width of the section to be primed by means of a pressure distributor. When traffic is maintained, not more than one half of the width of the section shall be treated in one application. Care shall be taken that the application of bituminous material at the junction of spreads is not in excess of the specified amount. Excess bituminous material shall be squeegeed from the surface.

Skipped areas or deficiencies shall be corrected.

Bituminous prime coat shall be applied to the base course at the rate of .3 gal. per square yard.

Asphaltic concrete shall be installed in lifts. The average compacted thickness shall be equal to or greater than the thickness specified. No skin patching will be accepted. Compaction of the bituminous concrete shall be equal to 97% of that obtained in the laboratory. Asphalt concrete shall be rolled with a ten ton roller as soon after placing as is practicable.

Provide a slope for drainage as indicated on the Drawings and slope to catch basins as provided.

The surface of the finished pavement shall be free of roller depressions. When testing with water, the surface shall not contain any irregularities which will impede the water flow.

After final rolling, the surface shall be tested with a ten (10) foot straight edge. The variation of the surface from the edge of the straight edge between any two contact points shall not exceed 1/4".

3.3 QUALITY CONTROL

3.3.1 Testing During Construction

The aggregate course shall be tested for compliance with the specified requirements. The installation shall be observed for compacted thickness, cross section, and grade.

Field density shall be checked with nuclear gages for every 10,000 S.F. of DGA surface placed.

Bituminous concrete mix shall be tested for bitumen content and physical requirements. OWNER's Site Representative shall observe bituminous concrete placement for number of lifts, procedure employed and compliance with indicated cross sections and grade. The Engineer shall conduct field density tests and thickness checks in accordance with Section 403 of KYDOH.

The CONTRACTOR shall pay for and have testing agency take two 4" diameter cores for every 10,000 square yards of paved surface at locations selected by OWNER's Site Representative, for density and thickness tests. Repair holes resulting from coring to match existing paving prior to placing surface course. OWNER reserves the right to take additional cores and should testing show insufficient thickness, all defective areas shall be remediated. CONTRACTOR shall also pay all costs related to remediation including cost of additional testing.

Density: Compare density of in-place material against laboratory specimen of same mixture, subjected to 50 blows of a Standard Marshall hammer on each side of specimen. Minimum acceptable density of in-place material shall be 97% recorded

laboratory specimen density.

3.3.2 Allowable Variation in Thickness

1) Base Course: plus or minus 1/2".

2) Intermediate Course: 1/4".

3) Surface Course: plus or minus 1/8".

3.3.3. Surface Smoothness: Test finished surface of each asphalt course for smoothness using a 10'-0" straight edge. Intervals of tests shall be as directed by OWNER's Site Representative. Surfaces exceeding the following tolerances will not be acceptable:

1) Base Course: 1/2" in 10'-0".

2) Intermediate Course: 1/4" in 10'-0".

3) Surface Course: 1/8" 10'-0".

3.3.4 CONTRACTOR's Testing Duties

Duties include:

1) Notifying laboratory of conditions requiring testing.

2) Coordinate with laboratory for field testing.

3) Paying costs for testing as well as for additional testing where initial test reveals non-conformance with specified requirements.

-- END OF SECTION --

Section-02520

Concrete Pavement, Walks,

Curbs and Ditches

SECTION 02520

CONCRETE PAVEMENT, WALKS, CURBS, AND DITCHES

PART 1: GENERAL

1.01 SCOPE OF WORK

A Provide labor, material, equipment and services necessary for proper and complete construction of concrete pavements, sidewalks, curbs, gutters, and paved ditches.

1.02 QUALITY ASSURANCE

A. All standards, materials, methods of installation, equipment and construction shall be in accordance with the current edition of the Kentucky Department of Highways (KYDOH) publication "Standard Specifications for Road and Bridge Construction," except as modified herein.

B. The KYDOH reference specifications directly related to this work are:

SECTION	TITLE
501	Portland Cement Concrete Pavement
601	Concrete
602	Steel Reinforcement
712	Concrete Sidewalks, Steps and Entrance Pavement
713	Concrete Curbs and Gutters
801	Portland Cement
802	Admixtures for Concrete
803	Water
804	Fine Aggregate
805	Coarse Aggregates
807	Joint Materials
808	Waterproofing Materials
811	Steel Reinforcement
823	Concrete Curing Materials

1.03 GUARANTEE

A. Provide the OWNER with an unconditional guarantee covering the workmanship and materials for all concrete surfaces for a period of one (1) year after the date of acceptance.

1.04 SUBMITTALS

A Mix Designs

1. Submit mix designs for each different concrete strength and for each different aggregate.

2. Secure confirmation of laboratory tests on proposed mix designs prior to submittal.

3. Use only approved mix designs.

4. Make compression and slump tests of mix as called for elsewhere in this specification.

B. Strength Specimens

Submit four (4) copies of all reports of strength testing performed pursuant to these specifications.

PART 2: PRODUCTS

2.01 MATERIALS

A. All materials indicted on the Drawings, specified or required, shall be in accordance with 1.2.1 (KYDOH) unless specified otherwise hereafter.

B. All concrete shall be KYDOH Class A (4,000 psi 28 day strength) unless noted otherwise.

PART 3: EXECUTION

3.01 INSTALLATION

A. All concrete materials for paving, sidewalks, curbs and gutters shall be mixed, transported, placed and cured in accordance with the current edition of the Kentucky Department of Highways publication "Standard Specifications for Road and Bridge Construction" except as specified otherwise hereafter.

B. Walks shall be scored at no less than 5' intervals within 24 hours of placement.

C. Aprons shall receive expansion joints at a minimum of 15' intervals.

D. Aprons, walks and curbs shall have heavy broom finish.

E. All exterior concrete shall receive one coat of exterior sealer.

3.02 QUALITY CONTROL

A. All costs of concrete testing shall be the responsibility of the CONTRACTOR. Testing of concrete shall be accomplished by taking four standard test cylinders of the concrete for each day concrete is poured. One set of test cylinders may represent no more than 50 cubic yards of concrete nor one day's pour. Cylinders shall be broken in accordance with ASTM Specifications; two at 7 days and two at 28 days. For all concrete, slump cone test shall be run at the job site on each truck delivery. Concrete used for slump cone test shall not be taken from first or last 15% of each load.

-- END OF SECTION --

Section-02575

Pavement Replacement

SECTION 02575

PAVEMENT REPLACEMENT

PART 1 - GENERAL

1.01 Work Included

The work includes replacement of all pavement cut or disturbed, with pavement similar in all respects to existing pavement, in accordance with the Standard Details. No permanent paving shall be placed within thirty (30) days after the backfilling has been completed.

1.02 Classification of Pavements

A. Concrete Pavement Replacement. This pavement replacement shall be Portland cement concrete construction in accordance with the requirements shown in the Standard Details. It shall include all pavement replacement on concrete surfaced roads, concrete driveways, concrete sidewalks and concrete parking areas, both public and private.

B. Heavy-Duty Bituminous Pavement Replacement. This type of asphalt pavement replacement shall be bituminous concrete surface over concrete base in accordance with the Standard Details. This type of pavement replacement shall be used on all heavily trafficked roads having an existing pavement greater than 2", whether public or private, or in other locations as directed by the Engineer.

C. Light-Duty Bituminous Pavement Replacement. This type of pavement replacement shall be bituminous concrete constructed in accordance with the Standard Details. This item shall include all light-duty bituminous concrete roadways, bituminous driveways and bituminous parking lots, both public and private.

D. Gravel Surface Replacement. This type of surface replacement shall include all graveled roadways, driveways, parking areas, or other gravel surfaced areas, both private and public. This type of surfacing may also be required as a base course for other pavement replacement.

PART 2 - PRODUCTS

2.01 Crushed Stone Backfill

Crushed stone backfill shall be dense graded aggregate (Class A Aggregate, Grading D) per Kentucky Department of Highways Standard Specifications for Road and Bridge Construction, Section 303. The Contractor shall be responsible for the maintenance of the aggregate and the surface of the trenches until the pavement replacement is completed.

2.02 Bituminous Materials

Bituminous materials and mixes shall be consistent with the recommended practice of the Asphalt Institute and it shall conform to the requirements of the Kentucky Department of Highways for prime coat and Class 1 bituminous concrete. The bituminous concrete shall consist of a binder or base course and a surface course.

2.03 Gravel Surface Replacement

Aggregate shall meet the applicable provisions of Kentucky Department of Highways Standard Specifications for Road and Bridge Construction Section 805, sizes 610 or 710.

PART 3 - EXECUTION

3.01 Preparation

The Contractor shall cut back the surfacing adjacent to the trench for 12 inches on both sides of the trench and shall cut down the dense graded aggregate he has placed to a depth required for either type of pavement replacement. The resulting surface shall be rolled to yield a smooth, dense surface and a uniform depth.

3.02 Pavement Installation

A. Concrete shall be placed in accordance with standard practice, with the welded wire mesh if required in proper position and thoroughly vibrated into place. The Contractor shall produce a surface consistent with the existing pavement. The Contractor shall apply a liquid curing component, sprayed on the surface of the concrete, and shall provide adequate protection to the pavement until it has set.

3.03 Seasonal and Weather Limitations

In the event the progress and scheduling of the work is such that the bituminous pavement replacement would occur in the winter months, during adverse cold weather and/or during such times the asphalt plants are not in operation, then the final pavement replacement shall be postponed until favorable weather occurs in the spring and the asphalt plants resume normal operations. No bituminous concrete shall be laid when the temperature is below 40° F except by written permission of the Engineer.

Concrete pavement shall not be placed when the temperature is such that the pavement placed will freeze before it has had adequate time to set and shall be placed in conformance with the temperature conditions specified in Section 03300 of these specifications.

The Contractor shall be responsible for replacement of pavement which he has placed which has been damaged by cold weather or freezing without additional compensation. In the meantime, the Contractor will be required to maintain the temporary surfacing until the permanent pavement is placed. The Contractor will be required to use a cold mix asphaltic concrete as a temporary surface for trenches under heavy traffic use.

END OF SECTION

Section-02670

Pressurized Potable Water

System less than 3" in Diameter

SECTION 02670

PRESSURIZED POTABLE WATER SYSTEM LESS THAN 3" IN DIAMETER

PART 1: GENERAL

1.01 DESCRIPTION

A. Scope: Furnish all labor and materials necessary for proper construction of potable water conveyance lines and their appurtenances less than 3 " in diameter.

B. Related work as called for on Drawings or specified herein.

1.02 QUALITY ASSURANCE

A. Each piece of pipe, fitting, valve or other appurtenance shall be marked to identify the manufacturer, pressure rating, material and compliance with any agency approval specification.

1.03 SUBMITTALS

A. Submit four copies of manufacturer's affidavit of compliance with the requirements of this section of the specifications.

B. Submit four copies of manufacturer's certification that valves hydrostatically tested to 200 percent of rated working pressure.

C. Submit four copies of report of successful hydrostatic test for pressurized lines.

D. Submit four copies of report of disinfection for potable water line.

PART 2: PRODUCTS

2.01 PLASTIC PIPE

A. Copper Pipe: All pipe less than 3" in diameter used for potable water transmission shall be considered service pipe. All service pipe shall be PVC Schedule 40 rated for 200 psi minimum.

2.02 FITTINGS FOR SERVICE PIPE

A. Fittings shall be PVA and shall conform to AWWA latest revision.

2.03 TAPPING SADDLES AND COCKS

B. Tapping saddles shall be of the double band type and shall be threaded to receive the corporation cock. The corporation cock shall meet AWWA C800 standards and shall have a compression outlet compatible with the diameter of service line to be employed.

PART 3: EXECUTION

3.01 INSTALLATION

A. The installation of water service lines and their appurtenances shall conform to the requirements of Part 3 of Section 02732 herein. The minimum depth of bury for water service lines is 30".

END OF SECTION

Section-02700

Piping and Valves

SECTION 02700

PIPING AND VALVES

PART 1 - GENERAL

1.01 Work Included

Work addressed in this Section includes furnishing all labor, tools, materials, equipment, supplies and services necessary for installation of all ductile iron piping, valves and appurtenances as shown on Contract Drawings and specified herein.

Excluded from this Section are piping and appurtenances discussed under disinfection, plumbing, laboratory fixtures, water supply, floor drains, sanitary waste lines, vents, HVAC venting and distribution equipment, and all gas and air lines.

PART 2 - PRODUCTS

2.01 Pipe

Ductile iron pipe and fittings shall be rated at 150 psi min. working pressures as described in all applicable AWWA and ANSI specifications, and have flanged or mechanical joint end or as shown on the plans, if a different type joint is required.

All ductile iron pipe and fittings shall be supported and blocked by hangers or concrete supports in an adequate and approved manner. Wall castings or sleeves of the proper size and length shall be furnished where required and shall be poured in place with the concrete as shown on the plans.

Tapping of cast iron pipe for sampling cocks, corporation cocks, chemical line injectors, control pipe and control tubing, etc. shall be as required for installation of the equipment shown on the plans.

Where couplings are indicated on the plans, they shall be installed according to the manufacturer's directions and shall be of the style indicated on the plans.

2.02 Gate Valves

A. Underground. All underground gate valves shall be of the double-disc, parallel seat-type, iron body, non-rising stem, fully bronze mounted, tar-coated outside, and suitable for working water pressures of 150 psi unless otherwise shown on the plans. Valves shall be of standard manufacture and of the highest quality both of materials and workmanship and shall conform to the latest revision of AWWA Specification C-500. Valves shall be furnished with bell, flanged or mechanical joint end connections suitable for connection to the pipe with which they are to be used.

Underground valves shall be nut operated, unless otherwise shown on the plans. Valve supplier shall furnish two standard stem iron wrenches for turning nut operated valves. All underground valves which have nuts deeper than 30 inches below the top of valve box shall have extended stems with nuts located within 2 feet of valve box cap.

B. Housed. Gate valves, 3" and larger, for fabricated pipe systems shall be double-disk, parallel seat-type, iron body, flanged, fully bronze mounted with O-ring seals, tar-coated outside, and suitable for working water pressures of 150 psi unless otherwise shown on the plans. Valves shall be standard manufacture and of the highest quality both of materials and workmanship and shall conform to the latest revision of AWWA Specifications C-500.

Unless otherwise shown on the plans, all housed valves and valves in basins shall be handwheel operated. Handwheels shall have not less than the following diameters:

Valve's Diameter	Handwheel Size
1"	3 1/8"
1½"	4-1/4"
2"	6"
3"	8"
4"	10"
6"	12"
8"	14"
10"	16"
12"	18"
14"	20"
16"	22"
18"	24"

Valve stand handwheels and handwheels on extended stems, shall have the same minimum diameters as those shown for handwheels directly on valves. Extension stems shall have adjustable cast iron guides per each ten (10) feet of extension stem length. All extension stems shall be connected with suitable coupling castings for connection to and removal from valves and stands. Nuts and bolts on all extension stem connections shall be stainless steel.

2.03 Swing Check Valves

Check valves shall be swing gate type. All check valves shall be iron body with

straightway passage of full pipe area when swing gate is open. The valve shall be of the outside lever and weight operating type. The valve must be tight sealing and must operate without hammer or shock. The seat ring or lining must be renewable. The valve should be bronze-mounted and may contain a rubber or neoprene lining in accordance with the manufacturer's recommendations. Valves shall be as manufactured by M & H, Clow or equal.

2.04 Butterfly Valves

All butterfly valves unless otherwise specified shall be of the tight closing, rubber seat type with rubber seats which are bonded to the valve body. Valves shall be rated for 150 psi pressure and shall be satisfactory for throttling applications and for applications involving valve operation after long periods of inactivity. Valve discs shall rotate 90° from the full open position to the tight shut position. Valves shall meet the full structural requirements of the applicable classes of AWWA C504, latest revision.

Valve bodies shall be constructed of cast iron ASTM A-48, Class 40 and shall have integrally cast mechanical joint or flanged ends (as required). Butterfly valves for buried service shall be equipped with 2-inch square operating nut and mechanical joint end connections. Buried service butterfly valves shall be installed in with valve boxes. Exposed butterfly valves shall have ANSI B16.1 Class 125 flanges. Two trunnions for shaft bearings shall be integral with each valve body. Body thickness shall be strictly in accordance with AWWA C504. Valve shafts shall be constructed of ANSI Type 304 stainless steel.

Butterfly valves shall have discs constructed of alloy cast iron ASTM A-436 Type 1. All disc seating edges shall be smooth and polished. Valve shafts shall be a one piece unit extending full size through the valve disc and bearings. Valve seats shall be of a synthetic compound. Seats must be simultaneously molded in, vulcanized and bonded to the body.

Valves shall be fitted with sleeve type bearings. Bearings shall be corrosion resistant and self-lubricating. Flanged butterfly valves shall be manufactured by Henry Pratt Company, Aurora, Illinois, BIF, West Warwick, R.I. or equal.

All surfaces of the valve shall be clean, dry and free from grease before painting. The valve interior surfaces except seating surfaces shall be evenly coated with black asphalt varnish in accordance with Federal Specification TT-V-51c and AWWA C504.

Hydrostatic and leakage tests shall be conducted in strict accordance with AWWA C504, Section 13.

2.05 Plug Valves

Valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the plans. Flanged valves shall be faced and drilled to the ANSI 125/150 lb. standard. Mechanical joint ends shall be to the AWWA

Standard C111, latest revision. Bell ends shall be to the AWWA Standards C100, latest revision Class B. Screwed ends shall be to the NPT standard.

Port areas for valves through 20" shall be minimum 80% of full pipe area and port areas of 24" and larger valves shall be minimum 70% of full pipe area.

Valve bodies shall be of ASTM A126 Class B cast iron in compliance with AWWA C504, Section 2.2. Bodies in 3" and larger valves shall be furnished with a welded overlay seat of not less than 90% pure nickel in accordance with AWWA C507, Section 7.2. Valves utilizing resilient seats attached to the body shall not be acceptable. As per AWWA C504, Section 35.2 and AWWA C507, Section 7.2, sprayed or plated seats are not acceptable, nor shall screwed in seats be acceptable.
Plugs shall be of ASTM A126 Class B cast iron in compliance with AWWA C504, Section 2.2. The plug shall be of one piece construction and shall be capable of withstanding the full pressure rating of the valve without use of additional structural reinforcing ribs that extend beyond the profile of the plug itself. Plugs shall be resilient faced with neoprene or hycar, suitable for use with sewage. Plugs with cast inlays shall not be acceptable.

Valves shall be furnished with replaceable, sleeve type metal bearings conforming to AWWA C504, Section 3.6 and AWWA C507, Section 8. Bearings shall be of sintered, oil impregnated and permanently lubricated type 316 ASTM A743 Grade CF-8M or AISI Type 317L stainless steel in 1/2" -36" sizes. In valves larger than 36", the upper and lower plug journals shall be fitted with ASTM A-240 type 316 stainless sleeves with bearings of ASTM B30, Alloy C95400 aluminum bronze. Non-metallic bearings shall not be acceptable.

Valves shaft seals shall be of the multiple V-ring type and shall be externally adjustable, repackable without removing the bonnet or actuator from the valve, and repackable under pressure. Shaft seals shall conform with AWWA C504, Section 3.7 and AWWA C507, Section 10.2. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable. All exposed nuts, bolts, springs, washers, etc., shall be stainless steel for buried valves and zinc plated for all others.

Valve pressure ratings shall be 175 psi through 12" and 150 psi for 14" through 72". Each valve shall be given a hydrostatic and seat test with test results being certified.

Certified copies of proof-of-design test reports shall be furnished as outlined in AWWA C504, Section 5.5

Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floor stands, etc., as indicated on the plans. All valves 8" and larger shall be equipped with gear actuators. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. All exposed nuts, bolts and washers shall be zinc plated.

Valves and gear actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs and washers shall be stainless steel. All gear actuators shall conform to AWWA C504, Section 3.8.

All valves and actuators shall be as manufactured by DeZurik or approved equal.

2.06 Shear Gates

Shear gates shall be iron body bronze mounted double wedge type with pull rod and handle. Rod length shall be as shown on plans. Shear gates shall be as manufactured by Clow, Waterman or equal.

2.07 Sluice Gates

A. Each gate shall be furnished and installed complete with wall thimble or anchor bolts, operating stem, gate lift operator and other appurtenances as needed to make a complete and operable installation.

Gates, stems, lifts and other appurtenances shall be the size, type, material and construction as shown on the drawings and specified herein. Gates shall meet the requirements of AWWA Specifications C-501 (latest revision). All component parts shall be of the type of material shown, and interchangeable where size and material are the same without grinding, chipping or special fitting in the field. All mating and sliding parts shall be fully machined.

B. Frame and Guide Rails. The frame and guide rails shall be cast one piece construction or may have guides doweled and bolted to the frame. Frames shall be of the flangeback or flatback type with round or rectangular opening as indicated on the plans. A machined dovetail groove for the mounting of the bronze seat facings shall be provided on the front face of the frame around the full periphery of the opening. The frame shall be provided with cast-on pads which shall be machined, drilled, and tapped for the mounting of the wedge devices. The back of the frame flange shall be machined to a plane and drilled to match the wall thimble, pipe flange, or anchor bolt pattern. Guide rails shall be of such length as to retain at least one-half of the vertical height of the slide when it is in the fully opened position. A groove running the full length of the guide rail shall be accurately machined to receive the slide tongue.

C. Cover or Slide. The cover shall be of one piece cast construction with vertical and horizontal ribs, a reinforced pocket to receive the thrust nut, pads to receive the wedges, and a reinforced periphery around the back side of the cover for machining of the dovetail grooves in which the seating faces shall be mounted. All wedge pads shall be machined, drilled and tapped to receive the wedge device. The cover shall have fully machined tongues running the full length of each side to properly engage the guide rail grooves. A thrust nut shall be provided to attach the slide to the stem. The nut shall

be threaded and, in the case of rising stems provided with keys or two set screws locked into indents in the stem to prevent rotation of the stem. For non-rising stems, the stem shall turn freely in the thrust nut, to open and close the slides as the stem is rotated.

D. Seating Face. All seating faces for both covers and frames shall be malleable extruded corrosion resistant material of a shape that will fill and permanently lock in the full width dovetail grooves of the slide and frame. (No other means of attachment will be allowed). They shall be machined to a 63 micro-inch finish, or better.

E. Wedges. All wedges and wedge blocks shall be solid corrosion resistant material and shall be of sufficient number to provide a practical degree of watertightness. All wedge bearing surfaces and contact faces shall be machined to give maximum contact and wedging action. Wedges shall be fully adjustable, but once set, shall not rotate or move from the desired position. All fasteners and adjustment screws shall be corrosion resistant.

F. Wall Thimbles and Anchor Bolts. Wall thimbles shall be provided with all gates except those to be mounted on pipe flanges or those gates to be attached to concrete headwalls with anchor bolts, as shown on the plans. Thimbles shall be of one-piece cast iron construction. There shall be integrally cast water stop around the periphery of the thimble. The front flange of the thimble shall be machined, drilled and tapped to receive the sluice gate attaching studs. Bolt pattern shall match gate bolt pattern. After machining, the front flange shall be marked with vertical centerline and the word "top" for correct alignment. Large square and rectangular opening thimbles shall be provided with grout holes in the invert to permit entrapped air to escape. The holes shall be 1½" diameter, no more than two feet apart and shall be upstream and downstream of the water stop.

   A mastic type gasket shall be provided between the sluice gate and the wall thimble. Anchor bolts shall be corrosion resistant.

   Gates mounted directly upon the wall shall be sealed between the gate back and wall with a non-shrink grout, per manufacturer's detailed installation instructions.

G. Stem and Stem Couplings. Operating stems shall be of a size to safely withstand, without buckling or permanent distortion, stresses induced by normal operating forces. Stems shall be fabricated from round bar stock of cold-finished steel, stainless steel or bronze, and shall be provided with 29° modified acme threads. Stems composed of two or more sections shall be joined by bronze couplings threaded and keyed to stems, or couplings of the same material as the stems, pinned, bolted, or welded and pinned to the stems. In section, couplings shall be stronger than the stems. Rising stems shall be provided with an adjustable limit nut or stop collar above the floor stand lift nut to prevent over closing of the gate.

H. Stem Guides. Stem guides shall be cast, with bronze bushings, and mounted on cast brackets. Guides shall be adjustable in two directions and shall be so constructed that

when properly spaced they will hold the stem in alignment and still allow enough play to permit easy operation. Stem guide spacing shall be as recommended by the manufacturer, but in no case shall it exceed an 1/r ration of 200. Brackets shall be attached to the wall by anchor bolts of sufficient strength to prevent twisting or sagging under load.

I. Manually Operated Lifts. Sluice gates shall be operated manually by handwheel or crank operated pedestal floor stands or bench stands as required. Each lift shall be provided with a threaded cast bronze lift nut to engage the threaded portion of the stem. The lift nut shall have a machined flange, fitted above and below with thrust ball bearings. Handwheel lifts shall be without gear reduction while crank operated lifts shall have either a single or double reduction. Lifts having a reduction greater than 4:1 shall be two-speed. A maximum effort of 25 lbs. pull on handwheel or crank, shall operate the gates under the specified operating head. The gears, when required, shall be steel or cast iron with machine cut teeth. Pinion gears shall be supported by bronze bushings. The lift mechanism shall be totally enclosed within a cast iron housing adequately provided with lubrication fittings.

The crank shall be of cast iron with a revolving handle and shall be removable. The crank shall be 15" long. All lifts for rising stems shall be provided with a counter type position indicator and a galvanized steel stem cover. Non-rising stem gates shall be provided with a counter type position indicator unless extension stems, valve boxes, or T-handle wrenches make an indicator impractical. Handwheels and crank input shafts shall be approximately 36" from the operating floor unless otherwise shown. The word "open" shall be cast onto the housing or handwheel indicating direction of rotation to open the gate.

J. Self-Contained Gates with Rising & Non-Rising Stems. A yoke of heavily designed cast iron shall be mounted on the machined pads provided on the upper ends of the guide rails. The yoke shall have a machined bearing surface for the thrust nut or pedestal mounting plate. On non-rising stem gates, the nut pocket shall be cast on top of the slide so that the stem does not project into the waterway when the gate is fully opened. The thrust generated by gate operation shall be transferred to the yoke by the stem thrust collar or lift. When the operating floor is above the self-contained gate, a stem extension of cold-rolled shall be coupled to the operating stem with a bronze stem extension bracket. Operation shall be by a T-handle wrench or floor stand with handwheels. In a T-handle arrangement, the stem extension shall be supported by at least one stem guide or floor box with integral guide embedded in the operating floor.

K. Flushbottom Sluice Gates. When a flushbottom closure is specified, a resilient seal shall be attached to the frame so that it is flush with the invert. It shall be supported by a cast iron bracket which shall be bolted to machined pads provided on the frame. The seal shall be held in place by a bronze or stainless steel bar which shall be bolted through the seal to the bracket with stainless steel fasteners. The cover (slide) shall be shortened and provided with a smooth rounded surface along the bottom to depress the

seal. When unseating heads are to be acting on a flushbottom gate, top wedges shall be added, but bottom wedges will not be required. Sealing pressure shall be varied by adjusting side and top wedges. As an alternate, the resilient seal may be attached to the slide bottom, and of a design to produce a good seal along the entire invert of the gate opening.

L. Painting. All cast iron parts of the sluice gate (not in bearing or sliding contact) and stem guides shall be painted in accordance with the section on painting found elsewhere in these specifications. That portion of the wall thimbles which will be embedded shall not be painted.

M. Shop Testing. The completely assembled gate and hoist shall be separately shop-operated to insure proper assemble and operation. The gate shall be adjusted so that a .004" thick gauge will not be admitted at any point between frame and cover seating surfaces.

2.08 Air and Vacuum Valves

Air and vacuum valves shall have body, cover and baffle of cast iron construction. Float shall be stainless steel and seat shall be Buna-N. Valves shall be designed for 150 pound working pressure unless otherwise shown on the plans. Valves shall have threaded inlet and outlet. In addition, each valve shall be equipped with a water diffuser and a throttling device to regulate the flow of air escaping from the valve.

2.09 Telescoping Valve

The valve shall consist essentially of a floor stand incorporating a valve lifting stem, handwheel, seamless brass tube, tube guide collar with Neoprene gasket, and appurtenances required to make a complete working installation as shown on the plans.

The sliding valve tube shall be seamless brass tubing with a minimum wall thickness of 1/8" to prevent corrosion and to insure proper operation at all times, and arranged to slide inside of a cast iron sludge draw-off pipe.

The telescopic valve shall be manually operated by means of an 18" diameter cast iron handwheel. The handwheel shaft, designed to prevent rotation of the brass sleeve during operation, shall be manufactured of 1-1/8" diameter brass stock. The valve lifting stem shall have an ACME thread at one end for engagement with the handwheel shaft and provisions for attaching the valve tube at the other end. The valve shall be complete with tube guide collar and Neoprene gasket for sealing at the cast iron sludge draw-off pipe.

All anchor bolts shall be plated steel furnished by the Equipment Manufacturer and shall be of ample size and strength for purpose intended. All anchor bolts shall be set by the General Contractor in accordance with the Manufacturer's instructions.

All parts of the mechanism shall be amply proportioned for all stresses that may occur during fabrication, erection, and intermittent operation. Workmanship shall be of high

grade in all respects.

2.10 Mud Valves

The equipment to be furnished and installed under this section shall be iron body, bronze mounted and rising stem mud valves. The stem, stem nut, disc ring and seat ring shall be bronze. Bolts and nuts shall be rust-proofed steel. Extension stem and floor stands shall be furnished with the valves along with the operating handwheel. Extension stems shall not extend more than 7'-0" without the use of stem guides.

2.11 Pressure Relief Valves (Tide Gates)

Valves shall be circular four (4) inch diameter, have minimum head loss, cast iron frames, shutters and hinge links (body) have flanged end for connection to the special 4-inch flanged wall pipe. Valves shall be bronzed mounted with soft composition rubber seat to facilitate seating should particles become attached. Seat material shall resist deterioration in sewage. Wall pipe shall be gray iron flange and plain end pipe. Flange shall be tapped for studs to 125 lb. template. It shall contain an integral gate. Valves shall be Type F-1494 by Clow Corp., Type R-5004-B by Neenah Foundry or approved equal.

PART 3 - EXECUTION

3.01 Installation

Piping valves and equipment shall be stored and installed in accordance with the installation manual furnished by the manufacturer. After installation the completely assembled valve shall be operated through one full cycle to demonstrate satisfactory operation. Such adjustments as necessary will be made until operation is approved by the Architect/Engineer. When required by the Architect/Engineer, the valve shall be subjected to leakage tests and pass the standard requirements for maximum leakage as specified in AWWA standards.

END OF SECTION

Section-02701

Combination Air/Vacuum

Valves

SECTION 02701

COMBINATION AIR/VACUUM VALVES

All air release valves shall be combination air/vacuum release valves designed for raw sewage and effluent. The valve shall be a model D-025TP02 as manufactured by A.R.I. or approved equal.

Each valve is to have: 2" N.P.T. intake; corrosion resistant conical body of either 316 stainless steel or nylon; corrosion resistant non-metallic operating mechanism; stainless steel spring loaded float to allow for system vibrations and turbulence; & working pressures of 3-150 PSI.

The conical body shape maintains maximum air gap and spring-loaded float and seal plug connection combine to ensure no contact between the sewage and the seal.

A 2" isolation valve shall be furnished for installation between the discharge pipe and air valve.

Valves with steel or cast iron bodies or internal parts that are subject to corrosion, are not acceptable.

END OF SECTION

Section-02725

Boring and Casing for Utilities

SECTION 02725

BORING AND CASING FOR UTILITIES

PART 1 - GENERAL

1.01 Work Included

The work to be performed hereunder shall consist of the installation of casing pipe for the purpose of installing utilities under streets, roads, highways or railroads. It shall include the excavation of a boring pit, auger boring, rock coring or jacking as and where required.

PART 2 - PRODUCTS

2.01 Casing Pipe

The casing pipe shall be of steel meeting the latest approved American Railway Engineering Association "Specifications for Pipelines for Carrying Flammable and Nonflammable Substances." The steel casing pipe shall have a minimum yield strength of 35,000 psi and shall have the minimum wall thickness shown in the following table for single carrier pipe installation. The casing pipe shall be of the size shown on the plans for multiple carrier pipe installations.

CARRIER PIPE	CASING PIPE	NOMINAL THICKNESS
6	12	0.250 inch
12	18	0.312 inch

When the casing pipe is installed without benefit of a protective coating, the wall thickness shown above shall be increased to the nearest standard size, which is a minimum of 0.063 inch greater than the thickness shown.

PART 3 - EXECUTION

3.01 Installation of Casing Pipe

The steel casing pipe shall be bored or jacked in place at the locations as shown on the plans or as directed by the ENGINEER. All joints between lengths shall be solidly welded with a smooth nonobstructive joint inside. When the casing is required from right-of-way to right-of-way or ditch line to ditch line, the casing pipe may be extended beyond the boring limits by open trenching. Open trenching at jacked or bored locations will be allowed no closer than three feet from edge of pavement.

A suitable approach trench shall be opened adjacent to the slope of the embankment, or adjacent to point of bored and jacked section as shown on the plans. The approach trench shall be long enough to accommodate the selected working room. Guide timbers or rails for keeping the casing pipe on line and grade shall be accurately set and maintained in the

bottom of the approach trench and with heavy timber back-stop supports installed at the rear of the approach trench to adequately take thrust of the jacks without any movement or distortion. It is paramount to the securing of acceptable tolerance limits of workmanship in the boring and jacking operation that extreme care be taken in the setting of all guides, rails and jacks to the end that the casing pipe in final position be within the limits of acceptability for the placing and laying of the carrier pipe. The minimum cover of 36 inches under the roadway must be maintained. Greater depth may be required.

3.02 Installation of Carrier Pipe

Casing spacers must be used to prevent the pipe and bells from snagging on the inside of the casing, and to keep the installed line from resting on the bells. Casing spacers shall be thick enough to allow for clearance between the bells and the casing bottom. Each end of the casing pipe shall be sealed to the carrier pipe or pipes by means of rubber seals with stainless steel bands.

Spacers (or insulators) shall be stainless steel with HDPE shoes or solid HDPE. Insulators shall be as manufactured by PSI (Model PE A-8 & A-12), or equal. Manufacturer's recommendations on sizing and spacing shall be followed.

END OF SECTION

Section-02731

Gravity Sewers

SECTION 02731

GRAVITY SEWERS

PART 1 - GENERAL

1.01 Work Included

The CONTRACTOR shall furnish all labor, materials and equipment required to install the gravity sewers as shown on the plans and as specified herein.

The pipe may be PVC pipe, ductile iron pipe, polyethylene plastic pipe, reinforced concrete pipe or plain concrete sewer pipe.

The CONTRACTOR will be required to deliver all equipment and other materials and place same as and where required for installation. Care must be exercised in the handling of all materials and equipment and the CONTRACTOR will be held responsible for all breakage or damage to same caused by his workmen, agents, or appliance for handling or moving. Pipes and other castings shall in no case be thrown or dropped from cars, trucks, or wagons to the ground, but same shall be lowered gently and not allowed to roll against or strike other castings and unyielding objects violently. Pipe and special castings may be distributed at places that will not interfere with other building operations as unloaded, or yarded and distributed as required, as the CONTRACTOR may elect.

All equipment and materials subject to damage from the weather, dampness, changes in temperature, or exposure shall be protected by a dry, weatherproof enclosure until ready for installation or use.

PART 2 - PRODUCTS

2.01 Polyvinyl Chloride Pipe (PVC)

Pipe and fittings shall meet or exceed all of the requirements of ASTM Specification D-3034 latest revision and ASTM 3033 and have an SDR of 35.

All pipe shall be suitable for use as a gravity sewer conduit. Provisions must be made for contraction and expansion at each joint with a rubber ring. The bell shall consist of an integral wall section stiffened with two PVC retainer rings which securely lock the solid cross section rubber ring into position at the factory. Standard lengths shall be 20 feet and 12.5 feet plus/minus 1 inch. All pipe shall be marked with the manufacturer's name, production lot number, ASTM designation, PVC and nominal diameter.

All fittings and accessories shall be as manufactured and furnished by the pipe supplier or approved equal and have bell and/or spigot configurations with integral rubber ring joints identical to that of the pipe. All in-line fittings shall be integral wye-tee combination with rubber ring joint. All rubber rings shall be factory installed. No saddle type fittings will be allowed.

2.02 Polyethylene Plastic Pipe

Pipe and fittings shall meet or exceed all of the requirements for Type III C5 P34 as tabulated in ASTM D 1248, latest revision (Ultra High Molecular Weight High Density Polyethylene Pipe). All pipe shall be a minimum of DR 11 rated at 160 psi if used for force main or as specifically noted on the plans. The pipe and fittings shall be pressure rated at 73.4F and have a suggested Modulus of Elasticity of 130,000 psi.

All pipe shall be virgin quality, have a melt flow (Condition F) of less than 0.11 gms/10 min. (ASTM D1238) and shall exceed 1,000 hours on Environmental Stress Crack Re-sistance (ASTM D1693 Condition C.)

The polyethylene pipe shall have a manufacturer's recommended hydrostatic design stress rating of 730 psi based on a material with a 1,460 psi design basis determined in accor¬dance with ASTM D 2837, Standard Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.

The PE pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, or other injurious defects. It shall be uniform in color, opacity, density and other physical properties.

Marking on the pipe shall include the nominal pipe size, the type of plastic material, the standard thermoplastic pipe pressure rating in psi for water at 73F for low pressure 160 and 200 psi pipe (schedule 40 pipe is marked as such) and manufacturer's name or trade mark and code, at intervals of not more than five feet.

Fittings shall be molded or fabricated from high density polyethylene.

Molded fittings shall be molded from high density polyethylene of same material as main line.

Fabricated fittings shall be prepared from polyethylene pipe of same material as main line and by means of thermal fusion.

Pipe and fittings shall be joined to one another by the thermal butt fusion system.

Polyethylene pipe lengths, fittings and flanged connections to be fused shall be of the same type, grade and class of polyethylene compound.

PART 3 - EXECUTION

3.01 Lines and Grades

The ENGINEER will establish the locations of key manholes by reference to landmarks on the ground and will establish a system of bench levels to be used in the construction of the sewer lines. These reference sheets will be furnished on request. The CONTRACTOR shall set line

and grade stakes for all gravity sewers, offset from the centerline of the trench or the axis of the pipelines. Where gravity sewer lines are being constructed, the maximum interval between cut stakes shall be 50 feet for grades of 1% and greater and 25 feet for grades less than 1%. The CONTRACTOR shall erect batter boards opposite each cut stake and at least three batter boards shall be in place at all times when pipe is being laid.

Laser beams may be used for laying gravity sewer lines provided the equipment is maintained in a good and accurate condition. If the laser beam is used, the CONTRACTOR shall set offset hubs with tack lines at each manhole at no more than 100 foot intervals between manholes. CONTRACTOR shall also provide the necessary leveling facilities to check the elevation of the flow line of the pipe every fifty feet.

If the laser beam apparatus is prone to error or not usable, the above described batter board method shall be employed.

Offset line and grade stations will be set ahead of the trenching. This layout shall be by the CONTRACTOR except in contracts requiring layout by the ENGINEER. All trenches must be dug neatly to lines and grades. Grade boards for finish grading after trencher has passed shall be set by the CONTRACTOR. These will be set each 25 feet or less. Grades shown on the plans and/or profiles are the elevations of the invert of the pipe in all cases.

Where bottoms of trench for 6 inch through 16 inch size pipe are in or on rock, trenches or tunnels shall be dug to a depth of 6 inches below bottom of pipe barrel. Where in earth they shall be dug to at least 6 inches below bottoms of pipe barrels and bells.

In sizes 18 inch and larger, the trench or tunnel shall be dug to a depth of at least one-fourth of the outside diameter of the pipe below the bottom of the pipe bell , with a minimum of 6 inches and a maximum of 9 inches. This requirement shall also apply to all sizes of pipe where concrete arch or cradle is added to protect pipe. When trench or tunnel is dug below grade, the pipe must be brought to grade by filling with crushed rock for pipe bedding, as specified in these specifications at the CONTRACTOR's expense. Fill for pipe support shall not be made with material excavated from bell holes.

Trenches shall be of sufficient width to properly join pipe sections.

The excavation of all trenches shall be fully completed between structures in advance of the laying of sewer, unless permission is granted by the ENGINEER to lay pipe just back of the completion of trenching. This precaution is necessary where pipes or other structures may be encountered at unknown elevations, whose grades cannot reasonably or economically be changed, requiring changes in grade of sewer being constructed.

3.02 Water and Sewer Separation

Wherever sewer lines and water lines cross, or are adjacent to each other, special precautions shall be taken.

A. Parallel Water and Sewer Lines. Water lines must, if possible, be located a minimum

lateral distance of 10 feet from any existing or future sewer lines measured from outside diameters. Where water lines and sewer lines must be placed in the same trench, the water line must be located on a shelf, 1.5 feet above and 1.5 feet to the side of the sewer line. Whenever this condition cannot be met, and upon direction from the Engineer, the water line shall be removed and replace with high density polyethylene pipe with a minimum pressure rating of 160 psi.

B. Crossing Water and Sewer Lines. Wherever sewer lines and water lines cross, it is desirable, if practical, that the sewer line be at least 18 inches below the water line.

Where it is not practical to provide such a separation, care shall be taken to ascertain that the existing water line or existing sewer line is in good sound condition and that no evidence of joint leakage is known in that vicinity. If any such evidence does exist, expose the existing line at least 10 feet on each side of the water line crossing. The Owner will arrange for examining and correcting any defects in the existing lines.

When the water line must be below or less than 1.5 feet above the sewer line, replace the waterline portion with high density polyethylene pipe rated for a minimum of 160 psi.

3.03 Installing Sanitary Sewer Pipe

All pipe must be tested for uniform diameter, straightness and defects by the CONTRACTOR before being lowered into the trench, and rejected pipe marked in a way not to impair its value. Rejected pipe must be separated from accepted pipe and removed from the project. The ENGINEER will make periodic inspections of pipe in storage and/or incorporated into the work. Pipe found defective, not meeting specifications, or improperly installed shall be rejected and replaced.

All pipe, after being inspected and accepted, shall be laid to correspond with lines and grades. All sewer lines shall be laid to constant grades between invert elevations shown on the plans. Grades shown on the drawings are invert of pipe and not trench subgrade. The pipe lengths shall be fitted together and matched, so that they will form a sewer with a smooth and uniform invert. Laying will begin at the lowest point and proceed upstream with the bells of the pipe pointing upstream.

Six inch through sixteen inch pipe shall be laid with bottom quadrant of barrel and bells of pipe bedded in at least 2 inch depth of stone when on earth and in at least 6 inch depth of stone below the bottom of the barrel of pipe on solid rock subgrade. Stone for bedding of 6 inch through 16 inch pipe shall be Kentucky Department of Highways size No. 67, No. 8 or No. 9-M crushed rock, hand placed or spaded, or as shown on the standard details.

No filling of trench with earth to bring pipe to grade will be permitted. If trenches are dug too deep, they must be brought to grade and supported by crushed rock for pipe bedding (size of bedding) at least the bottom quadrant of the pipe. This shall apply to all sizes of pipe where concrete arch is added to protect pipe.

No walking upon the completed pipelines will be permitted until trench has been backfilled to a depth of at least six inches over the top of the pipe. Exception may be made, at the discretion of the ENGINEER, where it is necessary in order to tamp the backfill around the pipe.

The interior of the pipe shall, as the work progresses, be cleaned of all dirt, jointing materials, and superfluous materials of every description. When laying of pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plywood plug fitted into the pipe bell, so as to exclude earth and other material, precautions being taken to prevent flotation of pipe by run-off into trench.

Laying of pipe may be held up by the ENGINEER until trench has progressed far enough ahead to remove the possibility of having to change grade or alignment on account of other structures, pipe lines or conduits.

In wet, yielding, and mucky locations where pipe is in danger of sinking below grade or floated out of grade or line, or where backfill materials are of such a fluid nature that such movements of pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective. If crushed rock fill is necessary, it will be paid for per ton of such material use, except in cases where instability is caused by neglect of the CONTRACTOR.
Pipe stubbed out of manholes for future connections shall be plugged and tightly sealed with same jointing material used to plug laterals.

Non-pressure pipes entering structures underground, unsupported by original earth for a distance of more than three feet shall be supported by Class "E" concrete, where depth of such support does not exceed three feet. All pipes entering building or basins below original ground, which have more than three feet depth above subgrade, three feet span between wall and original earth, and have cover of more than 24 inches of earth or under roadway, shall be supported by concrete beams under them as shown on drawings with columns each six feet between structural wall and edge of excavation for the structure in order to prevent breakage from settlement of backfill about the structure. Concrete and reinforcing steel for such support are to be included in the unit price bid portion of the contract and not as extra concrete, in order to discourage excessive excavation outside the limits of structures. Sewers entering structures shall have flexible joint within 16 inches of exterior of structure, including manholes.

No backfilling (except for securing pipe in place) over pipe will be allowed until the ENGINEER has had an opportunity to make an inspection of the joints, alignment and grade, in the section laid, but such inspection shall not relieve the CONTRACTOR of further liability in case of defective joints.

No joints will be accepted that show leakage and if after backfilling and inspection any joints are found that are allowing ground water to enter the sewer, such joints must be dug up and corrected.

Branches and fittings shall be provided and laid as and where directed. Tees and wyes, placed in the sewer for property service connections, shall be located by the CONTRACTOR, as directed by the ENGINEER, at such points in the sewer so as to result in the property service connection having the shortest length possible between the sewer and property line or easement

line, unless otherwise indicated on the Drawings or directed by the ENGINEER.

A. Installation of Polyvinyl Chloride (PVC) Pipe. All installation of PVC shall be in strict accordance with ASTM D-2321 - latest revision.

   All embedment materials as shown on the standard drawings shall be Class I materials as detailed in ASTM D-2321 and this material shall be used to a point at least 12 inches above the top of the pipe.

B. Installation of polyethylene plastic pipe. Pipe and fittings shall be joined to one another by the thermal butt fusion system. Polyethylene pipe lengths, fittings and flanged connections to be fused shall be of the same type, grade and class of polyethylene compound.

3.04 Installation of Stubs and Stacks

Stubs for future sewer pipe shall be installed as indicated by the Drawings. If the specified length of the stub is exceeded, there will be no additional cost to the OWNER unless the extra length is ordered by the ENGINEER. Existing sewer pipe stubs shall be removed as required, but only when directed by the ENGINEER.

Stacks shall be constructed as and where directed. The height of the stack shall be as indicated on the Drawings, set forth in the Proposal, or determined by the ENGINEER.

3.05 Cleaning and Testing

After the collecting and/or outfall lines have been brought to completion, and prior to final inspection, the CONTRACTOR shall rod out the entire system by pushing through each individual line in the system, from manhole to manhole, appropriate tools for the removal from the lines of any and all dirt, debris and obstructions. If necessary during the process of rodding the system, water shall be turned into the system in such quantities to carry off the dirt, debris and trash.

During the final inspection, the ENGINEER will inspect each individual line, from manhole to manhole, either by use of lights or other means at his disposal to determine whether the completed lines are true to line and grade as laid out or as shown on the drawings. The ENGINEER may require that the CONTRACTOR pass through the system under its own momentum a wooden ball of a diameter one inch less than that of the nominal diameter of the pipe. Television inspection of the lines may be conducted by the OWNER. All lines or sections of lines that are found to be laid improperly with respect to line or grade, that are found to contain broken or leaking sections of pipe, or are obstructed in such a manner that they cannot be satisfactorily corrected otherwise, shall be removed and replaced at the CONTRACTOR's expense.

3.06 Smoke Testing

The CONTRACTOR will be required to test any "house sewer" or service line conducted after backfilling, by the so called "smoke method" in which smoke is blown to closed-off sections of

the sewers under pressure and observation made of any smoke appearing on top of the ground indicating the presence of leaks. All such leaks or breaks discovered by the smoke test shall be corrected by the CONTRACTOR at no additional cost to the OWNER. Equipment and supplies required for smoke test on completed sewers shall be furnished by the CONTRACTOR at his expense. Supplementary smoke test prior to backfilling may be performed by the CONTRACTOR at his option, and at his expense; however, such test shall not supplant the final test of the completed work.

3.07 Low Pressure Air Testing

A. The CONTRACTOR shall conduct low-pressure air tests of all pipe laid under this contract before putting the new sewers into service. Tests shall be made from manhole to manhole at an average pressure of 3.0 PSI greater than the average back pressure of any ground water present and shall be conducted in accordance with the test procedure outline below. The minimum time requirements for testing the 0.5 PSI drop (from 3.5 PSI to 3.0 PSI plus ground water back pressure) shall not be less than shown below:

Pipe Size (Inches)	Time
4	1 min. 53 sec.
6	2 min. 50 sec.
8	3 min. 47 sec.
10	4 min. 43 sec.
12	5 min. 40 sec.
15	7 min. 05 sec.
18	8 min. 30 sec.
21	9 min. 55 sec.
24	11 min. 20 sec.
27	12 min. 45 sec.

B. The CONTRACTOR shall furnish all the necessary equipment and personnel required to conduct the tests, including:

1. Pneumatic plugs, which shall have a sealing length equal to or greater than the diameter of the pipe to be tested.

2. Pneumatic plugs shall resist internal test pressures without requiring bracing or blocking.

3. All air used shall pass through a single control panel.
4. Three individual hoses shall be used for the following connections:

   a. From control panel to pneumatic plugs for inflation.

b. From control panel to sealed line for introducing the low pressure air.

c. From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

C. Procedure:

1. The sewer line to be tested shall be flushed and clean prior to the test (a wetted pipe surface will produce more consistent results).

2. All pneumatic plugs shall be seal-tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 PSI. The sealed pipe shall be pressured to 5 PSI. The plugs shall hold against this pressure without movement of the plugs out of the pipe.

3. Plug all pipe outlets with suitable test plugs. Brace each plug assembly.

4. If the sewer line to be tested is submerged in ground water, insert a pipe probe (by boring or jetting) into the backfill material adjacent to the center of the pipe, determine the pressure in the probe when air passes slowly through it. This is the back pressure due to ground water submergence over the end of the probe. All gauge pressures in the test shall be increased by this amount.

5. Add air slowly to the portion of the sewer line installation under test until the internal pressure is raised to 4.0 PSI.

6. After an internal pressure of 4.0 PSI is obtained, allow at least two minutes for the air temperature to stabilize, adding only the amount of air required to maintain pressure.

7. When the pressure decreases to 3.5 PSI, start timing with a stopwatch. Determine the time, in seconds, that is required for the internal air pressure to reach 3.0 PSI.

No one shall be allowed in the manholes of the section being tested at the time of the test or until after the lines have been depressurized.

Pressurizing equipment shall include a regulator set at 10 PSI to avoid over pressurizing and damaging an otherwise acceptable line.

3.08 Deflection Testing

After all backfill is in place, any pipe with stiffness (F/Y) of less than 100 PSI shall be measured for vertical deflection. Maximum deflection of the installed pipe shall be limited to 4 percent of the vertical internal pipe diameter. If the pipe is measured more than six (6) months after all backfill has been placed, a deflection of 5 percent of the internal pipe diameter will be allowed. All pipe exceeding the allowable deflection shall be replaced or re-rounded by

the CONTRACTOR.

3.8.1 Method of Deflection Testing

There are two methods which are acceptable for use in deflection testing. These methods and the procedures are:

Method to be as recommended by the manufacturer's and approved by the ENGINEER.

A. Electronic Deflectometer Testing

B. Rigid Go-No Mandrel

The device is pulled through the line and measures only a "Go-No Go" basis. When using a Go-No device to check deflection, there are several steps that shall be followed:

1. Make sure the line is clean and free of debris that might cause the device to jam. It is recommended that the line be cleaned with a hydro-cleaner washing in the direction of flow.

2. The next step is to pull a line through the pipe with which to pull the Go No Go device. this can be done several ways.

   a. If a hydro cleaner is being used, attach the pull line to the nozzle end before the actual cleaning cycle starts. As the hose is pulled through the line, it will carry the pull line with it. When the hose nozzle reaches the manhole, disconnect the pull line and tie it off.

   b. A parachute device can be blown through the line with a light weight string attached. Detach the string, and attach the pull line. Manually draining the pull line through. Tie off at each manhole.

   c. If a sewer line is in service, a string can be floated through the manhole run. When the string reaches the next manhole, attach it to the pull line and drag through. tie the pull line at each manhole.

3. Pulling of the gauges may be done by hand. The pulling motion shall be smooth and easy to avoid jamming if an obstruction is encountered in the line. The gauge shall have a line on each end to facilitate removal should the gauge become obstructed in the direction of pull. If the gauge stops lightly, pull on it to see if it will clear the obstruction. When it appears that the gauge will not go forward, record the distance from the manhole at which the gauge is stuck and then pull the gauge back out. **Do not use** mechanical equipment to force the gauge through.

   When using a "Mandrel" device, it is recommended that the design be such that it will allow obstructions, such as gravel to pass through. The following table lists the base

I.D. of PVC Gravity Sewer Pipe and the Mandrel O.D. for a deflection test.

3.09 Final Clean -Up

Before completion of the contract, all backfill shall be reshaped, holes filled and surplus material hauled away, and all permanent walks, street, driveways and highway paving, and sod, replaced and re-seeding performed.

The CONTRACTOR shall be responsible for clean-up, grading, seeding, sodding or otherwise restoring all areas that he disturbs, even if these area are within the work limits of other contractors on this project.

The work shall not be accepted until the right-of-way of roads and all private property has been cleared of all rubbish and loose stone, and also all equipment, excess material and temporary structures. All property which has been damaged in the course of the work shall be restored in a manner fully acceptable to the property owner.

END OF SECTION

Section-02732

Force Mains

SECTION 02732

FORCE MAINS

PART 1: GENERAL

The Contractor shall furnish all labor, materials and equipment required to install the force mains as shown on the PLANS and as specified herein.

The pipe must be high-density polyethylene (HDPE) DR 11 plastic pipe as shown on the PLANS.

The Contractor will be required to deliver all equipment and other materials and place same as and where required for installation. Care must be exercised in the handling of all materials and equipment and the Contractor will be held responsible for all breakage or damage to same caused by his workmen, agents, or appliance for handling or moving. Pipes and other castings shall in no case be thrown or dropped from cars, trucks, or wagons to the ground, but same shall be lowered gently and not allowed to roll against or strike other castings and unyielding objects violently. Pipe and special castings may be distributed at places that will not interfere with other building operations as unloaded, or yarded and distributed as required, as the Contractor may elect.

All equipment and materials subject to damage from the weather, dampness, changes in temperature, or exposure shall be protected by a dry, weatherproof enclosure until ready for installation or use.

PART 2: PRODUCTS

2.01 POLYETHYLENE PLASTIC PIPE

Pipe and fittings shall meet or exceed all of the requirements for Type III C5-P34 as tabulated in ASTM D-1248, latest revision (Ultra High Molecular Weight High Density Polyethylene Pipe) . All pipe shall be a minimum of schedule 40 if used for force main or as specifically noted on the PLANS. The pipe and fittings shall be pressure rated at 73.4° F and have a suggested design hoop stress of 730 psi.

All pipe shall be virgin quality, have a melt flow (Condition F) of less than 5.9 gms/10 min. (ASTM D1238) and shall exceed 1,000 hours on Environmental Stress Crack Resistance (ASTM D1693 Condition C.)

The polyethylene pipe shall have a manufacturer's recommended hydrostatic design stress rating of 730 psi based on a material with a 1,460 Psi design basis determined in accordance with ASTM D-2837, Standard Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.

The PE pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, or other injurious defects. It shall be uniform in color, opacity, density and other physical properties.

Marking on the pipe shall include the nominal pipe size, the type of plastic material, the standard thermoplastic pipe pressure rating in psi for water at 73°F for low pressure 160 and manufacturer's name or trade mark and code, at intervals of not more than five feet.

Fittings shall be molded or fabricated from high density polyethylene.

Molded fittings shall be molded from high density polyethylene of same material as main line.

Fabricated fittings shall be prepared from polyethylene pipe of same material as main line and by means of thermal fusion.

Pipe and fittings shall be joined to one another by the thermal butt fusion system.

Polyethylene pipe lengths, fittings and flanged connections to be fused shall be of the same type, grade and class of polyethylene compound.

PART 3: EXECUTION

3.01 INSTALLATION OF FORCE MAINS

A. General. Before any length of pipe is placed in the trench, make a careful inspection to see that no foreign material is in the pipe. In order to properly remove any foreign materials, a swab of necessary length is to be available at all times.

All pipe shall be lowered carefully into the trench, properly aligned and properly jointed by use of suitable tools and equipment, in such manner as to prevent damage to protective coatings and linings. Excessive scratching of the exterior surface of the pipe will be cause for rejection of the pipe.

Under no circumstances shall pipeline materials be dropped or dumped into the trench. The pipe and fittings shall also be inspected for the purpose of determining if they are sound and free from cracks. Laying of pipe shall be commenced immediately after excavation is started.

When pipe laying is not in progress, the open ends of pipe shall be closed to prevent entrance of trench water into the line. Whenever water is excluded from the interior of the pipe, adequate backfill shall be deposited

on the pipe to prevent floating. Any pipe which has floated shall be removed from the trench and installed properly. No pipe shall be laid in water or on frozen trench bottom or whenever the trench conditions or the weather are unsuitable for such work.

If any defective pipe and fittings shall be discovered after the pipeline is laid, they shall be removed and replaced with a satisfactory pipe or fitting without additional charge to the Owner. Open ends of unfinished pipelines shall be securely plugged or closed at the end of each day's work or when the line is lefttemporarily at any other time.

Installation of Polyethylene Plastic Pipe. The handling of the jointed pipeline shall be insuch a manner that the pipe is not damaged by dragging it over sharp and cutting objects.

Sections of the pipes with deep cuts and gouges shall be cut out and the ends of the pipeline rejoined.

The trench bottom shall be free of stumps, stones, boulders, rocks, frozen clods and similar objects.

Where the trench is made through rock, it shall be excavated below grade and backfilled to grade with compacted materials as directed by the Engineer.

Butt fusion of pipes and fittings shall be performed in accordance with the pipe manufacturer's recommendation as to equipment and technique.

3.02 THRUST BLOCKING AND ANCHORAGE

All angles or bends in the pipeline, either vertical or horizontal, shall be braced or anchored against the tendency of movement with concrete thrust blocking. Where joint harness is used, all component parts shall be stainless steel. Cost of installing concrete thrust blocking or joint harness materials shall be considered incidental to installing the line.

Thrust blocks for plastic pipe will not be attached to couplings.

3.03 PIPE BEDDING

A. Standard Pipe Bedding. The standard pipe bedding shall be evenly spread fine granular earth material or bank run sand and gravel or dense graded aggregate as shown on the PLANS.

B. Special Pipe Foundation. When ordered by the Engineer, yielding and mucking material in subgrade shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe. In such locations, a special pipe foundation shall be constructed utilizing encasement class concrete.

C. Standard Concrete Encasement. Concrete encasement of pipe shall be placed as directed by the Engineer. Concrete shall form a continuous bed under pipe. In tamping concrete, care should be taken not to disturb the grade or line of the pipe or injure the joints.

3.04 WATER LINE AND SEWER LINE SEPARATION

A. Parallel Water and Sewer Lines. Water lines must, if possible, be located a minimum lateral distance of 10 feet from any existing or future sewer lines measured from outside diameters. Where water lines and sewer lines must be placed in the same trench, the water line must be located above the sewer line such that there is a minimum of 18" vertical distance between the outside of the water line and the outside of the sewer line.

B. Crossing Water and Sewer Lines. Wherever sewer lines and water lines cross, it is desirable, if practical, that the sewer line be at least 24 inches below the water line.

Where it is not practical to provide such a separation, the existing waterline or the sewer line must be encased at least 10 feet on each side of the water line crossing measured perpendicular to the water main. The Owner will arrange for examining and correcting any defects in the existing lines.

3.05 BACKFILLING

Begin backfilling as soon as practicable after pipe has been installed, spade sand or earth around pipe as laying progresses to avoid danger of misalignment from slides, flooding or other causes. The backfill shall be free from debris, organic material and stones, placed simultaneously on both sides of pipe to the same level by hand.

The backfilling of the lower part of the trench beginning at the top of the bedding, the backfill material shall be carefully and solidly tamped by hand or acceptable mechanical methods in six inch layers around the pipe and up to a point eight inches higher than the top of the pipe. Walking or working on the completed pipeline, except as necessary in tamping or backfilling, shall not be permitted until the trench has been backfilled to a point one diameter higher than the top of the pipe. The filling of the trench and the tamping of the backfill shall be carried on

simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed and injurious side pressures do not occur.

After the above specified backfill is hand placed, rock may be used in the backfill in pieces no larger than 18 inches in any dimension and to an extent not greater than one-half (1/2) the backfill materials used. Filling with rock and earth shall proceed simultaneously, in order that all voids between rocks may be filled with earth. Backfill material must be uniformly ridged over trench and excess hauled away, with no rock over 1-1/2 inch in diameter or pockets of crushed rock or gravel in top six inches of backfill. Confine backfill to the width of the trench and to the height sufficient for settlement of backfill. All rock, including crushed rock or gravel from construction, must be removed from yards and fields immediately following backfilling. Streets, roadways and walks shall be swept to remove all earth and loose rock immediately following backfilling.

In the case of street, highway, railroad, sidewalk and driveway crossings or within any roadway paving or about manholes, valve and meter boxes, the backfill must be machine tamped in not over 4-inch layers, measured loose in accordance with the Standard Details. Where backfill is under paved driveways, streets, highways, railroads, sidewalks, paved parking areas and other areas where settlement is not allowed, crushed stone or coarse sand backfill only shall be used up to the paving surface. Crushed stone shall be Kentucky Department of Highways Standards Specification No. 78 or finer. Tunnels shall be backfilled in not over 3-inch layers, measured loose, with selected material suitable for mechanically tamping. If material suitable for tamping cannot be obtained, sand, gravel or crushed rock (No. 78) shall be blown, packed or sluiced to completely fill all void spaces.

Coarse sand backfill shall be spread in layers not over four inches thick and thoroughly compacted. Sand may be moistened to aid compaction.

Any deficiency in the quantity of material for backfilling the trenches or for filling depressions caused by settlement, shall be supplied by the Contractor.

3.06 PROTECTION OF EXISTING STRUCTURES

Protect all sewer, gas, electric, telephone, water and drain pipes or conduits, power and telephone poles and guy wires from danger of damage while pipelines are being constructed and backfilled, or from danger due to settlement of the backfill.

In case of damage to any such existing structures, repair and restoration shall be made at once and backfill shall not be replaced until this is done.

3.07 HYDROSTATIC TESTS

The Contractor will be required to test all pipelines and appurtenances with water at pressure class of pipe installed. The pipe shall be slowly filled with water, care being taken to expel all air from the pipes. If necessary, the pipe shall be tapped at high points to vent the air. Pressure at least equal to 160 PSI (or the operating pressure if higher) as measured at the point of lowest elevation shall be applied for not less than one hour and all pipes, fittings, valves, hydrants and joints shall be carefully examined for defects or leakage. Any observed leakage shall be corrected.

The pipe pressure must be held at 160 PSI for one hour before beginning the test for leakage. No pipe shall be accepted unless or until the leakage, determined by this test, is less than 10 U.S. gallons over 24 hours, per mile, per inch nominal diameter of pipe. The leakage test shall be applied to the pipe for a period of not less than 4 hours.

The test shall be made between valves as far as practical in sections of pipe and shall, in general, be made within twelve working days of the completion of each section of line.

Furnish a suitable pump, pressure gauge and water meter or other appliance for measuring the amount of water pumped. The instrument used to measure leakage shall be tested for accuracy. Furnish all necessary labor and materials to make the test and to perform any work incidental thereto. Where it is impractical to test between the valves, temporarily place caps and plugs on the lines and test sections of the new line.

Wherever practicable, corporation stops and service lines shall be installed before testing. If these items are installed after the main is tested, then a visual inspection of the tap and service line must be permitted while under pressure before backfilling service line.

Where any section of the main is provided with concrete thrust blocking, the hydrostatic pressure test shall not be made until at least five days have elapsed after the concrete reaction blocking was installed. If high early strength cement is used in the reaction blocking, the hydrostatic pressure test shall not be made until at least two days have elapsed.

Should there be leakage over the allowable amount, the Contractor will be required to locate and repair the leaks and retest the section. It is suggested, but not required, that the Contractor have a geophone (underground listening device) on the job at the time of testing.

If the leakage of the section of pipeline being tested is below the allowable amount, but leakage is obvious due to water at the surface of the ground, or by

listening the leak can be heard underground with a geophone, or any other means of determining a leak, the Contractor will be required to repair these leaks.

The Contractor shall furnish a meter or suction tank, pipe test plugs and by-pass piping and make all connections for conducting the above tests. The pumping equipment used shall be centrifugal pump, or other pumping equipment which will not place shock pressures on the pipeline. Power plunger or positive displacement pumps will not be permitted for use on closed systems for any purpose.

Inspection of pipe laying shall in no way relieve the Contractor of the responsibility for stopping leakage or correcting poor workmanship.

3.08 FINAL CLEAN-UP

Before completion of contract, all backfill shall be reshaped, holes filled and surplus material hauled away, and all permanent walks, street, driveway and highway paving, and sod, replaced and reseeding performed.

The Contractor shall be responsible for clean-up, grading, seeding, sodding or otherwise restoring all areas that he disturbs, even if these areas are within the work limits of other contractors on this project.

The work shall not be accepted until the right-of-way of roads and all private property has been cleared of all rubbish and loose stone, and also all equipment, excess material and temporary structures. All property which has been damaged in the course of the work shall be restored in a manner fully acceptable to the property owner.

END OF SECTION

Section-02733

Manholes

SECTION 02733

MANHOLES

PART 1 - GENERAL

1.01 Work Included

The work to be performed includes the furnishing of all labor, materials, equipment and services necessary for the construction of all manholes, including reinforced concrete rings, bases, barrels, steps, frames and covers, invert construction, stubs and all other appurtenances.

1.02 Submittals

Submit at least four (4) copies of product data to the ENGINEER for review.

PART 2 - PRODUCTS

2.01 Manholes

Precast concrete manholes shall consist of precast reinforced concrete sections, a conical or flat slab top section and a base section conforming with the typical manhole details as shown on the drawings.

Precast manhole sections shall be manufactured, tested and marked in accordance with the latest provisions of ASTM Specification C-478.

Manholes shall be constructed of specified materials to the sizes, shapes and dimensions and at the location shown on the drawings or as otherwise directed by the ENGINEER. The height or depth of the manhole will vary with the location, but unless shown otherwise on the drawings, shall be such that the top of the manhole frame will be at finish grade in pavement and 12 inches above ground surface elsewhere and the invert will be at the designated elevations. Wall thickness of precast concrete manholes shall be as shown on the drawings.

Manholes shall be constructed of precast reinforced concrete manhole rings, unless specified otherwise. Form and dimensions shall be as shown on drawings. Bases for manholes may be poured in place or precast concrete.

The minimum compressive strength of the concrete for all sections shall be 4,000 psi.

The maximum allowable absorption of the concrete shall not exceed 8 percent of the dry weight.

The ends of each reinforced concrete manhole riser section and the bottom end of the manhole top section shall be so formed that when the manhole risers and the top are assembled, they will make a continuous and uniform manhole.

Joints of manhole sections shall be of the tongue and groove type with performed plastic gasket meeting the requirements of Federal Specification SS-S-00210, "Sealing Compound, Preformed Plastic for Pipe Joints" Type 1, Rope Form. The sealing compound shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler and shall contain no solvents, irritating fumes, or obnoxious odors. The compound shall not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength. It shall be supplied in extruded rope-form of suitable cross-section and of such sizes as to seal the joint space when the manhole sections are set. The sealing compound shall be protected by a suitable removable two-piece wrapper.

Each section of the precast manhole shall have not more than two (2) holes for the purpose of handling and laying. These holes shall be tapered and shall be plugged with rubber stoppers or mortar after installation.

2.02 Manhole Castings

Manhole frames and lids shall be cast iron conforming to the minimum requirements of Federal Specification WW-1-652 or to the latest ASTM Specification A-48, for Class 30 gray iron castings. All castings shall be made accurately to the required dimensions, fully interchangeable, sound, smooth, clean and free from blisters and/or other defects. Defective castings which have been plugged or otherwise treated shall not be used.

Manhole frames and lids shall be of the size shown on the drawings and as manufactured by J.R. Hoe & Sons, Neenah Foundry Co. No R1772-C, Clow No. F-3245-1 or equal. Sanitary sewer manhole covers shall have the word "Sanitary Sewer" cast on the top in letters 2 inches high.

Watertight manhole covers shall be equal to J.R. Hoe & Sons, Neenah Foundry Co., or equal. The size shall be as shown on the drawings.

2.03 Manhole Steps

Manhole steps shall be reinforced with three-eighths inch (3/8") Re-bar (minimum) and shall have a polypropylene plastic coating identical to the dimensions of cast iron manhole steps. They shall be produced specifically for use as manhole steps. Spacing of steps shall be built into the walls of all manholes.

Manhole steps shall be installed in each section of the manhole in accordance with the details on the drawings.

2.04 Line Connectors

All manholes shall have rubber gasket line connectors with stainless steel power expansion sleeves and clamps for the installation of the line such as manufactured by Press Seal Gasket Company or approved equal.

PART 3 - EXECUTION

3.01 Installation

Manhole inverts shall be constructed of 1:2 grout in accordance with details on drawings and inverts shall have the same cross-section as the invert of the sewer which they connect. The manhole invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in direction of flow through the sewer shall be made to a true curve with as large a radius as the size of the manhole will permit.

The cast iron frame for the manhole cover shall be set at the required elevation and properly anchored to the masonry. Where manholes are constructed in paved areas, the top surface of the frame and lid shall be tilted by using slanted grade rings as required to conform to the exact slope, crown and grade of the existing adjacent pavement.

Masonry work shall be allowed to set for a period of not less than 24 hours. Outside forms, if any, then shall be removed and the manhole backfilled and compacted in the manner provided in these specifications. All loose or waste material shall be removed from the interior of the manhole. The manhole cover then shall be placed and the surface in the vicinity of the work cleaned off and left in a neat and orderly condition.

After backfilling has been completed, the excavated area, if located in a street, alley or sidewalk, shall be provided with a temporary surface.

END OF SECTION

Section-02831

Chain Link Fences

And Gates

SECTION 02831

CHAIN LINK FENCES AND GATES

PART 1: GENERAL

1.01 Work Included

This section will cover fences to be constructed at locations and in the manner shown on the Plans.

PART 2: PRODUCTS

2.01 Chain Link Fencing

Chain link fencing shall be standard overall height of eight (8) feet and constructed of chain link fabric with three rows of barb wire on top of steel brackets. Chain link fabric shall be one foot less than complete overall height of fence.

Vehicular gates shall be of single swing type having opening of 20 feet, unless otherwise shown on the Plans.

Braces shall be provided at all corners and wherever fabric is not continuous, such as at gates or at other openings. Braces shall be of the same material as top rail. Extension arms on intermediate posts shall be of pressed steel. Extension arms shall carry 3 barbed wires. Fittings used in connection with the fence and gates shall be malleable iron or pressed steel. Barbed wire shall be four-point pattern, two strand, No. 12-1/2 gauge, copper-bearing steel wire, heavily hot galvanized after weaving, with large barbs placed 3 inches apart. Chain link fabric shall be copper-bearing base metal No. 9 gauge wire heavily zinc coated by hot dip process after weaving. The fabric shall have a knuckled selvage along the top rail and a twisted and barbed selvage at the bottom. The barbing shall be done by cutting the wire on a bias, creating sharp points. A 2-inch padlock and chain shall be furnished with each gate. Three keys shall be furnished with each padlock. Chain shall be welded to the gate

PART 3: EXECUTION

3.01 Installation

End, corner and gate posts shall be set in a concrete base not less than 18 inches in diameter which shall extend at least three inches below the bottom of the post. The post shall extend to a depth of at least three feet below the surface of the ground. A brace shall be spaced midway in height of each end, corner and gate post and shall extend to the first line post. Braces shall be securely fastened to posts by means of malleable iron connections and trussed from line post back to end, corner or gate post with a 3/8 inch diameter rod.

Line posts shall be set in a concrete base not less than 12 inches in diameter which shall extend at least three inches below the bottom of the post. The post shall extend to a depth of at least thirty inches below the surface of the ground. Line posts shall be equally spaced along the line of fence at intervals not to exceed ten (10) feet.

Galvanized steel pipe sleeves, 4 inch O.D. for corner, pull and gate posts and 3-1/2 inch O.D. for line posts shall be embedded in concrete as shown on the plans for all fence posts to be installed on concrete structures.

Top rail shall be installed between line posts. Fabric shall not be erected until concrete has had sufficient time to cure. Chain-link fabric shall be stretched to uniform tightness on the outside of the posts with suitable tools and shall be attached with No. 6 gauge galvanized wire clips securely clinched and attached by means of adjustable clamps.

END OF SECTION

Section-02910

Finish Grading, Sodding

And Seeding

SECTION 02910

FINISH GRADING, SODDING AND SEEDING

PART 1: GENERAL

1.01. SCOPE OF WORK

A. Furnish all labor, materials, equipment and services necessary for, and incidental to the work of finish grading and seeding of the site in accordance with the drawings and specifications.

B. Finish grading and seeding is requested at all disturbed areas within the site boundaries, adjacent rights-of-way and slope easements not covered by building or paving and shall be done after the completion of rough grading, paving, and installation of walks and utilities.

1.02 PRODUCT DELIVERY, STORAGE, HANDLING

A. Store topsoil, seeding materials and equipment in areas designated by the OWNER's Site Representative.

1.03 JOB CONDITIONS

A. Seedings shall not be placed on frozen soil or when the outside temperature is below 32 degrees F.

B. Topsoil shall not be spread or tillage done when conditions are such, by reason of drought or excessive moisture, that satisfactory results are not likely to be obtained.

1.04 GUARANTEE

A. Provide a one year guarantee but not less than one (1) full growing season that all seeded and sodded areas will have a 95 percent vegetative cover of lawn grasses free of noxious weeds.

PART 2: PRODUCTS

2.01 GRASS SEED

A. Seed shall be composed of the required varieties which shall be mixed in the proportions and shall test the minimum percentages of purity and germination specified.

B. All seed shall be certified Blue Tag Class as classified by the Kentucky Seed

Improvement Association.

C. Seed shall be fresh, clean, new crop seed. Seed may be mixed by the dealer. If the seed is mixed by the dealer, furnish to the OWNER's Site Representative the dealer's guaranteed statement of the composition of the mixtures and the percentages delivered before use.

D. Seed Mixture: The lawn seed shall be clean, fresh seed as follows:

NAME	LB. PER 1000 SQ. FT.	% OF PURITY	% OF GERMINATION
Kentucky Bluegrass (Combination of 2 varieties such as Windsor and Kenblue)	1	90	80
Tall Fescue (Kenwall Kenhy or Florie)	3	95	80
Annual Ryegrass	2	90	90

PART 3:EXECUTION

3.01 INSPECTION

A. Verify that rough grading has been completed and that there are no errors or defects which would result in poor application or cause latent defects in the finished grading or seeding.

3.02 PREPARATION OF FINISH GRADING

A. The rough grade, where compacted, shall be loosened to depth of two inches (2") and then regraded to maintain proper elevation. All stones over 2" in size, sticks, rubbish and any other extraneous matter shall be removed from rough grade before beginning finish grading.

3.03 FINISH GRADING AND SEED BED PREPARATION

A. Spread topsoil over areas to receive finish grading as required to obtain a minimum 3" thick layer compacted measure and/or to bring these areas to finish grade. Care shall be taken in this operation not to compact the sub grade.

B. Leveling: Any undulations or irregularities in the surface resulting from tillage, fertilizing, liming or other operations shall be leveled out by use of a float before seeding operations are begun.

C. Rolling: Roll entire area with 200 pound roller after leveling.

D. Clean-Up: Prior to seeding, the surface shall be cleared of all stones, or other objects larger than one inch in thickness or diameter and of all roots, brush, wire and other objects that might be a hindrance to maintenance operations.

3.04 SEEDING

A. After the areas to be seeded have been brought to the approximate finished surface grade by the use of existing or hauled in topsoil, they shall be fine graded. All small areas or those adjacent to the trees, planted areas, buildings, walks or other structures shall be fine graded by hand tools, but larger areas may be fine graded by mechanical devices if done in a manner acceptable to the OWNER's Site Representative. No fine grading shall be done when the soil is frozen or muddy. Do not overwork the soil. A finely pulverized seed bed can soon develop a dusty mulch resulting in crusting after rain. It is more subject to wash and seed float. Soil clods ranging in size from grapes to walnuts would be ideal. After rain, the seed bed shall be prepared for sowing and repeated after each rain until lawn in completed.

B. Seed may be applied by drilling, broadcasting, or hydro-seeding.

C. Reseeding: All seeded areas which do not show satisfactory grass shall be reseeded as herein specified at intervals of 21 days, until a satisfactory turf is established.

3.05 PROTECTION

A. The seeded area shall be protected by straw mulch.

3.06 MAINTENANCE

A. Lawns shall be protected against damage including erosion and washouts, damaged areas shall be promptly reseeded. Settled trenches or other areas and shall be filled and reseeded.

3.07 CLEANING UP SITE OF THE WORK

A. Upon completion of the work, the CONTRACTOR shall remove from the site of all excess sub-soil, cordage, wrappings and other extraneous material. He shall remove all his tools, equipment and other material, except those necessary for maintenance. Litter developing by reason of the CONTRACTOR's maintenance shall be removed as it gathers.

Section-03200

Steel Reinforcement

For Concrete

SECTION 03200

STEEL REINFORCEMENT FOR CONCRETE

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install all concrete reinforcement as shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete Joint Accessories are included in Section 03250.

B. Cast-in-place Concrete is included in Section 03300.

1.03 SUBMITTALS

A. SUBMITTALS shall be in accordance with Section 01300.

B. The following shall be submitted for review prior to the fabrication of reinforcement.

1. Placing drawings for steel reinforcement.

2. Bar bending details.

C. The fabricator shall certify the following on reinforcing shop drawings:

1. That the reinforcing steel supplied conforms to ASTM A615 including Supplementary Requirement S1.

1.04 REFERENCE STANDARDS

A. Steel reinforcement in concrete shall conform to ACI 318 unless otherwise Specified.

1.05 PRODUCT DELIVERY AND HANDLING

A. Reinforcing shall be substantially free from mill scale, rust, dirt, grease, or other foreign matter.

B. Reinforcement shall be shipped and stored with bars of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing the same designations as shown on the submitted placing drawings.

C. Reinforcing steel shall be stored off the ground and shall be protected from moisture and kept free from dirt, oil, or other injurious contaminants.

PART 2: PRODUCTS

2.01 MATERIALS

A. Materials shall be new, shall be of domestic manufacture and shall conform to the following material specifications.

1. Deformed concrete reinforcing bars: ASTM A 615, Grade 60 including Supplementary Requirement SI for deformed bars.

2. Welded steel wire fabric: ASTM A185.

2.02 FABRICATION OF REINFORCEMENT

A. Fabrication tolerances shall be in accordance with the CRSI, Manual of Standard Practice-Fabrication.

B. Bars shall be cold bent.

C. Bars shall be bent around a revolving collar having a diameter of not less than that recommended by the CRSI, Manual of Standard Practice Detailing. Hooks shall conform to the same Manual.

D. Bars that are to be butt spliced, placed through limited diameter holes in metal or have a threaded end shall have the applicable end(s) saw-cut.

PART 3: EXECUTION

3.01 INSTALLATION

A. Surface condition, bending, spacing, and tolerances of placement of reinforcement shall conform to the CRSI, Manual of Standard Practice-Field Erection.

B. Except as otherwise indicated on the Drawings, the minimum concrete cover of reinforcement shall be as follows:

1. Concrete cast against and permanently exposed to earth; 3-in.

2. Concrete surfaces in contact with soil, water, sewage, sludge or exposed to the weather; 2-in.

3. Concrete surfaces not in contact with soil, water, sewage, sludge or exposed to the weather:

C. Reinforcement which is to be exposed for a considerable length of time after being placed shall be painted with a heavy coat of neat cement slurry.

D. If welding is required the reinforcing ASTM A615 bars shall be substituted with ASTM A706 bars.

3.02 REINFORCEMENT AROUND OPENINGS

A. Place an equivalent area of steel to that interrupted by an opening, pipe penetration, electrical conduit group or duct penetration around the opening or penetration. The bars shall have sufficient length to develop bond at each end beyond the opening or penetration.

3.03 SPLICING OF REINFORCEMENT

A. Except as otherwise indicated on the Drawings, compression embedment and lap splices shall be 40 diameters. The lap splice length for any column vertical bars shall be based on the bar size in the column above.

B. Except as otherwise indicated on the Drawings, tension lap splices shall be in accordance with the applicable tables in the ACI 315 Detailing Manual.

3.04 ACCESSORIES

A. The Contractor is solely responsible for determining, providing and installing accessories such as chairs, chair bars, and the like in sufficient quantities and strength to adequately support the reinforcement and prevent its displacement during the

erection of the steel and the placement of concrete and to provide spacings of bars with adequate cover as shown on the Drawings or specified herein.

B. Precast concrete blocks with wires shall be used where the reinforcing steel is to be supported over soil.

C. Stainless Steel protected bar supports shall be used to firmly hold vertical reinforcement in position.

D. Alternate methods of supporting top steel in slabs, such as steel channels supported on the bottom steel or vertical reinforcing steel fastened to the bottom and top mats, may be used if accepted by the Engineer.

3.05 INSPECTION

A. In no case shall any reinforcing steel be covered with concrete until the amount and position of the reinforcement has been observed by the Engineer and his permission given to proceed with the concreting. The Engineer shall be given ample prior notice of the availability of set reinforcement for his review.

END OF SECTION

Section-03300

Cast-In-Place

Concrete

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1: GENERAL

1.01 SCOPE OF WORK

Furnish all labor, materials, equipment and incidentals required to place all cast-in-place concrete, reinforcing steel, forms, and miscellaneous related items, including sleeves, reglets, anchor bolts, inserts and embedded items, as shown on the Drawings and as specified.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete Reinforcement is included in Section 03200.

B. Concrete finishes are included in Section 03345.

C. Metal fabrications to be cast in concrete are included in Division 5.

D. Electrical items cast into concrete are included in Division 16.

1.03 DESCRIPTION

A. Concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, water and admixtures as specified and shall be ready-mixed concrete All constituents, including admixtures, shall be batched at the central batch plant.

B. Reinforced concrete shall comply with ACI Specifications 318.

C. All concrete testing services required shall be provided by the Contractor using a testing laboratory acceptable to the Engineer and the Owner.

D. Samples of constituents and of concrete as-placed will be subjected to laboratory tests. All materials incorporated in the Work shall conform to accepted samples.

1.04 QUALITY ASSURANCE

A. The actual acceptance of aggregates and development of mix proportions to produce concrete complying with the specific requirements of this Section shall be determined by means of prior laboratory tests made with the constituents to be used on the Work.

B. The following limiting strengths, water contents and cement factors shall apply.

Table 03300-1

Minimum Compressive Strength,f'c (psi at 28 days)	Maximum Water Content* (gals./100 lbs.)	Net Minimum Cement Factor*** (100 lbs./c.y.)
4000		

1. Minimum compressive strength shall be as shown in Table 03300-1. The Contractor shall increase cement content or the combined cement plus fly ash content when fly ash is used, as required to meet strength requirements. The amount of fly ash used shall not exceed 25 percent nor be less than 15 percent of the total weight of fly ash plus cement.

2. When high early-strength Portland cement is permitted, the same strength requirements shall apply except that the indicated strengths shall be attained at seven days instead of 28 days.

D. If, during the progress of the work, it is impossible to secure concrete of the required workability and strength with the materials being furnished, the Engineer may order such changes in proportions or materials, or both, as may be necessary to secure the desired properties. All changes so ordered shall be made at the Contractor's expense.

E. If, during the progress of the work, the Contractor desires to use materials other than those originally accepted or if the materials from the sources originally accepted change in characteristics, the Contractor shall, at his expense, make new acceptance tests of aggregates and establish new design mixes. Such testing and design shall be accomplished with the assistance of a testing laboratory acceptable to the Engineer.

F. Consistency of the concrete as measured by the ASTM C 143, shall be as shown in Table 03300-2.

Table 03300-2

	Slump (inches) Portion of Structure	Recommended Range
Pavement and slabs on ground	2	1-3

Plain footings, gravity walls, slabs and beams	2-3	1-4
Heavy reinforced foundation walls and footings	3-4	2-5
Thin reinforced walls and columns	4	3-5

1. Concrete shall be of a consistency which can be readily worked into the corners and angles of the forms and around the reinforcement, inserts, and wall castings without permitting materials to segregate or free water to collect on the surface. Consideration shall be given to the proposed methods of placing and compacting in establishing the consistency of the concrete.

1.06 ACCEPTANCE TESTS

A. The actual proportioning of cement, aggregates, and water necessary to produce concrete complying with the requirements of Table 03300-1, shall be determined by tests made with representative samples of the materials to be used for the Work. Tests shall be made by a testing laboratory approved by the Engineer. Testing shall comply with ASTM C 39.

B. Cement shall be tested to Certify Compliance with the requirements of this Specification. Methods of testing shall comply with the appropriate Specifications, but the place, time, frequency, and method of sampling will be determined by the engineer in accordance with the particular need.

C. Samples of fine and coarse aggregates shall be furnished for examination and testing at least three weeks before the Contractor proposes to use them in the work.

PRODUCTS

2.01 MATERIALS

A. Materials shall comply with these Specifications and any State or local specification requirements.

B. Cement for all cast-in-place concrete shall be domestic Portland cement (ASTM C 150, Type II), high early strength portland cement (ASTM C 150, Type II) or ASTM C 150 Type I mixed with fly ash free from injurious water soluble salts or alkalies. Cement brands shall be subject to approval by the Engineer. Air entraining cements shall not be used.

1. Fly ash may be combined at the batch plant or during the production of cement.

The type I cement and the fly ash shall comply with these Specifications individually and as a combination.

2. High early strength cement shall be used only after obtaining written approval from the Engineer.

C. Aggregates

1. Fine aggregate shall consist of washed inert natural sand conforming to the requirements of ASTM C 33 and the following detailed requirements:

   a. Gradation:

Sieve (ASTM Specification E11)	Retained
3/8 in.	0%
No. 4	0-5%
No. 8	0-20%
No. 16	15-50%
No. 30	40-75%
No. 50	70-90%
No. 100	90-98%
Fineness Nodule	2.60-3.00
Organic	See Plate 2, ASTM C 33
Silt	2.0% maximum
Mortar Strength	95% minimum as per ASTM C 87 Section 10
Soundness	8% maximum loss, using magnesium sulfate, subjected to 5 cycles

2. Coarse aggregate shall consist of well-graded crushed stone or washed gravel conforming to the requirements of ASTM C 33, Class 5M, and the following detailed requirements.

Organic	See Table 1, per ASTM C 33
Silt	1.0% maximum
Soundness	8% maximum loss, using magnesium sulfate, Subjected to 5 cycles

3. Maximum coarse aggregate size shall be:

2-inch for mass concrete
1-inch for reinforced Section 10-in and over in thickness
3/4-inch for reinforced sections less than 10~in thickness

The "Designated Size" and the corresponding gradations shown represent the end or combined gradation of the coarse aggregate to be used in the final concrete.

D. Water

1. Water shall be clean and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

2. Mortar specimens made with the water under examination and normal Portland cement shall have at least 100 percent of the strength of similar specimens made with distilled water when tested for 26-day Strength in accordance with ASTM C 87.

3. Potable tap water will normally fulfill the requirements noted. Water from all other sources shall be tested and approved before use and shall not contain impurities in excess of the following limits:

   a. Acidity or alkalinity calculated in terms of calcium carbonate: 0.05%
   b. Total organic solids: 0.05%
   c. Total inorganic solids: 0.08%
   d. Total chlorides as sodium chloride: 0.05%

E. Admixtures

1. A water reducing agent such as pozzolan, WRDA or approved equal shall be used in all concrete. The admixture shall comply with ASTM Specification C 494, Type A or Type D, shall contain no chlorides, shall be nontoxic after 30 days, and shall be compatible with the air entraining admixtures. Proportioning and mixing shall be as recommended by the manufacturer.

2. Admixtures causing accelerated setting of cement in concrete shall not be used.

3. Air entraining admixtures compatible with the concrete mix shall be used in moderation along with the water reducing agent to obtain the specified percent air in the resultant concrete.

F. Pozzolan (Fly ash)

1. The pozzolan to be used in combination with Type I cement shall be Class C or Class F fly ash conforming to ASTM C 618, including the requirements of Table IA, and the following supplementary requirements:

a. Carbon Content by weight, Maximum	3%
b. Loss on Ignition, Maximum	3%
c. Water Requirement, Maximum, Percent of Control	100%
d. Fineness, Maximum Retained on a No. 325 Sieve	25%

2. The Engineer may require testing of the fly ash and/or the fly ash and Concrete mixture to provide test data confirming that the fly ash in combination with the Cement to be used meets all strength requirements, is compatible with air-entraining agents and other additives, and provides sulfate resistance equivalent to or better than that of Type II cement. The cost of such testing shall be at the expense of the Contractor.

   a. Pozzolan shall be tested in compliance with ASTM C311 with the following restriction: A minimum of one sample weighing four pounds shall be taken from each 200 tons of pozzolan supplied for the project. The sample shall be tested and the pozzolan certified to meet the requirements previously noted. Such certification shall be presented to the Engineer prior to use of the pozzolan in the Work.

G. Non-Shrink Cement Grout: Non-shrink Cement Grout shall consist of cement, aggregate and additives formulated to meet the following volume change requirements. Early volume change (within 24 hours) as tested by ASTM C827 shall be limited to zero (0) percent shrinkage and four tenths (0.4) percent maximum expansion. Long term volume change of hardened non shrink cement grout (after 1 day of cure) shall conform to the Corps of Engineers Specification for Non-Shrink Grout, CRD-C621-82B. Shrinkage shall be 0% and expansion limited to a maximum of 0.4% volume change. Cement additives required to meet this specification shall be recommended by the grout manufacturer but shall be non staining and non-metallic. Grout shall be equal to Five Star products by the U.S. Grout Corporation.

Grout shall be mixed as recommended by the manufacturer to give the necessary consistency for placing and to give a minimum compressive strength of 3000 lbs. per sq. inch in three (3) days.

PART 3: EXECUTION

3.01 MEASURING MATERIALS

A. Measure materials by weighing except as otherwise specified or where other methods are specifically authorized by the Engineer. The apparatus provided for weighing the aggregates and cement shall be suitably designed and constructed for this purpose. Scales shall have been certified by the local Sealer of Weights and measures within one year of use, The accuracy of all weighing devices shall be such that successive quantities can be measured to within one percent of the desired amount.

B. Cement, fly ash when used, and each type of aggregate shall be weighed separately. Cement in standard packages (sacks) need not be weighed, but bulk cement and fractional packages shall be weighed.

C. Water shall be measured by volume or by weight. The water-measuring devices shall be capable of control to one-half percent accuracy. All measuring devices shall be subject to approval by the Engineer.

D. Admixtures shall be dispensed either manually with use of calibrated containers or measuring tanks, or by means of an automatic dispenser approved by the manufacturer of the specific admixture.

3.02 MIXING

A. Concrete shall be ready-mix concrete by equipment acceptable to the Engineer. No hand-mixing will be permitted. Adding water in controlled amounts during the mixing cycle shall be done only with the expressed approval of the Engineer and under his direction. The amount of water added shall be shown on each delivery invoice.

B. Ready-mix concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of rated capacities for the respective conditions as stated on the name plate.

C. All central plant and rolling stock equipment and methods shall comply with the latest Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers' Bureau of the National Ready-Mixed Concrete Association, as well as ASTM Standard 318 Section 5.2, and ASTM C 94.

D. Retempering of concrete or mortar which has partially hardened (that is, mixing with or without additional cement, aggregate, or water) will not be permitted.

E. Attention is called to the importance of dispatching trucks from the batching plant so they arrive at the site of the work just before the concrete is required, thus avoiding excessive mixing of concrete while waiting or delays in placing successive layers of

concrete in the forms.

3.03 FIELD TESTS

A. Sets of three field control cylinder specimens will be taken at random by the Engineer during the progress of the Work, in compliance with ASTM C 31; the total number of specimens taken on the project shall average one set per 150 cubic yards, and in general not less than one set of specimens shall be taken on any one day. When average 2-day compressive strength of control cylinders in any set falls below the required compressive strength or below proportional minimum seven-day strengths (where proper relation between seven and 28 day strengths have been established by tests), proportions, water content, or temperature conditions shall be changed to achieve the required strengths.

B. The Contractor shall cooperate in the making of tests by allowing free access to the work for the selection of samples, providing an insulated closed curing box for specimens, affording protection to the specimens against injury or loss through his operations, and furnishing material and labor required for the purpose of taking concrete cylinder samples. All shipping of specimens will be paid for by the Contractor. Curing boxes shall be acceptable to the Engineer.

C. Slump tests shall be made in the field by a qualified representative of the testing laboratory.

D. Air entrainment shall be measured by the Owner's representative at the time the concrete is deposited in compliance with ASTM C 231.

3.04 INSPECTION AND CONTROL

A. The preparation of forms, placing of reinforcing steel, conduits, pipes, and sleeves, batching, mixing, transporting, placing and curing of concrete shall be at all times under the inspection of the Engineer.

B. The Contractor shall advise the Engineer of his readiness to proceed at least 24 hours prior to each concrete placement. The Engineer will inspect the preparations for concreting including the preparation of previously placed concrete, the reinforcing and the alignment and tightness of form work. No placement shall be made without the inspection and acceptance of the Engineer.

3.05 CONCRETE APPEARANCE

A. Concrete for the Work shall provide a homogeneous structure which, when

hardened, will have the required strength, durability and appearance.

B. Form work, mixtures and workmanship shall be such that concrete surfaces, when exposed, will require no finishing.

C. When concrete surfaces are stripped, the concrete when viewed in good lighting from 10 feet away shall be pleasing in appearance, and at 20 feet shall show no visible defects.

3.06 FORMS

A. Forms shall be used for all cast-in-place concrete including footings. Forms shall be constructed and placed so the resulting concrete will provide the shape, lines, dimensions, appearance, and elevations indicated on the Drawings.

B. Forms for all other cast-in-place concrete shall be made of wood, metal, or other acceptable material. Wood forms shall be constructed of sound lumber or plywood of suitable dimensions, free from knotholes and loose knots. Where used for exposed surfaces, boards shall be dressed and matched. Plywood shall be sanded smooth and fitted with tight joints between panels. Metal forms shall be of an acceptable type for the class of work involved and of the thickness and design required for rigid construction.

C. Edges of all form panels in contact with concrete shall be flush within 1/32-inch and forms for plane surfaces shall be such that the concrete will be plane within 1/16-inch in 4 feet. Forms shall be tight to prevent the passage of mortar, water and grout.

D. Molding or bevels shall be placed to produce a 3/4-inch chamfer on all exposed projecting corners, unless otherwise noted on the Drawings. Provide similar chamfer strips at horizontal and vertical extremities of all wall placements to produce 'clean' separation between successive placements as called for on the Drawings.

E. Forms shall be sufficiently rigid to withstand vibration and to prevent displacement or sagging between supports. Forms shall be constructed so that the concrete will not be damaged by their removal. The Contractor shall be entirely responsible for the adequacy of the forming system.

F. Forms, including new pre-oiled forms, shall be oiled before reinforcement is placed, with an approved nonstaining oil or liquid form coating not having a paraffin base.

G. Before form material is reused, all surfaces in contact with concrete shall be thoroughly cleaned; all damaged places repaired; all projecting nails withdrawn;

and all protrusions smoothed. Wood forms shall be pre-oiled before reuse.

3.07 PLACING AND COMPACTING

A. Unless otherwise permitted, work begun on any day shall be completed in daylight of the same day.

B. Place no concrete until reinforcing steel, pipes, conduits, sleeves, hangers, anchors, and other work required to be built into concrete have been inspected and approved by the Engineer. Remove water and foreign matter from forms and excavation. Place no concrete on frozen soil, and provide adequate protection against frost action during freezing weather. All soil preparation below slabs and footings shall be approved by the Engineer before placing concrete.

C. Transport concrete from mixer to place of final deposit as rapidly as possible by methods which prevent separation of ingredients and displacement of reinforcement, and which avoid rehandling. Deposit no partially hardened concrete.

D. "Cold Joints" are to be avoided unless called for on the Drawings. If they occur they are to be treated as bonded construction joints.

E. At construction joints, the surfaces of the concrete already placed, including inclined surfaces, shall be thoroughly cleaned of foreign materials, laitance, and weak concrete and roughened with suitable tools to expose a fresh face. At least two hours before and again shortly before the new concrete is deposited, the joints shall be saturated with water. After glistening water disappears, the joints shall be given a thorough coating of neat cement slurry mixed to the consistency of very heavy paste.

The surfaces shall receive a coating at least 1/8-inch thick, well scrubbed-in by means of stiff bristle brushes whenever possible. New concrete shall be deposited before the neat cement dries.

F. Deposit concrete to maintain, until the completion of the unit, a horizontal plastic surface. Vertical lifts shall not exceed 24-inches. Vertical lifts of 18 inches are preferable.

G. Pumping of concrete is an acceptable method of placement. The proposed pumping equipment and concrete mix shall be submitted to the Engineer prior to usage for approval.

H. Concrete shall be thoroughly compacted during and immediately after placement using suitable tools. Internal type mechanical vibrators shall be employed to produce

the required quality of finish. Vibration shall be done by experienced operators under close supervision and shall be of the duration required to produce homogeneity and optimum consolidation without permitting segregation of the solid constituents or pumping" or migration of air. All vibrators shall be supplemented by proper wooden spades to prevent puddling adjacent to forms and to remove bubbles and honeycomb. This is essential for the top lifts of walls. All vibrators shall operate at minimum 10,000 rpm. At least one vibrator shall be used for every 10 cubic yards of concrete placed per hour. In addition, one spare vibrator in operating condition shall be on the site.

I. Concrete slabs on the ground shall be well-tamped into place. Foundation materials shall be wet, tamped, and rolled until thoroughly compacted prior to placing concrete.

J. Concrete shall be deposited continuously in layers of such thickness that no concrete will be deposited on concrete which has sufficiently hardened to cause the formation of seams and planes of weakness within the section. If a section cannot be placed continuously, construction joints may be located at points as provided for in the Drawings or as acceptable to the Engineer.

3.08 CURING AND FROST PROTECTION

A. Protect all concrete work against injury from the elements and defacements of any nature during construction operations.

B. Concrete placed at air temperature below 40 deg F shall have a minimum temperature of 60 deg F. When the air temperature is below 40 deg F or near 40 deg F and falling, the water and aggregates shall be heated before mixing. Concrete shall be protected so the temperature at the surface will not fall below 50 deg F for at least 7 days after placing. The Contractor shall submit for acceptance by the Engineer the methods he proposes to use for concrete placement and curing during temperatures below 40 deg F. No salt, manure, or other chemicals shall be used for protection. Over heating or non-uniformity of heating shall be prevented. The surface temperature of the concrete shall not exceed 95 deg F during heating operations.

C. All concrete, particularly exposed surfaces, shall be treated immediately after concreting or cement finishing is completed to provide continuous moist curing above 50 deg F for at least 7 days, regardless of the ambient air temperature. Walls and vertical surfaces may be covered with continuously saturated burlap, or other approved means; horizontal surfaces, slabs, etc. shall be ponded to a depth of ½-inch or kept continuously wet by use of sprinklers.

D. In cold weather continuous warm curing (with supplementary heat when required)

shall provide a total of 350 day-degrees (i.e., 5 days at 70 F, etc.) of heat.

E. Wherever possible, finished surfaces and slabs shall be protected from the direct rays of the sun to prevent checking and crazing.

F. Concrete deposited in hot weather shall have a placing temperature which will not cause a difficulty from loss of slump, flash set or cold joints. In any case the temperature of concrete being placed shall not exceed 90 deg F. If necessary the Engineer may direct the Contractor to immediately cover plastic concrete with polyethlene sheeting to prevent rapid loss of moisture due to excessive ambient temperature and/or low humidity. This work will be considered a part of the Contract price and not an extra payment item.

3.09 REMOVAL OF FORMS

A. Except as otherwise specifically authorized by the Engineer, forms shall not be removed before the concrete has attained a strength of at least 30 percent of the 28-day compressive strength prescribed by the design, and not before reaching the following number of day-degrees (whichever is the longer).

Forms for	Day-degree*
Beams and slabs	500
Walls and vertical surfaces	100

*Day-Degree: Total number of days times average daily air temperature at surface of concrete. For example, 5 days at a daily weighted average temperature of 60 F equal 300 day-degrees. Temperatures below 50 deg F not to be included.

B. Shores shall not be removed until the concrete has attained at least 60 percent of the specified strength and also sufficient strength to safely support both its own weight and any construction live loads to which it will be subjected.

3.10 FAILURE TO MEET REQUIREMENTS

A. Should the strengths shown by the test specimens made and tested in compliance with the previous provisions fall below the values given in Table 03300-1, the Engineer shall have the right to require changes in proportions outlined to apply on the remainder of the Work, furthermore, the Engineer shall have the right to require additional curing on those portions of the structure represented by the test specimens which failed. The cost of such additional curing shall be at the Contractor's expense.

In the event that such additional curing does not give the strength required, as evidenced by core and/or load tests, the Engineer shall have the right to require strengthening or replacement of those portions of the structure which fail to develop the required strength. The cost of all such core boring and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be entirely at the expense of the Contractor. In such cases of failure to meet strength requirements the Contractor and Engineer shall confer to determine what adjustment, if any, can be made in compliance with Sections 15 and 17 of ASTM C 94.

B. When the tests on control specimens of concrete fall below the required strength, the Engineer will permit check tests for strengths to be made by means of typical cores drilled from the structure in compliance with ASTM C 42 and C 39. In case of failure of the latter, the Engineer, in addition to other recourses, may require, at the Contractor's expense, load tests on any one of the elements in which such concrete was used. Test need not be made until concrete has aged 60 days.

C. Should the strength of test cylinders fall below 60 percent of the required minimum 28-day strength, the concrete shall be rejected and shall be removed and replaced.

3.11 PATCHING AND REPAIRS

A. It is the intent of these specification to require forms, mixture of concrete and workmanship so concrete surfaces, when exposed, will require no patching.

B. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed, recesses left by the removal of form ties shall be filled, and surface defects which do not impair structural strength shall be repaired. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to approval of the Engineer.

C. Immediately after removal of forms remove plugs and break off metal ties as required by Article 3.06. Holes are then to be promptly filled upon stripping as follows: Moisten the hole with water, followed by a 1/16-inch brush coat of neat cement slurry mixed to the consistency of a heavy paste. Immediately plug the hole with a 1-1.5 mixture of cement and concrete sand mixed slightly damp to the touch (just short of 'balling'). Hammer the grout into the hole until dense, and an excess of paste appears on the Surface in the form of a spiderweb. Trowel smooth with heavy pressure. Avoid burnishing.

D. When patching or repairing exposed surfaces the same source of cement and sand as used in the parent concrete shall be employed. Adjust color if necessary by addition

of proper amounts of white cement. Rub lightly with a fine Carborundum Stone at an age of one to five days if necessary to bring the surface down with the parent concrete. Exercise care to avoid damaging or staining the virgin skin of the surrounding parent concrete. Wash thoroughly to remove all rubbed matter.

E. Defective concrete and honeycombed areas as determined by the Engineer shall be chipped down reasonably square and at least 1-inch deep to sound concrete by means of hand chisels or pneumatic chipping hammers. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly imbedded in the parent concrete, subject to Engineer's final inspection. If honeycomb exists around reinforcement, chip to provide a clear space at least 3/6-inch wide all around the steel. For areas less than 1-1/2-inch deep, the patch may be made in the same manner as described above for filling form tie holes, care being exercised to use adequately dry (non-trowelable) mixtures and to avoid sagging. Thicker repairs will require build-up in successive 1-1/2-inch layers on successive days, each layer being applied (with slurry, etc.) as described above. To aid strength and bonding of the multiple layer repairs, the Engineer may order the use of non-shrink, non-metallic grout as specified.

F. Non-Shrink Grout (see material specification Article 2.01-G)

1. For small repairs and patching the grout shall consist of the following minimum cement/sand proportions plus the manufacturers recommended additives.

Material	Volumes	Weights
Cement	1.0	1.0
Sand	1.5	1.5

2. For very heavy (generally formed) patches; the Engineer may order the addition of pea gravel to the mixture and the proportions modified as follows: (Non-shrink additives by manufacturer).

Material	Volumes	Weights
Cement	1.0	1.0
Sand	1.0	1.0
Pea Gravel	1.5	1.5

3.12 INSTALLATION SCHEDULE

A. Concrete for all structures shall have minimum compressive strength at 28 days of 4,000 psi.

3.13 FIELD CONTROL

A. The Engineer may have cores taken from any questionable area in the concrete work such as construction joints and other locations as required for determination of concrete quality. The results of tests on such cores shall be the basis for acceptance, rejection or determining the continuation of concrete. The Contractor shall cooperate in obtaining cores by allowing free access to the Work and permitting the use of ladders, scaffolding and such incidental equipment as may be required. The Contractor shall repair all core holes. The work of cutting and testing the cores will be at the expense of the Contractor.

END OF SECTION

Section-03345

Concrete Finishing

SECTION 03345

CONCRETE FINISHING

PART 1: GENERAL

1.01 SCOPE OF WORK

Furnish all labor, materials, equipment and incidentals required to finish cast-in-place concrete surfaces as specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Patching and repair of defective and honeycombed concrete is included in Section 03300.

B. Concrete curing is included in Section 03300.

1.03 SCHEDULE OF FINISHES

A. Concrete for the project shall be finished in the various specified manners either to remain as natural concrete or to receive an additional applied finish or material under another section.

B. The base concrete for the following conditions shall be finished concrete as noted and as further specified herein:

1. Concrete where not exposed in the finished work and not scheduled to receive an additional applied finish or material - Off-form finish. See paragraph 3.01D.

2. Concrete for exterior walks, interior and exterior stairs - Broomed finish perpendicular to direction of traffic. See paragraph 3.02B.

3. Concrete to receive hardener - Wood float finish, non-slip. See paragraph 3.02A2. (Provide hardener at interior slabs.)

1.04 RESPONSIBILITY FOR CHANGING FINISHES

A. The surface finishes Specified for concrete to receive additional applied finishes or materials are the finishes required for the proper application of the actual products specified. Where different products are approved for use, it shall be the Contractor's responsibility to determine if changes in finishes are required and to provide the proper finishes to receive these products.

B. Changes in finishes made to accommodate products different from those specified shall be performed at no additional cost to the Owner. Submit the proposed new finishes and their construction methods to the Engineer for acceptance.

PART 2: PRODUCTS

2.01 MATERIALS

A. Floor hardener shall be Frictex H aluminum oxide abrasive aggregate by Sonneborn, Minneapolis, Minnesota or equal as accepted by the Engineer.

PART 3: EXECUTION

3.01 FORMED SURFACES

A. Care shall be exercised to prevent damaging edges or obliterating the lines of chamfers, rustication or corners when removing the forms or doing any other work adjacent thereto.

B. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to the satisfaction of the Engineer.

C. Concrete not exposed in the finished work shall have off-form finish with fins and other projections removed and tie cones and defects filled as specified under Section 03300.

3.02 FLOORS AND SLABS

A. Floated Finish:

1. Machine Floating:

Screed floors and slabs with straightedges to the established grades shown on the plans. Immediately after final screeding, a dry cement/sand shake in the proportion of 2-sacks of Portland cement to 350 pounds of coarse natural concrete sand shall be sprinkled evenly over the surface at the rate of approximately 500 pounds per 1,000 square feet of floor. Neat, dry cement shall not be sprinkled on the surface. When the concrete has hardened sufficiently to support the weight of the power float used without digging in or disrupting the level surface, the shake shall be thoroughly floated into the surface with a heavy revolving disc type power compacting machine capable of providing a 200 pound compaction force distributed over a 24-inch diameter disc.

This compacting machine shall be the "Kelly Power Float" with "Compaction Control" as manufactured by Kelley Industries of SSP Construction Equipment, Inc.; P.O. Box 2038, Pomona, CA 91766; (714) 623-6184, or equal acceptable to the Engineer. Troweling machines equipped with float (shoe) blades that are slipped over the trowel blades may be used for floating. Floating with a troweling machine equipped with normal trowel blades shall not be permitted. The use of any floating or troweling machine which has a water attachment for wetting the concrete surface during finishing of a floor shall not be permitted.

Floating should start along walls and around columns and then move systematically across the surface leaving a matte finish.

NOTE: This operation (application of the cement/sand shake) may be eliminated at the discretion of the Engineer if the base slab concrete exhibits adequate fattiness and homogeneity, and the need is not indicated.

2. Hand Floating:

In lieu of power floating, small areas as defined by the Engineer may be compacted by hand floating. The dry cement/sand shake specified in 1 above shall be used unless eliminated by the Engineer. Screed the floors and slabs with straightedges to the established grades shown on the plans. While the concrete is still green, but sufficiently hardened to support a finisher and kneeboards with no more than 1/4-inch indentation, wood float to a true, even plane with no coarse aggregate visible. Sufficient pressure shall be used on the wood floats to bring moisture to the surface.

3. Finishing Tolerances:

Floors and slabs shall be level with a tolerance of 1/8 inch when checked with a 10-foot straightedge placed anywhere on the slab in any direction, except where drains occur, in which case floors shall be pitched to drains such that there are no high spots left undrained. Failure to meet either of the above requirements shall be cause for removal, grinding, or other correction as directed by the Engineer.

B. Broom Finish:

1. Finish concrete as specified in paragraph 3.02A. Then draw a stiff bristle broom lightly across the surface in the direction of drainage, or in the case of walks and stairs, perpendicular to the direction of traffic to provide a non-slip surface.

2. All outer edges of walks and drives including edges at expansion joints and

grooves shall be rounded.

3.03 APPROVAL OF FINISHES

A. All concrete surfaces, when finished, will be inspected by the Engineer.

B. Surfaces which, in the opinion of the Engineer, are unsatisfactory shall be refinished or reworked until accepted by the Engineer.

C. After finishing horizontal surfaces, regardless of the finishing procedure specified, the concrete shall be cured in accordance with Section 03300 unless otherwise directed by the Engineer.

END OF SECTION

Section-05120

Structural Steel

SECTION 05120

STRUCTURAL STEEL

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Provide labor, material, equipment and services necessary for proper and complete installation of all structural steel components.

B. Related work as called for on Drawings or specified in this or other specifications.

1.02 SUBMITTALS

A. SHOP DRAWINGS

1. Shop drawings shall include the following:

a. Complete details and schedules for fabrication of each member, and for shop assembly of members.

b. Complete details, schedules, procedures and diagrams indicating sequence of erection.

c. Mark each member indicated on shop drawings in such a manner than member designations on drawings coincide with member designation on member in field.

B. Submit test reports and other data as required to show compliance with Specification including certified copies of mill reports designating chemical and physical properties.

PART 2: PRODUCTS

2.01 MATERIALS

A. Rolled steel plates, beams, columns, bars, and Miscellaneous items shall be structural quality carbon steel complying with ASTM A 36 (minimum yield 36,000 psi).

B. Anchor bolts shall comply with ASTM A307. Nuts shall conform to ASTM A307, Grade B hexagon.

C. High-strength threaded fasteners shall be complying with ASTM A 36.

D. Electrodes for manual shield and metal-arc welding shall be covered mild steel electrodes complying with AWS Code and ASTM A588, or E70 as required. All wide flange structural steel shall meet ASTM A992 (50 ksi).

PART 3: EXECUTION

3.01 SHOP PAINTING

A. All new structural steel shall be shop primed in accordance with Section 09901.

3.02 FABRICATION

A. Fabricate and assemble structural assemblies in shop to greatest extent possible, Fabricate items of structural steel in accordance with requirements of A.I.S.C. Specifications and as indicated on final shop drawings.

B. Where finishing is required, complete assembly, including welding of units before start of finishing operation. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

3.03 CONNECTIONS

A. Weld all shop connections to develop full strength of section.

B. Bolt field connections, except where welded connections are indicated. Details indicated on Drawings are to illustrate general methods of connection and do not necessarily include all minor pieces required to complete the work. Such pieces shall be provided as specified and required.

C. Connections for beams shall be designed to support a reaction equal to one half the total uniform load capacity for the shape, span and steel specification of the particular beam as tabulated in tables for "Allowable Loads on Beams" in the AISC Manual of Steel Construction, latest edition.

D. Punch holes for Connection of all structural steel work in shop. Clearly mark such holes on shop drawings. Additional holes not indicated on Drawings shall be approved by Engineer and shall be drilled in field.

3.04 ERECTION

A. All structural steel shall be accurately set and properly secured in place.

B. All bolted connections shall be bearing type with thread, excluded from bearing area and using Direct Tension Indicator.

3.05 FIELD PAINTING

A. Structural steel shall be field painted in accordance with Section 09902.

END OF SECTION

Section-05510

Miscellaneous Metal

SECTION 05510

MISCELLANEOUS METAL

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install covers, grates, frames, manhole rungs, catch basin castings and other miscellaneous metals as shown on the Drawings and specified herein. The miscellaneous metal items include but are not limited to the following:

1. Miscellaneous anchors or anchor bolts except those specified to be furnished with all equipment.

2. Cast iron frames, covers, grates, drain leaders and drains.

3. Steel plates, overhead steel door frames, angle frames, plates and channels.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Pipe hangers, supports and concrete inserts along with pipe sleeves, wall sleeves, and wall castings are included under Division 15.

1.03 COORDINATION

A. The work of this Section shall be completely coordinated with the work of other Sections. Verify at the site both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items herein specified.

B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.

1.04 SUBMITTALS

A. Detail shop drawings, as provided for in the General Conditions and Section 01300, showing sizes of members, method of assembly, anchorage, and connection to other members shall be submitted to the Engineer for approval before fabrication.

1.05 FIELD MEASUREMENTS

A. Field measurements shall be taken at the site to verify or supplement indicated dimensions and to insure proper fitting of all items.

1.06 REFERENCE SPECIFICATIONS

A. Unless otherwise specified, materials shall conform to the following:

Structural Steel	ASTM A36
Gray Iron Castings	ASTM A48, Class 30
Galvanizing, general	ASTM A123
Galvanizing, hardware	ASTM A153
Galvanizing, assemblies	ASTM A386
Bolts and Nuts for wood & concrete	ASTM A307
Bolts and nuts for steel members	ASTM A325-N
Stainless Steel - Bolts, nuts and washers	ASTM A276, Type 316
I-Welding Rods for Steel	AWS Spec. for Arc Welding

PART 2: PRODUCTS

2.01 ANCHORS, BOLTS, AND FASTENING DEVICES

A. Anchors, bolts etc., shall be furnished as necessary for installation of the work of this Section.

B. Compound masonry anchors shall be of the type shown or required and shall be equal to Star Slug compound masonry anchors manufactured by Star Expansion Industries. Anchors shall be minimum "two unit" type.

C. The bolts used to attach the various members to the anchors shall be the sizes shown or required. Aluminum and stainless steel shall be attached to concrete or masonry by means of stainless steel machine bolts and iron or steel shall be attached with steel machine bolts unless otherwise specifically noted.

D. For structural purposes, unless otherwise noted, expansion bolts shall be Molly "Parabolts", Wej-it 'Ankr-Tite", Phillips Drill Co "Wedge Anchors", or Hilti Kwik-Bolt". When length of bolt is not called for on the Drawings, the length of bolt provided shall be sufficient to place the wedge portion of the bolt a minimum of 1-inch behind the reinforcing steel within the concrete. Material shall be galvanized steel, unless otherwise noted On the Drawings.

2.02 ALUMINUM ITEMS

A. Miscellaneous aluminum shapes and plates shall be fabricated as shown. Angle frames for hatches, beams, grates, etc., shall be furnished complete with welded strap anchors attached. Furnish all miscellaneous aluminum shown but not otherwise detailed. Structural shapes and extruded items shall conform to the detail dimensions or the plans within the tolerances published by the Aluminum Association, Inc.

2.03 STEEL ITEMS

A. Sleeves shall be steel or cast iron pipe in walls and floors with end joints as shown on the Drawings. All pipe sleeves shall have center anchor around circumference as shown.

B. Structural steel angle along with channel door frames shall be A36 steel provided as shown on the drawings. Frames shall be galvanized and shall be fabricated with not less than three anchors on each jamb.

C. All miscellaneous structural steel lintels and closures whether or not shown on the Drawings shall be galvanized steel and shall be provided as a part of this Section.

D. Miscellaneous steel pipe for sleeves and lifting attachments and other uses as required shall be Schedule 40 pipe fabricated according to the details shown on the Drawings.

E. Frames, covers and grates for manholes, catch basins and inlets shall be of a good quality, strong, tough even grained cast iron except as otherwise specified below. Castings shall be as manufactured by the Neenah Foundry, Mechanics Iron Foundry, or equal. Sizes shall be as shown on the Drawings. Covers to have letters "SEWER" or "DRAIN", as applicable, embossed on top.

F. Miscellaneous steel shall be fabricated and installed in accordance with the Drawings and shall include: beams, angles, support brackets, closure angles in roof at edge of T-beam, base plates to support ends of T-beams, splice plates, anchor bolts and any other miscellaneous steel called for on the Drawings and not otherwise specified.

G. Headed anchors shall be Nelson type H4L or 53L or equal, flux filled, welded to plates or other embeds as shown on the drawings. Studs shall be made from cold drawn steel grades C-1010 through C-1020 per ASTM A-l0B and shall be welded per the manufacturer's recommendations.

PART 3: EXECUTION

3.01 FABRICATION

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability.

B. Connections and accessories shall be of sufficient strength to safely withstand stresses and strains to which they will be subjected. Steel accessories and connections to steel or cast iron shall be steel, unless otherwise specified. Threaded connections shall be made so that the threads are concealed by fitting.

C. Welded joints shall be rigid and continuously welded or spot welded as specified or shown. The face of welds shall be dressed flush and smooth. Exposed joints shall be close fitting and jointed where least conspicuous.

D. Welding of parts shall be in accordance with the latest edition of the AWS structural welding code for steel (Dl.l) or aluminum (Dl.2) as appropriate and shall only be done where shown, specified, or permitted by the Engineer. All welding shall be done only by welders certified as to their ability to perform welding in accordance with the requirements of the AWS Code. Component parts of built-up members to be welded shall be adequately supported and clamped or held by other adequate means to hold the parts in proper relation for welding.

E. Welding of aluminum work shall be on the unexposed side as much as possible in order to prevent pitting or discoloration.

F. Ml aluminum finish exposed surfaces, except as specified below, shall have manufacturer's standard mill finish. A coating of methacrylate lacquer shall be applied to all aluminum before shipment from the factory.

G. Castings shall be of good quality, strong, tough, even-grained, smooth, free from scale, lumps, blisters, sand holes, and defects of any kind which render them unfit for the service for which they are intended. Castings shall be thoroughly cleaned and will be subjected to a hammer inspection in the field by the Engineer. All finished surfaces shown on the Drawings and/or specified shall be machined to a true plane surface and shall be true and seat at all points without rocking. Allowances shall be made in the patterns so that the thickness specified or shown shall not be reduced in obtaining finished surfaces. Castings will not be acceptable if the actual weight is less than 95 percent of the theoretical weight computed from the dimensions shown. The Contractor shall provide facilities for weighing castings in the presence of the Engineer showing true weights, certified by the supplier.

H. All steel finish work shall be thoroughly cleaned, by effective means, of all loose mill

scale, rust, and foreign matter before shipment and shall be given one shop coat of primer compatible with finish coats specified in Painting Section after fabrication but before shipping. Preparation for shop painting shall be in accordance with Steel Structures Painting Council Specification SP-6. Paint shall be applied to dry surfaces and shall be thoroughly and evenly spread and well worked into joints and other open spaces. Abrasions in the field shall be touched up with primer immediately after erection. Final painting is specified in Painting Section 09902.

I. Galvanizing, where required, shall be the hot-dip zinc process after fabrication. Following all manufacturing operations, all items to be galvanized shall be thoroughly cleaned, pickled, fluxed, and completely immersed in a bath of molten zinc. The resulting coating shall be adherent and shall be the normal coating to be obtained by immersing the items in a bath of molten zinc and allowing them to remain in the batch until their temperature becomes the same as the bath. Coating shall be not less than 2 oz per square foot of surface.

3.02 INSTALLATION

A. Items to be attached to concrete or masonry after such work is completed shall be installed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted. All dimensions shall be verified at the site before fabrication is started.

B. All steel surfaces to come in contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in accordance with the manufacturer's instructions prior to installation.

C. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of zinc-chromate primer followed by two coats of aluminum metal and masonry paint to the dissimilar metal.

D. Where aluminum contacts masonry or concrete, apply a heavy coat of acceptable alkali resistant paint to the masonry or concrete.

E. Where aluminum contacts wood, apply two coats of aluminum metal and masonry paint to the wood.

F. High strength steel bolting may be visually inspected. All high strength bolts shall have the turned portion marked with reference to the steel being connected after the nut has been made snug and prior to final tightening. These marks shall be considered in the inspection. Rejected bolts shall be either replaced or retightened as required. In cases of disputed bolt installations, the bolts in question shall be checked by a calibrated wrench certified by an independent testing laboratory

acceptable to the Engineer. The certification shall be at the Contractor's expense.

G. Any material or workmanship which is rejected by the Engineer either at the shop, mill, or buildings must be promptly replaced by the Contractor to the Engineer's entire satisfaction at no additional cost to the Owner. The fact that work has been accepted at the shop and mill shall not prevent its final rejection at the site, or even after it has been erected, if it is found to be defective in any way.

END OF SECTION

Section-05520

Metal Fabrications/

Handrails

SECTION 05520

METAL FABRICATIONS/HANDRAILS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, and equipment required to construct and install metal fabrications as shown on the Drawings and specified herein. Included in this section are handrails, grating, nuts, bolts, anchors, hatches, ladders, and stairs.

1.02 RELATED WORK NOT INCLUDED

A. Concrete work is included in Division 3.

B. Castings are included in Division 5.

C. Painting is included in Division 9.

1.03 QUALITY ASSURANCE

A. All fabricated materials shall be of the highest quality, free of structural, handling, and workmanship defects.

C. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.04 SUBMITTALS

A. Shop Drawings

1. The CONTRACTOR shall submit to the ENGINEER in accordance with Division 1, Section 01300 detailed shop drawings of all materials to be fabricated, and shall receive the Engineer's certification of review before fabrication. Include plans, elevations and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor bolt installation by others. Include any requirements for surface preparation, paint products, or grout.

2. Where materials or fabrications are indicated to comply with

certain requirements for design loadings, include structural computations, material properties and other information needed for structural analysis. This shall not relieve the CONTRACTOR of responsibility for all errors, omissions, and deviations of his shop drawings from the Drawings and Specifications and from requirements of final results called for in the Drawings and Specifications.

B. Samples

1. The CONTRACTOR shall submit 2 sets of representative samples of materials and finished products as may be requested by the ENGINEER, or as specified herein.

PART 2: PRODUCTS

2.01 MATERIALS

A. Steel

1. Prime and paint in accordance with Division 9, unless otherwise required or permitted.

2. Unless otherwise noted on the Drawings or in the Specifications, galvanizing shall be by hotdip process in accordance with ASTM A 525-93, Coating Designation G90 (previous Coating Class Commercial 1.25 oz. per sq. ft.).

B. Aluminum

1. Aluminum shall have a high resistance to corrosion and shall be Alloys 6061-T6, 6062-T6, 6063-T5, 6063-T6, or 6105-T5 for wrought products such as rods, bars, standard structural shapes, extrusions, and forgings; and Alloy 214 for castings, or equal.

2. Aluminum fabrication shall be in accordance with ASCE the Aluminum Association "Specifications for Aluminum Structures," latest revision. Welding shall be done by the argon-shielded tungsten-arc method or the automatic or semi-automatic argon-shielded consumable-electrode method, or equal. Welding rods and electrodes shall be in strict accordance with above specifications.

2.02 HANDRAILS AND TOEBOARDS

A. General

1. All handrail components and systems shall meet the requirements of Kentucky OSHA Standards for General Industry, ADAAG, and the Kentucky Building Code.

2. Handrail shall be the product of a company normally engaged in the manufacture of pipe railing.

3. Toeboards shall be provided on handrails as required by OSHA.

4. Openings in the railing shall be guarded by a self-closing handrail gate.

5. Handrail and toeboard finish shall be Aluminum Association Ml0-C22-A41 (215-R1). The pipe shall be plastic wrapped. The plastic wrap is to be removed after erection.

6. Aluminum surfaces in contact with concrete, grout or dissimilar metals shall be protected with a coat of bituminous paint or zinc chromate paint, mylar isolators, or other approved material.

7. Shop drawing submittals shall include verification that all components, including base flanges, side mounting assemblies and anchor bolts, will meet required strength capacities. Anchorages shall be identical to those shown on the Drawings.

8. Acceptable manufacturer:

   a. Hollaender Manufacturing Company - Interna-Rail
   b. A manufacturer providing an acceptable equivalent product.

B. Standard Aluminum Handrail

1. Handrail posts spacing shall be a maximum of 6'-0". Posts and railings shall be 1-1/2 inch diameter Schedule 40 aluminum pipe alloy 6063-T6. The manufacturer shall show that their posts are of adequate strength to meet the loading requirements. If the manufacturer's posts are not of adequate strength, the manufacturer may reduce the post spacing or add reinforcing dowels or may do both in order to meet loading requirements.

2. Handrails and stair rails shall be designed to withstand a 200 lb. concentrated load applied in any direction at any point on the top rail. Hand-rails and stair rails shall also be designed to withstand a load of 50 lb./ft. applied horizontally to the top rail. The 200 lb. load will not be applied simultaneously with the 50 lb./ft. load. In

addition, the handrails shall be designed to withstand a load of 100 lb./ft. applied vertically downward to the top rail and simultaneously with the 50 lb./ft. horizontal load. The 100 lb./ft. vertical load does not apply to stair rails.

3. The handrail shall be made of pipes joined together with component fittings. All components must be mechanically fastened with stainless steel hardware. Components that are pop-riveted or glued at the joints will not be acceptable.

4. Posts shall not interrupt the continuation of the top rail at any point along the railing, including corners and end terminations. The top surface of the top railing shall be smooth and shall not be interrupted by projecting fittings.

C. Performance

1. Handrail system design, construction and installation shall meet or exceed all applicable federal and state regulations. Handrail anchors, posts, rail and fabric shall be capable of withstanding a load of at least 200 pounds applied in any direction at any point on the top rail, with a minimum of deflection.

2. The manufacturer shall submit to the ENGINEER certified test data verifying the strength of his handrail system.

2.03 STEEL FRAMED STAIRS

A. General: Construct stairs to conform to sizes and arrangements indicated; join pieces together by welding unless otherwise indicated. Provide complete stair assemblies including metal framing, hangers, columns, railings, newels, balusters, struts, clips, brackets, bearing plates and other components necessary for the support of stairs and platforms and as required to anchor and contain the stairs on the supporting structure.

B. Stair Framing: Fabricate stringers of structural steel channels, or plates, or a combination thereof, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members as indicated. Bolt or weld headers to strings, newels and framing members to strings and headers; fabricate and join so that bolts, if used, do not appear on finish surfaces. Where masonry walls support steel stairs, provide temporary supporting struts designed for erection of steel stair components before installation of masonry.

C. Steel Floor Plate Treads and Platforms: Provide raised pattern steel floor plate complying with FS QQ-F-461, Class I. Provide pattern indicated or,

if not indicated, as selected from manufacturer's standard patterns. Provide plate manufacturer's standard abrasive granules, rolled into surface of steel plate, complying with ASTM A-283/A-283M-93, Grade A.

1. Form treads of 1/4 inch thick steel floor plate with integral nosing and back edge stiffener. Weld steel supporting brackets to strings and treads to brackets.

2. Fabricate platforms of steel floor plate of thickness indicated. Provide nosing matching that on treads at all landings. Secure to platform framing members with welds.

D. Galvanize all steel stair components.

2.04 STEEL PIPE RAILINGS AND HANDRAILS

A. Fabricate steel pipe railings and handrails to design, dimensions, and details indicated. Provide railing and handrail members formed of pipe of sizes and wall thickness indicated, but not less than that required to support design loading.

B. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.

1. At tee and cross intersections provide coped joints.

2. Form bends by use of prefabricated elbow fittings and radius bends or by bending pipe, at fabricator's option.

3. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross-connection of pipe throughout entire bend without buckling, twisting or otherwise deforming exposed surfaces of pipe.

4. Provide wall returns at ends of wall-mounted handrails, except where otherwise indicated.

5. Close exposed ends of pipe by welding 3/16 inch thick steel plate in place or by use of prefabricated fittings.

6. Toe Boards: Where required, provide toe boards at railings around openings and at the edge of open-sided floors and platforms. Fabricate to dimensions and details indicated, or if not indicated, use a 4" high x 1/4" plate secured to each railing post and

intermediate brackets, as required, with stainless steel fasteners. Provide for thermal expansion and contraction, as necessary, through elongated fastener holes, or equal.

C. Brackets, Flanges, Fittings and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings and anchors for interconnections of pipe and attachment of railings and handrails to other work. Furnish inserts and other anchorage devices for connecting railings and handrails to concrete or masonry work.

1. For railing posts set in concrete, provide sleeves of galvanized steel pipe not less than 6 inches long and with an inside diameter not less than 1/2 inch greater than the outside diameter of pipe. Provide steel plate closure welded to bottom of sleeve and of width and length not less than 1 inch greater than outside diameter of sleeve.

2. Provide friction fit, removable covers designed to keep sleeves clean and hold top edge of sleeve 1/2 inch below finished-surface of concrete.

D. Galvanize steel railings, including pipe, fittings, brackets, fasteners and other ferrous metal components.

2.05 GRATINGS

A. Gratings shall be the dimensions required on the Drawings and as required to meet deflection specs. below and of aluminum Alloy 6063-T5, 6063-T6, or 6061 -T6, or equal. Gratings shall be designed for an allowable uniformly distributed load of 200 lbs./s.f. and a concentrated load of 400 lbs./ft. of width with less than 0.25 inch deflection.

2.06 NUTS AND BOLTS

A. Unless otherwise shown on the Drawings or required in other parts of these Specifications, all nuts and bolts shall be in accordance with ASTM A 307-93a, Grade A and shall be electrogalvanized according to ASTM B 633-85 (1994).

B. All nuts, bolts, washers and accessories in contact with water, in any moist atmosphere or damp area such as occurs above water, or embedded in concrete exposed to the weather, shall be Type 302 or 304 stainless steel. Stainless steel nuts, bolts, and washers shall be used to fasten aluminum to all materials including aluminum.

2.07 CONCRETE ANCHORS

A. Sizes and spacings or numbers of anchors shall be shown on the Drawings and materials shall comply with exposure requirements listed under Nuts and Bolts above. All anchors used for securing moving or vibrating equipment (pumps, motors, gears, sluice gates, conveyors, etc.), shall be of the cast-in-place type.

B. The size and number of anchors shall be approved by the equipment manufacturer.

2.08 ALUMINUM LADDERS

A. Aluminum ladders shall be fabricated as detailed on the Drawings.

2.09 HATCHES

A. Metal hatches shall be fabricated as detailed on the Drawings.

2.10 GUARD POST

A. Concrete filled, steel posts shall be as shown on Drawings.

PART 3: EXECUTION

3.01 GENERAL

A. The CONTRACTOR shall be responsible for all errors, omissions, and deviations of the shop drawings from the Drawings and Specifications. Any errors or omissions shall be brought to the attention of the ENGINEER whose interpretation and instructions shall be received before proceeding with the fabrication of that portion of the work.

B. Manufacturers' printed installation instructions shall be strictly followed and any conflicts with the shop drawings and/or Contract Drawings shall be directed to the ENGINEER for resolution before proceeding with installation.

C. All base plates, inserts and anchorages shown embedded in concrete shall be accurately located and secured before placing concrete as per a manufacturer supplied template. All structural members and components shall be accurately leveled, plumbed and secured at locations shown on the Drawings.

D. Painting

1. Cleaning and painting of all fabricated materials shall be in strict

accordance with Division 9, of these Specifications.

E. Steel

1. All fabrication and erection shall be done in conformity with the "AISC Load and Resistance Factor Design Specification for Structural Steel Buildings," Second Edition dated December 1, 1993, latest revision.

2. Refer to Article 2.01 A. of this Specification Section for repair of galvanized surfaces.

F. Aluminum

1. The contact surfaces of aluminum with steel, dissimilar materials, concrete and/or masonry shall be protected from corrosion by a coating of coal tar, Kop-Coat Bitumastic Super Service Black, or equal.

2. Aluminum surfaces embedded in concrete shall be protected from corrosion by a tightly adherent coating of 2 applications of zinc chromate primer.

3.02 HANDRAILS

A. General

1. Shop drawings and handrail manufacturer's printed instructions shall be closely followed during handrail installation. Posts shall be installed plumb and rails parallel.

2. Required anchorages shall be strictly followed.

B. Workmanship

1. All rail and post cuts shall be square and accurate for minimum joint gap, clean and straight, and free of burrs and nicks.

2. In exterior and high humidity interior fabricated fitting installations, provision shall be made to drain entrapped water from inside the railing system to prevent electrolysis and/or damage from freezing. Manufacturer's printed instructions shall be strictly followed.

3. Welds and damaged areas shall be finished and coated according to Article 2.02, this Section.

4. Where required, holes shall be drilled and countersunk the correct size for proper fit of all components.

5. In aluminum handrail systems where protection is applied for prevention of electrolysis from dissimilar materials, visibility of protective material shall be minimized.

6. Handrail system surfaces shall be protected from physical damage and discoloration during storage, assembly and installation. manufacturer's coverings to protect anodized finishes shall be left intact until damage from construction operations no longer exists.

C. Rigidity

1. Posts shall be continuous from mounting surface to top rail.

2. Top and bottom rails shall be unspliced lengths between posts except as covered under expansion joints.

3. Railing manufacturer's instructions shall be strictly followed regarding torqueing and tightening of fittings, and type and materials of fasteners.

4. Only stainless steel fasteners shall be used in aluminum installations, unless otherwise noted.

3.03 GRATINGS

A. Grating frames shall be installed flush with the floor surface. Adequate blocking shall be provided to hold corners square during placing concrete and exposed aluminum surfaces shall be protected to prevent pitting from the concrete. Surfaces embedded in concrete shall be protected as covered under Article 3.01, this Section.

3.04 NUTS AND BOLTS

A. Bolts embedded in concrete shall be secured with templates at the time of pouring concrete. Bolts shall be suitably protected from damage throughout the construction period.

B. Damaged galvanized surfaces on nuts and bolts shall be repaired according to Article 2.01, this Section.

3.05 CONCRETE ANCHORS

A. Concrete anchors shall be installed strictly in accordance with manufacturer's printed instructions which shall be available on the job site.

B. Refer to Division 15 for supporting small pipe.

3.06 LADDERS

A. Install ladders as herein specified and as detailed on the Drawings.

3.07 HATCHES

A. Install hatches as herein specified and as detailed on the Drawings.

3.08 GUARD POSTS

A. Set in concrete as indicated. Fill cores solidly with air-entrained concrete having a 28-day minimum compressive strength at 4,000 psi.

END OF SECTION

Section-05531

Aluminum Access

Hatches

SECTION 05531

ALUMINUM ACCESS HATCHES

PART 1: GENERAL

1.01 SCOPE OF WORK

Provide all labor, materials, equipment and services required to furnish and install aluminum access hatches grating where shown on the Plans.

1.02 RELATED WORK

Section 05500 – Miscellaneous Metal

1.03 SUBMITTALS

A. Submit shop drawings as described in Section 01300.

B. Indicate areas where the hatches are to be used.

C. Show installation details.

D. Indicate coordination with equipment suppliers where openings for such equipment are required.

PART 2: PRODUCTS

2.01 CHANNEL FRAME ACCESS HATCHES

2.01 The hatches shall be as manufactured by the Bilco Company, or approved equal. Double leaf access hatches shall be Type JD and single leaf access hatches shall be Type J where channel frame installations are required. The size of the hatches shall be as shown on the Plans or of a size which is adequate for removal of the equipment below. Door leaf shall be ¼" aluminum diamond pattern plate to withstand a live load of 300 lb/ft^2 with a maximum deflection of 1/150th of the span. Channel frame shall be ¼" aluminum with an anchor flange around the perimeter and have a minimum cross-section area of 7-1/2 in^2 to allow for adequate water drainage. A Sch. 40 PVC pipe shall be attached to the channel frame to allow water to drain to the outside of the structure to a crushed stone french drain. Door shall be equipped with heavy forged brass hinges having 3/8" minimum diameter stainless steel pins and pivot so that the cover does not protrude into the channel frame. Compression spring

operators enclosed in telescopic tubes shall be provided for smooth, easy and controlled door operation throughout the entire arc of opening and closing. Operation shall not be affected by temperature. The door shall automatically lock in the vertical position by means of a heavy steel hold-open arm with release handle. A Type 316 stainless steel snap lock with a gasketed cover plug and a removable turn handle shall be provided. A 1-1/2" drainage coupling shall be located in the front right corner of the channel frame. Hardware shall be zinc plated and chromate sealed and all fasteners shall be Type 316 stainless steel. Finish shall be a Mill-finish with bituminous coating applied to exterior of the frame.

2.02 TEE FRAME ACCESS HATCHES

The hatches shall be as manufactured by the Bilco Company, or approved equal. Double leaf access hatches shall be Type KD and single leaf access hatches shall be Type K. The size of the hatches shall be as shown on the Plans or of a size which is adequate for removal of the equipment below.

Frame shall be ¼" extruded aluminum with built-in neoprene cushion and with strap anchors bolted to exterior. Door leaf shall be ¼" aluminum diamond plate to withstand a live load of 150 lb/ft^2 with a maximum allowable deflection of 1/150th of the span. Cast steel cam-action hinges shall be bolted to underside and pivot on torsion bars for smooth, easy and controlled door operation throughout the entire arc of opening and closing. Operation shall not be affected by temperature. Doors shall open to 90 degrees and lock automatically in that position. A vinyl grip handle shall be provided to release the cover for closing. A Type 316 stainless steel snap lock and removable turn handle shall be provided. Aluminum shall be mill finish, with bituminous coating to be applied to exterior of frame by manufacturer. Hardware shall be zinc plated and chromate sealed.

PART 3: EXECUTION

3.01 INSTALLATION

Installation shall be in accordance with manufacturer's instructions.

END OF SECTION

Section-06100

Carpentry and Millwork

SECTION 06100

CARPENTRY AND MILLWORK

PART 1: GENERAL

1.01. SCOPE

A. This work includes the furnishing of all labor, materials, tools, appliances, etc., necessary to the proper and complete job of carpentry, millwork and related items as shown on the Drawings as herein specified.

1.02. RELATED WORK

A. The General Conditions, Supplemental General Conditions, Special Conditions, and the applicable portions of Division 1 of the Specifications are a part of this Section.

B. The Contractor for this work shall be governed by any Alternate Bids requested insofar as they affect his work.

1.03. SHOP DRAWINGS

A. Shop drawings showing all necessary large scale and full size drawings of millwork shall be submitted to the Engineer in three (3) sets for approval prior to fabrication.

1.04. DELIVERY OF MATERIAL

A. All lumber when delivered to the site shall be stored and protected from injury or dampness and shall not be installed in any part of the building until the concrete and masonry in such part is dry.

PART 2: PRODUCTS

2.01. ROUGH HARDWARE AND FASTENINGS

A. This Contractor shall furnish all nails, spikes, bolts, screws, hangers, anchors, etc., of suitable types as required to properly secure the woodwork.

B. Fastenings for wood, ground, furring, etc., to masonry or concrete shall be of metal and of type and spacing best suited to conditions.

C. The use of wood plugs set in masonry for fastenings shall not be allowed.

2.02 FINISH HARDWARE

A. This Contractor shall receive all finish hardware to be furnished under another section, and shall store and be responsible for its safety, distribution, and application to the location listed in the hardware schedule.

B. Hardware shall be accurately fitted and adjusted.

C. Where practicable after fitting, hardware shall be taken off and be replaced after painting and finishing.

D. Where scheduled and/or practical, hardware removed from existing doors shall be re-used in new doors requiring similar hardware. Existing hardware shall be cleaned and reinstalled in properly working order.

2.03 MATERIALS - WOOD

A. The following specification for wood shall apply where indicated on the drawings.

B. The various grades and kinds of lumber herein specified shall be in accordance with the grading rules of the National Lumber Manufacturer's Association under whose jurisdiction the species was manufactured and conform to the American Lumber Standards, U.S. Department of Commerce or other applicable agencies. Structural lumber shall not exceed 19% moisture content. Finish items shall not exceed 12% moisture content. Unless otherwise indicated all items shall be dressed four sides with finish lumber well sanded, free from all tool marks.

C. Each panel of softwood plywood shall be identified with the DFPA grade - trademark of the American Plywood Association and shall meet the requirements of the latest edition of U.S. Product Standard PS 1-66 for Softwood Plywood.

D. Framing material and dimension lumber, shall be Douglas Fir, or approved equivalent in Southern Yellow Pine, Western Hemlock, or approved equal, 1500 f.

E. Concealed blocking, furring, grounds, cants, nailing strips, etc., shall be Standard Grade Douglas Fir, or approved equivalent in Southern Yellow Pine, Western Hemlock, or other suitable species.

F. Plywood sheathing shall be INT-DFPA "Plyscord", C-D grade, exterior glue.

G. Plywood concealed - DFPA B-D Interior Grade.

H. Thickness of plywood shall be 3/4" unless otherwise noted. Nail size, type, and spacing shall be as outlined in DFPA Construction Guide.

2.04 WOOD PRESERVATIVE

A. All permanent wood used for concealed framing, blocking, roofing strips and cants, flashing strips, curbs for equipment, etc., shall receive a non-leaching wood preservative treatment meeting the requirements of the American Wood Preservers Association (AWPA) for classification CCA Type C, and Federal Specification, TT-W-550 for CCA Type II Treatment shall be Osmose K-33, or equal.

2.05 INSULATION

A. Blanket (batt) insulation for sound attentuation where shown shall be fiberglass, by Owens Corning (or approved equal) of the thickness required to achieve the stated R value.

PART 3: EXECUTION

3.01. INSTALLATION

A. All work that is to be done under these specifications shall be done by mechanics and artisans skilled in their respective trades in order to produce first-class construction and installation of the work. All work shall meet all requirements of the Kentucky Building Code.

B. All framing material shall be put up in a substantial manner, properly cut, closely fitted, nailed and bolted into place as required for the conditions involved. Provide all anchors, cross bracing, clips, etc. required to meet code.

C. The application of plywood shall be in accordance with the recommendations of The American Plywood Association.

D. Install millwork items in accordance with details shown on the Drawings, square, level, or as otherwise required to scribe to adjacent walls or finished for near inconspicuous joints.

E. This Contractor shall install all Hollow Metal and Fiberglass Reinforced Doors and Frames as specified under Division 8.

F. All frames shall be accurately set and thoroughly and rigidly anchored and fastened in place to the building construction.

G. Receive, store, protect, and be responsible for all doors to be installed hereunder. Report immediately to the General Contractor any shortages, damage, improper preparation, defective finishes, warped doors, etc., and do not install any material not perfect in every respect.

H. Inspect openings and frames to receive doors. Report any damage or discrepancy affecting proper installation of units to the General Contractor, and have corrective work done in a suitable and satisfactory manner.

I. Install doors in openings as shown, scheduled or detailed on the Drawings in conformance with approved shop drawings and hardware schedule. Doors shall be installed so they hang plumb and true, with proper clearances, using items of hardware scheduled for the openings.

END OF SECTION

Section-09901

Surface Preparation

And Shop Prime Painting

SECTION 09901

SURFACE PREPARATION AND SHOP PRIME PAINTING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required for the surface preparation and application of shop primers on ferrous metals, excluding stainless steels, as specified herein.

1.02 RELATED WORK SPECIFIED

A. Field and finish painting is included in Section 09902.

1.03 SUBMITTALS

A. Submit to the Engineer for approval, as provided in Section 01300, shop drawings, manufacturer's specifications and data on the proposed primers, detailed surface preparation and application procedures, dry mil thicknesses and MSDS forms.

B. Submit representative physical samples of the proposed primers, if required by the Engineer.

PART 2: PRODUCTS

2.01 MATERIALS

A. Submerged Surfaces - Surfaces which will be submerged or which are subject to splash action or which are specified to be considered submerged service shall be sprayed with one shop coat of Tnemec Series 66 Boston Gray Primer, dry film thickness 3.5 to 4.5 mils, Koppers 654 Epoxy Primer, or equal.

B. Non-Submerged Surfaces - Spray apply one shop coat of Tnemec Series 66 Boston Gray Primer, dry film thickness 3.0 to 4.0 mils Koppers 654 Epoxy Primer, or equal.

C. Surfaces in Non-process Buildings - Apply one shop coat of Tnemec Series 4, Gray, dry film thickness 2.0 to 3.0 mils, Koppers 662 shop primer, or equal.

D. Non-Primed Surfaces - Gears, bearing surfaces, and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during all periods of storage and erection and shall be satisfactory to the Engineer up to the time of the final acceptance test.

E. Ferrous Metal Surfaces - Spray apply one shop coat of Tnemec Series 66 Boston Gray Primer, dry film thickness 3.0 to 4.0 mils Koppers 654 Epoxy Primer, or equal.

F. Compatibility of Coating Systems - Shop priming shall be done with primers that are guaranteed by the manufacturer to be compatible with their corresponding primers and finish coats specified in Section 09902 for use in the field and which are recommended for use together.

PART 3: EXECUTION

3.01 APPLICATION

A. Surface Preparation and Priming

1. Ferrous metal components scheduled to receive shop coating, as defined above, shall be sand blasted clean in accordance with SSPC-SP-6, Commercial Grade, immediately prior to priming. Submerged components scheduled for priming, as defined above, shall be sandblasted clean in accordance with SSPC-SP-10, Near White, immediately prior to priming. Surface profile after abrasive blasting shall be 1.0 to 1.5 mils for exterior surfaces, 2.0 to 2.5 mils for immersion service, or approximately 25% of the total dry film thickness of the paint being applied.

2. Surfaces shall be dry and free of dust, oil, grease and other foreign material before priming, by detergent and/or steam cleaning per SSPC-SP-1.

3. Shop coat in accordance with approved manufacturer's recommendations.

4. Cold water pipes used for grounding shall not be painted where grounding wire is connected.

5. The interior surfaces of walls, ceiling, etc. Also See 09902.

6. All equipment and electrical components shall be protected prior to any surface preparation activities taking place.

The components shall be protected by plastic wrapping or other measures with the Engineer's approval.

7. The surfaces shall be free of dust, flaking paint, grease or other foreign matter prior to priming. The surfaces shall be primed with material compatible with the finish paint as specified in Section 09902.

END OF SECTION

Section-09902

Finish Painting

SECTION 09902

FINISH PAINTING

GENERAL

1.01 SCOPE OF WORK

A. Furnish all materials, labor, equipment and incidentals required to perform all the painting necessary to complete this contract in its entirety.

B. It is the intent of these Specifications to paint all exposed structural and miscellaneous steel, doors, frames, hatch covers, mechanical equipment, operators, posts, pipe, fittings, and valves as specified in the attached painting schedules and all other work obviously required to be painted unless otherwise specified. Minor items not mentioned in the schedule of work shall be included in the work of this Section where they come within the general intent of the specifications as stated herein.

C. The following items will not be painted, except as is the normal procedure of a manufacturer furnishing a finished product:

1. Concrete
2. Finish hardware unless specifically noted otherwise.
3. Non-ferrous metals, or galvanized metals unless specifically noted otherwise.
4. Aluminum Grating.
5. Packing glands and other adjustable parts and name plates of mechanical equipment.
6. Factory pre-finished architectural components.
7. Parts of buildings not exposed to sight, unless specifically noted otherwise.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Shop priming and surface preparation of equipment and piping are Specified in Section 09901. Additional instructions are included in the respective Sections.

PART 2: PRODUCTS

2.01 MATERIALS

A. All painting materials shall be equal to those manufactured by the Tnemec Company, Inc., Mobil Co., Koppers Co., or equal. The painting schedule has been prepared on the basis of Tnemec products (unless otherwise noted) and Tnemec recommendations for application.

B. All painting materials shall be delivered to the mixing room in unbroken packages, bearing the manufacturer's brand and name. They shall be used without adulteration and mixed, thinned, and applied in strict accordance with manufacturer's directions for the applicable materials and surface and with the Engineer's approval before using.

C. Shop priming shall be done with primers that are guaranteed by the manufacturer to be compatible with the finish paints to be used. Refer to Section 09901 for primers.

D. No paint containing lead will be allowed. Oil shall be pure boiled linseed oil.

E. Work areas will be designated by the Engineer for storage and mixing of all painting materials. Materials shall be in full compliance with the requirements of pertinent codes and fire regulations. Proper containers outside of the buildings shall be provided and used for painting wastes, and no plumbing fixture shall be used for this purpose.

2.02 COLOR CODING FOR PIPES AND EQUIPMENT

A. To facilitate identification of piping in plants and pumping stations, the following color scheme shall be utilized.

Water Lines

Raw	Olive Green
Settled or Clarified	Aqua
Finished or Potable	Dark Blue

Chemical Lines

Alum or Primary Coagulant	Orange
Ammonia	White
Carbon Slurry	Black

Caustic	Yellow w/Green Band
Chlorine (Gas and Solution)	Yellow
Fluoride	Light Blue w/Red band
Lime Slurry	Light Green
Ozone	Yellow w/Orange Band
Phosphate Compounds	Light Green w/Red Band
Polymers or Coagulant Aids	Orange w/Green Band
Potassium Permanganate	Violet
Soda Ash	Light Green w/Orange Band
Sulfuric Acid	Yellow w/red Band
Sulfur Dioxide	Light Green w/Yellow Band

Waste Lines

Backwash Waste	Light Brown
Sludge	Dark Brown
Sewer (Sanitary or Other)	Dark Gray
Raw Sludge Line	Brown w/Black Bands
Sludge Recirculation Suction Line	Brown w/Yellow Bands
Sludge Draw Off Line	Brown w/Orange Bands
Sludge Recirculation Discharge Line	Brown
Sludge Gas Line	Orange (or red)
Natural Gas Line	Orange (or red) w/Black Bands
Nonpotable Water Line	Blue w/Black Bands
Water Lines for Heating digesters or buildings	Blue w/6-inch(152mm) Red Band Spaced 30 inches (762mm) apart

Other

Compressed Air	Dark Green
Other Lines	Light Gray

In situations where two colors do not have sufficient contrast to easily differentiate between them, a six-inch band of contrasting color shall be on one of the pipes at approximately 30 inch intervals. The name of the liquid or gas shall also be on the pipe. Provide arrows indicating the direction of flow.

B. All hangers and pipe support floor stands shall be painted the same color with the same paint as used to paint the pipe it supports. The system shall be painted up to but not including the flanges attached to the mechanical equipment nor the flexible conduit connected to electrical motors.

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 fixed flanges or connections on the equipment.

D. The color code shall establish, define and assign a definite color for each category of pipe.

E. All pipes and equipment shall be painted unless otherwise approved by the Engineer.

2.03 LETTERING OF TITLES

A. The name of the materials in each pipeline and alongside this an arrow indicating the direction of flow of liquids, shall be indicated on each pipe system. Titles shall be as designated on the Contract Drawings. Titles shall not be located more than twenty six (26) linear feet apart and shall also appear directly adjacent to each side of any wall the pipeline breaches, adjacent cleanout, and all pieces of equipment.

B. Titles shall identify the contents by complete name. Identification title locations shall be determined by the Engineer but in general they shall be placed where the view is unobstructed and on the two lower quarters of pipe or covering where they are overhead. Title should be clearly visible from operating positions especially those adjacent to control valves.

C. Numbers and letters shall be die-cut from 3.5 mil vinyl film and prespaced on carrier tape. Adhesive and finish surface shall be protected with one piece removable liners. Color shall be black or white.

D. Letter size shall be as indicated in the following table.

OUTSIDE DIAMETER OF PIPE SIZE	SIZE OF LEGEND LETTERS OR COVERING
3/4-in to 1-1/4-in	½-in
1-1/2-in to 2-in	3/4-in
2-1/2-in to 6-in	1-1/2-in
8-in to 10-in	2-1/2-in
Over 10-in	3-in

2.04 METAL TAGS

A. For pipelines smaller than 3/4-in in diameter, securely fasten metal tags, 2-1/2-in x ½-in, of 316 ss construction with lettering etched and filled with enamel. Tags shall be approved by the Engineer.

2.05 EXTRA PAINT

A. Furnish to the Owner one unopened gallon can of each type and each color of paint used.

B. A listing shall be provided, indicating for each surface painted, the paint used, keyed to the extra paint provided.

PART 3: EXECUTION

30.1 PREPARATION OF SURFACES

A. All surfaces to be painted shall be prepared as specified herein and shall be dry and clean before painting. Special care shall he given to thoroughly clean interior concrete block surfaces to receive polyamide cured epoxy paint of all marks before application of finish.

B. All metal welds, blisters, etc., shall be ground and sanded smooth. All pits and dents shall be filled and all imperfections shall be corrected so as to provide a smooth surface for painting. All loose scale, oil, grease and dirt shall be removed by steam and/or detergent cleaning per SSPC-SP-1.

C. Concrete masonry unit surfaces shall be smooth and cleaned of all dust, loose mortar and other foreign matter.

D. All surfaces that received a shop coat as specified in Section 09901 in which the shop coat has been removed before and during erection shall be touched up at the damaged area. The touch-up coat shall be the same material as the shop coat and should be placed in such a manner to maintain uniform thicknesses and continuity of appearance.

E. All PVC pipe and other plastic matrix surfaces to be painted shall be lightly sanded and cleaned of residue before painting.

3.02 PAINTING OR COATING SYSTEMS

A. Contractor shall submit proposed colors for approval.

B. The following types of paints by Tnemec, unless otherwise indicated, have been used as a basis for the paint schedule. See 2.01.A for procedure to secure approval of equal types of paints.

1. Hi-build Epoxoline (Series 69) - polyamide cured epoxy

2. Endura-Shield - Semi-gloss (Series 71) - aliphatic polyurethane

3. Epoxy-Polyamide Masonry Filler (Series 54-660) - Block Filler and Concrete Sealer

4. Tneme-Creto (Series 52) modified epoxy masonry texture coating

5. Tneme-Cryl (Series 6) - acrylic latex coating.

C. Interior Concrete Block Walls:

1. Surface Preparation: Prepare surfaces as specified in Section 3.01. Fill pores of concrete block with block filler at a rate of 50 to 100 square feet per gallon.

2. Product and Manufacturer: Provide the following:
   a. Tnemec (System No. 66-15 Epoxy-Polyamide)
      (1) Primer: No. 130 Modified Acrylic masonry filler – l coat at a rate of 75 to 100 square feet per gallon.
      (2) Intermediate: No. 135 – Series Chembuild – 1 coat 2.0 to 3.0 dry mils.
      (3) Finish: No. 135 – Series chembuild – 1 coat 4.0 to 6.0 dry mils.

D. Ferrous Metals and all Ferrous Piping; Interior Non-submerged

1. Product and Manufacturer
   a. Tnemec
      (1) Surface Preparation: SSPC-SP6 Commercial Blasting Cleaning
      (2) Primer: No. 135 Epoxy – l coat, 4.0 to 6.0 dry mils
      (3) Finish: No. 104 Epoxy – 2 coats, 4.0 to 6.0 dry mils per coat

E. Submerged or Intermittently Submerged, Ferrous and Non-Ferrous Metals; Interior and Exterior, Potable Water Exposure

1. Surface Preparation:
   a. SSPC-SP-10 with 2.0 mil profile.

2. Product and Manufacturer: Provide the following:
   a. Tnemec
      (1) Primer: Potapox II at 3.0 to 5.0 dry mils.
      (2) Finish: Potapox II at 4.0 to 6.0 dry mils.

F. Ferrous, Non-ferrous Metals and Galvanized Metals; Exterior Non-submerged

1. Surface Preparation
   a. Ferrous Metals: SSPC-SP6 Commercial Blast Cleaning
   b. Galvanized and Non-ferrous Metal: Solvent wipe and pretreatment with paint manufacturers recommended system.

2. Product and Manufacturer: Provide the following:
   a. Tnemec (System No. 74-1 Aliphatic Polyurethant)
      (1) Primer: No. 66-Color(b) Hi-Build Epoxoline – 2 coats, 4.0 to 6.0 dry mils per coat.
      (2) Finish: No. 74/75 – Color Endura – Shield – 1 coat, 2.0 to 5.0 dry mils per coat.

G. Galvanized Metal and Non-Ferrous Metal; Interior, Non-submerged

1. Surface Preparation: Pretreatment with Carboline Multi-Bond 120 or Clean-N-Etch by Great Lakes Laboratories.

2. Product and Manufacturer: Provide the following:
   a. Tnemec
      (1) Primer: No. 135 Epoxy Chembuild – 1 coat, 3.0 to 5.0 dry mils.
      (2) Finish: No. 135 Epoxy Chembuild – 1 coat, 4.0 to 6.0 dry mils.

H. Pipe and Duct Installation, Cloth; Interior

1. Surface Preparation: Remove all foreign matter as specified in 3.02 G.

2. Products and Manufacturer: Provide the following:
   a. Tnemec
      (1) Primer: Series 6/7 Color Tnemecryl – 1 coat, 2.0 to 3.0 dry mils.
      (2) Finish: Series 6/7 Color Tnemecryl, 2.0 to 3.0 dry mils.

I. PVC Piping, Fiberglass, Fiberglass Insulation Covering; Interior

1. Surface Preparation: Sand as specified in 3.01.
2. Product and Manufacturer: Provide the following:
   a. Tnemec
      (1) Primer: No. 135 Chembuild – 1 coat, 4.0 to 6.0 dry mils.
      (2) Finish: No. 135 Chembuild – 1 coat, 4.0 to 6.0 dry mils.

J. Gypsum Wallboard, Interior (If Applicable)

1. Surface Preparation: Sand and seal as specified in 3.2.H.
2. Product and Manufacturer: Provide the following:
   a. Tnemec
      (1) Primer: No. 51-792 PVA sealer – 1 coat, 1.0 to 2.0 dry mils.
      (2) Intermediate: No. 113/114, Color Tnemec, Tufcoat – 1 coat, 2.0 to 2.5 dry mils.
      (3) Finish: No. 113/114, Color Tnemec, Tufcoat – 1 coat, 2.0 to 2.5 dry mils.

K. Ferrous Metals, Buried Exterior or Concrete Waterproofing, Buried Exterior

1. Surface Preparation: SSPC-SP10 Near-White Metal Blast Cleaning (ferrous metals). Clean concrete of all dirt, residues.

2. Product and Manufacturer: Provide the following:
   a. Tnemec (System No. 46-30 Coal Tar Epoxy)
      (1) Finish: No. 46H – 413 Hi-Build Tneme – Tar, 1 coat, 14.0 to 20.0 dry mils.

3.03 WORKMANSHIP

A. General

1. At the request of the Engineer, samples of the finished work prepared in strict accordance with these Specifications shall be furnished and all painting shall be equal in quality to the approved samples. Finished areas shall be adequate for the purpose of determining the quality of workmanship. Experimentation with color tints shall be furnished to the satisfaction of the Engineer where standard chart colors are not satisfactory.

2. Protection of furniture and other movable objects, equipment, fittings and accessories shall be provided throughout the painting operation. Canopies of lighting fixtures shall be loosened and removed from contact with surface, covered and protected and reset upon completion. Remove all electric plates, surface hardware, etc., before painting, protect and replace when completed. Mask all machinery name plates and all machined parts not receiving a paint finish. Dripped or spattered paint shall be promptly removed. Lay drop cloths in all areas where painting is being done to adequately protect flooring and other work from all damage during the operation and until the finished job is accepted.

3. On metal surfaces apply each coat of paint at the rate specified by the manufacturer to achieve the minimum dry mil thickness required. If material has

thickened or must be diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material. One gallon of paint as originally furnished by the manufacturer shall not cover a greater area when applied by spray gun than when applied unthinned by brush. Deficiencies in film thickness shall be corrected by the application of an additional coat(s). On masonry, application rates will vary according to surface texture; however, in no case shall the manufacturer's stated coverage rate be exceeded. On porous surfaces, it shall be the painter's responsibility to achieve a protective and decorative finish either by decreasing the coverage rate or by applying additional coats of paint.

B. Field Priming

1. Steel members, metal castings, mechanical and electrical equipment and other metals which are shop primed before delivery at the site will not require a prime coat on the job. All piping and other bare metals to be painted in the field shall have surfaces prepared in accordance with Section 09901 and shall receive one coat of primer before exposure to the weather, and this prime coat shall be the first coat as specified in the painting schedule.

2. Equipment which is customarily shipped with a baked-on enamel finish or with a standard factory finish shall not be field painted unless the finish has been damaged in transit or during installation. Surfaces that have been shop painted and have been damaged, or where the shop coat or coats of paint have deteriorated, shall be properly cleaned and retouched before any successive painting is done on them in the field. All such field painting shall match as nearly as possible the original finish, or a full-surface repainting shall be applied, to produce an attractive finish.

3. Equipment shipped with a protective shop painting coat or coats shall be touched up to the satisfaction of the Engineer with primers as recommended by the manufacturer of the finish paint.

C. Field Painting

1. All painting at the site shall be designated as Field Painting and shall be under the direct and complete control of the Engineer, and only skilled painters and specialists, where required, shall be used on the work.

   Adequate notice (minimum of two working days) shall be given to the Owner to move cars and protect necessary items from over spray.

2. All paint shall be at room temperature before applying, and no painting shall be

done when the temperature of the surface being painted is below 60 deg. F., in dust-laden air, when rain or snow is falling, or until all traces of moisture have completely disappeared from the surface to be painted.

3. Successive coats of paint shall be tinted so as to make each coat easily distinguishable from each other with the final undercoat tinted to the approximate shade of the finished coat.

4. Finish surfaces shall not show brush marks or other irregularities. Undercoats shall be thoroughly and uniformly sanded with No. 00 sandpaper or equal to remove defects and provide a smooth even surface. Top and bottom edges of doors shall be painted and all exterior trim shall be back-primed before installation. Finishes in clarifier launders shall be as required to produce a smooth, easily cleaned surface.

5. Painting shall be continuous and shall be accomplished in an orderly manner so as to facilitate inspection. Materials subject to weather shall be prime coated as quickly as possible. Surfaces of exposed members that will be inaccessible after erection shall be cleaned and painted before erection.

6. All materials shall be brush painted unless spray painting is specifically approved by the Engineer.

7. All surfaces to be painted as well as the atmosphere in which painting is to be done shall be kept fresh, warm and dry by heating and ventilation, if necessary, until each coat of paint has hardened. Any defective paint shall be scraped off, or otherwise removed, and repainted in accordance with the Engineer's directions.

8. Before final acceptance of the work, all damaged surfaces of paint shall be cleaned and repainted as directed by the Engineer.

9. Only the aluminum work noted on the Drawings or in the Painting Schedule shall be field painted.

3.04 CLEANUP

A. At all times keep the premises free from accumulation of waste material and rubbish caused by employees or work. At the completion of the painting, remove all tools, scaffolding, surplus materials, and all rubbish from and about the buildings and leave the work 'broom clean" unless more exactly specified.

B. Upon completion, remove all paint where it has been spilled, splashed, or spattered on all surfaces, including floors, fixtures, equipment, furniture, etc., leaving the

work ready for inspection.

3.05 COLOR SELECTION FOR BUILDINGS

A. Colors for interior and exterior items including doors, walls, and structural members, etc. shall be selected by the Engineer from color charts provided by the Contractor.

END OF SECTION

Section-11100

Odor Control System

SECTION 11100

ODOR CONTROL SYSTEM

Chemical Feed System and Storage Tank

Part 1 – General

1.01 Scope

A. Project in this section includes a complete odor control feed system with chemical storage tank. The chemical feed system consists of two chemical feed pumps, control panel, calibration column, piping and other components enclosed in a stainless steel cabinet to feed odor control chemical (Nitra-Nox) into the wastewater system.

B. All components of the odor control chemical feed system shall be compatible with odor control chemical (Nitra-Nox). All components also shall be compatible with the conditions of the normal operations of the wastewater system. All materials must be compatible with the following:

1. Hydrogen Sulfide (H_2S)
2. Nitra-Nox (Odor Control Chemical)

1.02 Process Description

A. The chemical feed system shall provide storage for Nitra-Nox (odor control chemical).

B. The chemical feed system shall contain components to automatically adjust the feed dosage rate as needed.

C. The chemical feed system and odor control shall have the capability to feed over a 24 hour period.

1.03 Approved Manufacturers

A. Aulick Chemical Solutions, Inc.

B. Approved Equals.

1.04 Submittals

A. Manufacturers shall provide complete drawings and engineering data to the owner, contractor or engineer upon request.

B. Submittals shall include:

1. Shop drawings with elevation views of the chemical feed system and chemical storage tank
2. Control panel drawing
3. Control system electrical diagram
4. Description of chemical feed pumps
5. Description of calibration column
6. Description of Pentabloc (anti-siphoning device)

1.05 Substitutions

A. No substitutions or deviations shall be made form the specified system prior to approval from owner, contractor, and engineer.

Part 2 – Products

2.01 Chemical Storage Tank

A. The chemical storage tank shall be high density polyethylene (HDPE).

B. The chemical storage tank shall be compatible with Nitra-Nox (odor control chemical).

C. Chemical storage tank shall be, at the minimum, large enough to hold 30 days supply of the chemical.

2.02 Chemical Feed System

A. General- The chemical feed system shall be manufactured by Aulick Chemical Solutions, Inc. The operation of the chemical feed system shall be operated from the control panel located inside of the stainless steel cabinet. All components enclosed in the stainless steel cabinet shall be rated for outdoor weather exposure and other conditions.

B. Control panel shall be equipped with hinged door.

C. The chemical feed system shall include calibration column for calibrating the feed rate.

D. Enclosure – All components shall be enclosed in a 30" width, 72" height, and 22" depth stainless steel cabinet. The stainless steel cabinet shall be lockable. The stainless steel cabinet shall be anchored to concrete with 4 each 3/8" stainless steel anchors.

E. Components – Chemical feed system shall include; 2 solenoid actuated diaphragm pumps, control panel, calibration column and electrical timer for pumps.

F. Control Panel- Control panel shall be located in a separate internal panel mounted in the stainless steel cabinet.

G. Electrical Requirement- 120 VAC/ 1PE/ 60

A. Chemical Feed Pumps

B. General- Chemical feed pumps shall be manufactured by Lutz Jesco America. Each pump shall be a solenoid actuated diaphragm pump.

B. Performance – Each pump shall be equipped with a Pentabloc (anti-siphoning device).

C. The flow rate of each pump shall have an adjustable feed rate.

2. Calibration column shall be included for feed rate calibration.

2.04 Piping/ PVC Requirement

A. All suction and discharge piping located inside the stainless steel cabinet shall be provided by Aulick Chemical Solutions, Inc. (manufacturer). All piping shall be ½ " diameter SCH 80 PVC diameter. All valves, fittings and connectors shall be 2 " SCH 80 PVC.

B. All fill line piping shall be 2" SCH 80 PVC. All fill lines, fittings, and connectors shall be SCH 80 PVC.

C. Fill line should have 2" plastic female camlock with 2" plastic male camlock cap.

D. All chemical feed seals shall be compatible with the chemicals to be used in the regular operation, maintenance, and cleaning of the feed system.

Part 3 – Execution

3.01 Field Site/ Utilities

A. Electrical- One 120 VAC, 60 Hz, 15 Amp single-phase electrical service shall be required.

B. Concrete Pad- 6" concrete pad is required. Refer to contract drawings for size of concrete pad for tank and stainless steel feed system to set on. Refer to contract drawing for location of electrical line and chemical discharge line in the concrete pad.

C. Chemical Feed System- The stainless steel Chemical Feed System shall be bolted to the concrete with (4) 3/8 " stainless steel anchors.

3.02 Equipment Testing

D. Before shipping/delivering chemical feed system, Aulick Chemical Solutions, Inc. shall perform testing which shall include;

1. Visual inspection of all components, equipment and chemical storage tank.

2. Complete testing on chemical feed pumps and piping/ PVC.

3.03 Installation

A. The installation of the equipment shall be in accordance with the manufacturer guidelines. All personnel shall be qualified in their area of work to complete the installation.

3.04 Field Testing

A. A manufacturer's representative shall be on site for field testing, training, and demonstration during start up.

3.05 Warranty

E. The manufacture shall guarantee that the stainless steel system & storage system will perform as described in these specifications. The manufacture shall provide full warranty in materials of workmanship for a period of 12 months from contract completion.

F. The manufacture shall repair or replace defective components under this warranty. In addition, the chemical storage tanks shall be warranted for a period of 3 years from start up or 44 months from the shipment, whichever comes first.

END OF SECTION

Section-11140

Influent Grinder/Spiral

Screening System

SECTION 11140

INFLUENT GRINDER/SPIRAL SCREENING SYSTEM

PART 1 – GENERAL

1.01 DESCRIPTION:

The Franklin Miller SpiraLift, or approved equal, unit shall be designed to grind, wash, de-water and remove solids entrained in a raw sewage flow in continuous service and meet the following requirements:

1.02 QUALITY ASSURANCE:

A. REFERENCES:

This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
AISI	Grade 304 and 316 Stainless Steel.
AISI 4140	Heat Treated Hexagon Steel
ASTM A 536-84	Standard Specification for Ductile Iron Castings

PART 2 –PRODUCTS

2.01 SPIRAL-SCREENING SYSTEM:

A. General:

1. The spiral screen shall be located downstream from the grinder. An integrated grinder/auger controller, using time and level sensors, shall control it.

2. The spiral screen system shall consist of the following main components:

a. Support Frame: The support frame shall be constructed of A36 steel. It shall constitute both a grinder guide rail and any necessary Auger screen channel baffling and support.

b. Screen: The Auger screen shall be constructed of T304 Stainless Steel perforated sheet with a minimum inside diameter of 12" (170mm).

c. Auger Casing: Auger transport casing flanges and outlet shall be made of 304 Stainless Steel.

d. The unit shall have a center-less Auger spiral made of wear-resistant alloy carbon steel to assure long life and reduce run cycles.

e. Brush-wiper - shall be affixed to the outer edge of the lower portion of the center-less spiral to clear the screen. The brushes shall be fastened to the auger in sections for easy replacement. Strip brushes and/or brushes that are set or pressed into a slot on the perimeter of the auger shall not be allowed.

3. Spray Wash

a. A spray wash system shall intensively wash the particles in the screen area and be constructed as follows:

b. The spray wash tubing shall be heavy wall stainless steel tubing and shall be supplied with multiple nozzles installed to enhance water pressure, direct the spray, and reduce orifice wear.

c. A solenoid valve shall be supplied for interface of the spray-wash with the SPIRALIFT control system.

4. Drive assembly shall consist of (as a minimum):

a. Adapter spool.

b. Hollow shaft speed reducer.

2.02 SEWAGE GRINDER:

A. General:

1. The twin shaft grinder shall be designed to reduce solids normally found in a sewage system.

2. The grinder shall be capable of handling the specified flow rate without the use of moving diverter screen(s).

3. Each grinder shall consist of the following main components:

   a. Grinder assembly (Lower Works)

   b. Drive assembly

   c. Channel Frame:

      1) The channel frame shall facilitate the slide-in installation of the grinder, in a wet well or open channel.

4. Two-shaft design shall consist of two parallel shafts stacked with intermeshing cutter cartridges. The shafts shall counter-rotate with the driven cutter peripheral linear speed operating at approximately two-thirds (2/3) that of the drive cutter peripheral linear speed.

B. Main Housing:

1. The main housing components shall be a cast structure made of ASTM A536-84 ductile iron.

2. The main housing components shall be independent of and shall not be subject to wear from seal or labyrinth seal system and shall not constitute a seal wear element.

C. Cutters:

1. The cutters shall be a monolithic cutter cartridge type comprising a plurality of 7-tooth cam shaped cutter elements. The cartridges shall be designed to eliminate individual cutter and spacer disks for improved strength and transmission of power from the shaft. Units using multitudes of individual cutters and spacers shall not be accepted.

2. No cutter stack re-tightening shall be required with this system.

3. The cutter profile shall be a 7 tooth cam type to minimize frictional drag. To maintain particle size, the height of the tooth shall not exceed 1/2-inch (13-mm) above the root diameter. Cutter to cutter root diameter overlap shall not be less than 1/16-inch (1.6-mm) or greater than 1/4-inch (6.0-mm) to maintain the best possible cutting efficiency while incurring the least amount of frictional losses.

4. The inside configuration of cutters shall be hexagonal so as to fit the shafts with a total clearance not to exceed 0.015-inch across the flats to assure positive drive and minimize wear.

5. Cutter Cartridges shall be AISI 4140 Heat Treated Alloy Steel, The spaces defined by the adjacent side surfaces of the cutting edges and outer surface of the connecting spacer areas shall be cylindrically ground for uniformity. Each cutter cartridge shall further have a total accumulated tolerance of plus or minus .0005" to eliminate shimming, cutter stack tolerance accumulation and misalignment. The cutters shall be through-hardened to a minimum 45-49 Rockwell.

6. The cutters shall exert a minimum force of 450-lbs./HP (2680-N/kW) continuously and 1430-lbs./HP (8530-N/kW) at momentary load peaks at the tooth tip.

D. Shafts:

1. Grinder drive and driven shafts shall be made of AISI 4140 heat treated hexagon steel with a tensile strength rating of not less than 135,000-psi (930.8-MPa). Each shaft size shall be a minimum of 2-inch hexagon (across the flats) (51-mm).

E. Bearings and Seals:

1. The cutter shaft's radial and axial loads shall be borne by a sealed oversize deep-groove (Conrad type) ball bearing at each end. The bearings shall have a minimum rating of 9230 lbs (basic dynamic rating).

2. The bearings shall be protected by a combination of a replaceable and independent tortuous path device and end face mechanical seals.

3. Face materials shall be tungsten carbide vs. tungsten carbide and not require an external flush. The seals shall employ elastomer members operating as opposing disk springs when compressed and at the same time maintain a positive seal face pressure to insure positive sealing. No metal springs shall be employed.

4. The bearings and seals shall be housed in a replaceable cartridge that supports and aligns the bearings and seals. The cartridge housings shall be constructed of hardened 17-4 PH stainless steel for superior resistance to corrosive and abrasive contaminants.

5. Components subject to wear shall be designed into replaceable elements and not be a part of the ductile iron unit main housing.

6. O-rings shall be made of Buna-N elastomers.

F. Reducer:

1. The speed reducer shall be a grease-filled planetary or cycloidal type reducer with "Heavy-Shock" load classification. The reduction ratio shall be 29:1. The high-speed shaft of the grinder shall be directly coupled with the reducer via a coupling.

2. The two-piece, three-lobed coupling shall have jaws that Intermesh by at least 3/4" for dependable torque transmission.

G. Motor

1. Motor

a. The motor shall be: (TEFC) (Explosion Proof) design, 2 HP, 460 Volt, 3-phase, 60 Hz. Motor service factor shall be 1.15, the efficiency factor not less than 87.5% at full load and the power factor not less than 82% at full load.

2.03 CONTROL PANEL, ELECTRICAL COMPONENTS & ACCESSORIES

A. A automatic reversing controller shall be supplied with oil tight controls and overload heater protection. The contents of the controller shall be encased in a NEMA 4X FRP enclosure.

PART 3 - EXECUTION

3.01 FACTORY TEST:

Each grinder, auger, and controller shall be factory tested to ensure satisfactory operation.

3.02 INSTALLATION:

Spiral screen and controller shall be installed in accordance with the supplier's installation instructions, and in compliance with all OSHA, local, state, and federal codes and regulations.

3.03 FIELD QUALITY CONTROL:

Supplier shall provide the services of a factory-trained representative to check installation and to start-up of the system. Factory representative shall have complete knowledge of proper installation, operation, and maintenance of equipment supplied. Representative shall inspect the final installation and supervise a start-up test of the equipment.

3.04 OPERATION AND MAINTENANCE MANUALS:

Supplier shall provide three (3) Operation and Maintenance Manuals. The manuals shall include equipment descriptions, operating instructions, drawings, troubleshooting techniques, a recommended maintenance schedule, and the recommended lubricants.

PART 4 -- INSULATING

4.01 WEATHER PROTECTION

Heat tracing shall be supplied using self-regulating cable and including insulation jacket as follows:

Auger transport and discharge sections shall be wrapped with heat trace and insulation to prevent freezing.

The heat tracing shall be rated for a minimum of 6-watts / foot at 40 degrees and shall be automatically energized at temperatures below 40 degrees F.

Cable shall be protected by braided metal sheathing and waterproof jacket securely fastened in place.

The spray system shall be wrapped with heat trace and insulation to prevent freezing.

Heat trace connections shall be the responsibility of the electrical contractor.

Section-11145

Influent Spiral Screening Controller

SECTION 11145

INFLUENT SPIRAL SCREENING CONTROLLER

Controller: The controller shall completely sequence the operation of a Grinder motor and an Auger motor as provided by Franklin Miller, or approved equal.

Enclosure type: The controller shall be provided in a NEMA 4X fiberglass enclosure. The enclosure **MAY** be mounted outdoors so all door mounted switches, indicators, etc. must be capable of withstanding UV exposure.

The controller shall contain the following features.

1. Disconnect: The primary feeder cables entering the controller enclosure shall be disconnected from the internal wiring of the controller with a device that has a through-the door operating means. The mechanism shall have provision for locking the disconnect in the open position.

2. Motor starter: A reversing starter shall be provided. The size of the starter shall be based on motor horsepower. A motor overload relay shall be furnished as part of the starting equipment.
Motor overload relays shall be furnished as part of each motor. When the relay trips, the motor shall stop, the Trip pilot light shall flash, and the Trip Status contact shall close. Resetting the relay shall resume normal operation. Output terminal blocks shall be provided for connection of the motor leads exiting the enclosure.

3. Control circuit: The following provisions apply.

PLC: A programmable logic controller shall be provided within the controller, to sequence the operation of the machine.

4. Operator control: A three-position "HAND- OFF/RESET- AUTO" selector switch shall be provided for the Grinder. Its function is as follows:

Hand: When in this position, the grinder shall run under the control of the PLC as described in "Operation."

Off/Reset: When in this position, the motor shall be prevented from starting (in both the forward and reverse directions); the

remote-start signal shall be disabled; and the established Alarm Condition lockout circuitry reset.

Auto: When in this position, a signal from a remote source (by others) shall initiate the PLC Grinder cycle and the motor shall run until the signal is interrupted; an Alarm Condition lockout circuit is established; or the E-stop pushbutton is actuated.

A three-position "HAND -OFF/RESET- TIMER" selector switch shall be provided for the Auger. Its function is as follows:

Hand: When in this position, the auger shall run under the control of the PLC.

Off/Reset: When in this position, the motor shall be prevented from starting (in both the forward and reverse directions); and the established Alarm Condition circuitry reset.

Timer: When in this position, a timer setting (adjustable) will determine the cycling on and off of the Auger.

5. Pilot lights: The following LED pilot lights shall be provided.

A green "GRINDER RUN" pilot light shall be illuminated when the selector switch is in the Hand or Auto position and the motor is running in the forward or reverse direction, and during motor reversal pauses.

A green "AUGER RUN" pilot light that shall be illuminated similar to the grinder pilot light when the selector switch is in the Hand or Timer position.

A red "GRINDER TRIP" pilot light shall be illuminated steadily when the selector switch is in the Hand or Auto position and the Grinder has experienced an Alarm Condition stoppage, and flash when the motor overload relay trips. It shall remain illuminated until the selector switch is placed in the Off/Reset position, resetting the Alarm Condition circuit.

A red "AUGER TRIP" pilot light shall be illuminated similar to the grinder pilot light when the selector switch is in the Hand or Timer position..

6. Remote I/Os: Provisions for the following inputs and outputs shall be made. Wiring shall be complete from the PLC to terminal blocks.

Grinder Run Status: A dry-contact output shall close when the Grinder is running, and remain closed until the grinder is stopped by placing the selector switch in the Off/Reset position; the motor overload relay trips; it trips on an Alarm Condition; or power to the controller is disconnected.

Auger Run Status: Similar to that of the Grinder.

Alarm Status: A dry-contact output shall close when the Grinder and/or Auger experience an Alarm Condition and remain closed until the Alarm Condition circuit is reset.
The contact shall also close and remain closed (no pulsing) when either of the motor overload relays trip. It shall open when the relay is reset.

Alarm Horn: Provisions shall be made for connection of an alarm horn (by others) that will sound intermittently before the Grinder and/or Auger are started, and sound continuously when an Alarm Condition exists. The pre-start signal time shall initially be set in the PLC for zero sec.

Spray Wash: Provisions shall be made for connection of a spray wash solenoid. The solenoid shall be energized when the Auger motor is running in either direction, and during reversal pauses.

Water Level: Provisions shall be made for a conductivity probe.

When a high level signal is received the Auger shall run continuously (bypassing the Timer if the selector switch is in the Timer position). The Auger cycle shall return to normal when the signal is removed for more than 30 seconds.

When normal-level signal is received, signifying sufficient water level and flow, both the Grinder and Auger shall be enabled to run. The grinder will run if the (3) position grinder switch is in the "Auto" position. The auger will run if the (3) position switch is in the "Timer" position and the cycle timer starts it. If the normal-level contact opens (for 30 continuous seconds), signifying lack of sufficient flow, both the Grinder and Auger shall be stopped.

Remote E-stop: Provisions shall be made for connection of a maintained contact pushbutton (by others). Depressing the pushbutton shall disconnect control voltage within the enclosure.

Remote start: Provision shall be made for a maintained-contact closure input that starts the Grinder cycle when its selector switch is in the Auto position.

8. Operation

The mode of operation for both the Grinder and Auger shall be S260 (momentary reversing motor controller that will normally operate in only one direction.

Normal cycle If the Grinder selector switch is in Auto and a remote start contact closes (or if the selector switch is in Hand), the Grinder "reverse" motor starter coil shall be energized. The Grinder rotates in that direction for a short period and the reverse coil is then deenergized. After a delay to allow the Grinder to coast to a stop, the "forward" motor starter coil is energized and the Grinder runs in that direction until the motor starter is deenergized by turning the selector switch to the Off/Reset position; or a jam occurs that triggers an auto-clear cycle described below.

Note the provision for a pre-start alarm horn (if installed by others) described in (6.) above.

With the Auger selector switch in the Hand position, the "reverse" starter coil shall be energized. The auger rotates in the reverse direction for a short period and the starter is then deenergized. After a delay, the Auger "forward" starter coil is energized and the Auger runs in that direction. If the Auger selector switch is in the Timer position, the cycling of the Auger is determined by a repeat-cycle timer.

The Auger runs in the forward direction until the motor starter is deenergized by the timer; placing the selector switch in the Off/Reset position; or a jam occurs in the Auger, triggering an auto-clear cycle.

Note the operation of the Spray Wash Solenoid valve and the Water Level probes detailed in 6. Above.

Auto-clear cycle: If a high current condition occurs on either the Grinder or the Auger (indicated by its current sensor tripping), its motor starter shall be deenergized. After a delay, the normal starting sequence described above shall be initiated.
This automatic auto-clear cycle shall repeat a total of four times, two for the auger.

If at any time the Grinder and/or Auger runs for more than sixty seconds in the forward direction during the four attempts, its reversal counter shall be reset.

Alarm Condition. If after four attempts, two for the auger, the Jam condition still exists, the motor starter shall be deenergized and after a 2-sec delay, the reverse coil shall be energized for 1-sec. An Alarm Condition lockout circuit shall be established and remain in the alarm state (even if power is lost) until it is reset. The circuit established upon failure of the Grinder or Auger shall disable the automatic cycle, cause its Run pilot light to be extinguished, its Overload pilot light to be illuminated, the common Trip contact to close/open, and the alarm horn to sound (if installed by others).

Once the obstruction has been cleared, the Alarm Condition lockout circuit can be reset by moving the selector switch to the Off position. The equipment can then be started as detailed for a normal starting sequence.

NOTE: Before manually clearing an obstruction, the controller enclosure disconnect switch must be opened and locked out.

Section-11150

Sequential Batch

Reactor WWTP

SECTION 11150

SEQUENTIAL BATCH REACTOR WWTP

Aqua-Aerobic Systems, Inc.
Specification for AquaSBR®
For
Ball Creek WWTP, KY

SYSTEM SOURCE & QUALITY ASSURANCE

The SBR System shall be supplied by a company of good reputation that is regularly engaged in the manufacture and fabrication of SBR wastewater treatment systems. The manufacturer's experience shall include a minimum of ten installations where equipment of similar size and design has been in operation successfully in a similar process for a minimum of five years. As a minimum, the supplier shall be the manufacturer of the following components: aerators, Aerator/Mixer/Decanters, and controls.

The Contractor shall assign full responsibility for the functional operation of all SBR System components to a Single Source Supplier. This Supplier shall be responsible for all engineering necessary in order to select, furnish, inspect the installing contractor's equipment installation and connections, calibrate, and place into operation the SBR System along with all other equipment and accessories as specified herein.

INSTALLATION

The installation of the equipment furnished by the manufacturer shall be the responsibility of the installing contractor in accordance with all requirements of the contract documents.

SPECIFICATION PRECEDENCE

The valves, equipment, materials of construction and controls specified under this section supersede valves, equipment, materials of construction and controls specified elsewhere in the contract documents. Purchased components such as gear reducers, pumps, motors, valves, and actuators shall be provided with standard recommended manufacturers paint, unless otherwise specified within this section.

The SBR area electrical classification shall be Nonclassified. Motors within the basin shall be rated for a temperature code T2A (280 Deg.C).

ACCEPTABLE MANUFACTURERS

These specifications and accompanying drawings are based upon the use of the AquaSBR® System manufactured by Aqua-Aerobic Systems, Inc., 6306 North Alpine Road, Rockford, IL, 61130, phone no. 815/654-2501, fax no. 815/654-2508.

SERVICE

The equipment manufacturer shall furnish the services of a factory trained representative for a maximum of three (3) trips and twelve (12), eight-hour days at the jobsite to inspect the installing contractor's equipment installation, supervise the initial operation of the equipment, instruct the plant operating personnel in proper operation and maintenance, and provide process assistance.

If additional service is required due to the mechanisms not being fully operational, at the time of service requested by the contractor, the additional service days will be at the contractor's expense.

WARRANTY:

The Manufacturer shall provide a written warranty against defects in materials and workmanship. Manufacturer shall warrant the goods provided by the Manufacturer to be free from defects in materials and workmanship under normal conditions and use for a period of one (1) year from the date the goods are put into service, or eighteen (18) months from shipment of equipment, whichever first shall occur. This warranty shall not apply to any goods or part which has been altered, applied, operated or installed contrary to the Manufacturer's instructions or subject to misuse, chemical attack/degradation, negligence or accident.

SBR FUNCTIONAL REQUIREMENT

The manufacturer of the SBR system shall be completely responsible for the proper design of their system, including but not limited to; transfer pumps, aerators, Aerator/Mixer/Decanters, and controls. All equipment shall perform as specified and the completed installation shall operate in accordance with the requirements of the plans and specifications.

Any supplier wishing to bid other than the specified supplier shall provide the following:

A letter signed by an officer of the company certifying compliance with the specifications without exception. In addition, the supplier must certify the proposed motors will be Warranted by the motor supplier as outlined in the specified Warranty.

A field test report documenting the proposed or similar units have been field tested.

Proof of manufacturing and testing facilities.

Installation list with contacts and phone numbers for a minimum of ten installations of similar size in operation for ten years.

FAILURE FOR THE CONTRACTOR TO SUPPLY THIS INFORMATION WITH THE BID MAY BECAUSE FOR DISQUALIFICATION OF THE CONTRACTORS BID.

As an alternate to the specified AquaEndura maintenance free unit herein specified, the manufacturer shall supply one (1) complete power section for each AquaEndura unit specified. The power section shall include a motor and shaft section, diffusion head or motor base and propeller complete and assembled. The complete power section shall include storage protection and motor space heaters.

The aeration system is defined as the aeration device working in conjunction with a mixer. The aeration system shall be designed to provide oxygen distribution to the entire basin. It shall also ensure mixing to promote suspension of all biological solids in the basin without the introduction of air. No change in the basin geometry shall be allowed. The velocity and mixing in the basin shall be sufficient to ensure complete biological solids suspension and dispersion.

The aeration system for the aeration basins shall be capable of providing mixing such that when operated under any combination of the specified design conditions it shall suspend all biological floc and mixed liquor suspended solids throughout the liquid mass in each basin. The aeration system shall further be capable of maintaining complete aerobic conditions and suspension of all biological floc and suspended solids throughout the liquid mass in each basin.

The aeration system shall be designed to operate within a minimum of 10.2 feet and a maximum of 17 feet side water depth and shall be capable of transferring a minimum of 16.5 lbs/hr of process oxygen (A.O.R.) into the wastewater.

The jobsite conditions are:

a) 0.1 MGD Avg. design flow 0.204 MGD Max. design flow
0.3 MGD Peak Hyd. flow

b)

Design Loadings	Influent	Effluent
BOD	250 mg/l	10 mg/l
TSS	250 mg/l	15 mg/l
TKN	45 mg/l	
NH_3-N		4 mg/l
Phosphorus	7 mg/l	

c) Wastewater temperature 77 °F to 53.6 °F

d) Jobsite elevation 750 feet MSL

e) Ambient air temperature 85 °F to 30 °F

f) Alpha (maximum value allowed) 0.85

g) Beta (maximum value allowed) 0.95

h) F/M ratio 0.091 lb BOD_5/lb MLSS - Day

I) MLSS at low water level 4500 mg/l

j) Maximum Cycles at Peak Daily Flow 5/day/basin

k) Oxygen Requirements 1.5 lbs O2/lb BOD_5 applied
4.6 lbs O2/lb TKN applied

l) Minimum Aeration Time 2.93 hrs/cycle at peak daily flow
Minimum Mixing Time 3.46 hrs/cycle at peak daily flow
Minimum Settling Time 0.75 hrs/cycle at peak daily flow

m) Field Oxygen Transfer Rate (Design Conditions): 0.77 lbs O_2/BHP-hour

PRE-EQUALIZATION/HOLDING BASIN STRUCTURE

The Pre-Equalization/Holding basin shall be field erected in one (1) basin as shown on the contract drawings:

Inside Dimensions: 20 ft. x 20 ft.

Side Water Depth:
Minimum Operating Level: 1.5 ft. SWD
Maximum Operating Level: 17 ft. SWD
Top Of Wall: 20 ft.

PRE-EQ/HOLDING TRANSFER PUMP

Furnish three (3) submersible non-clog transfer pumps for each basin. Each pump shall be equipped with 2.4 HP, submersible electrical motor connected for 460 volt, three phase, 60 hertz operation. Pump housing shall be painted cast iron. Pump shall include an adequate length of multi-conductor chloroprene jacketed type SPC cable suitable for submersible pump applications. The power cable shall also be sized according to NEC and ICEA standards. The pump shall be supplied with a mating cast iron discharge elbow and be capable of delivering 40 GPM at 26.2 ft. TDH and 120 GPM at 20.7 TDH. Each unit shall be fitted with an adequate length of galvanized steel lifting chain of adequate strength to permit raising and lowering the pump.

Each pump shall include a "Seal Failure" and "Over Temperature" warning system.

The pump shall be capable of handling raw, unscreened sewage. The 3" diameter discharge connection elbow shall be permanently installed with the discharge piping. The pump shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service. There shall be no need for personnel to enter the basin or pump well. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump.

A galvanized steel upper guide bar bracket shall be provided with each pump. The entire weight of the pumping unit shall be guided by galvanized steel guide bars and pressed tightly against the discharge connection elbow with metal-to-metal contact. No sealing of the discharge interface by means of a diaphragm, O-ring, or other devices shall be acceptable. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 ft.

Supply of all discharge piping, supports, gaskets, and hardware beyond the flanged connection of the pump discharge connection elbow shall be the responsibility of the installing contractor.

Each pump shall include a manually operated discharge valve to control the design transfer flow rate.

Valve shall be a 3" diameter Milliken 601-N0, 125# flanged end connection, ASTM A-126 Class B cast iron body with welded in nickel seat, EPDM coated ductile iron plug. The valve shall be a non-lubricated type with a port area of at least 80% of full pipe size.

Each pump shall include a 3" diameter Nibco F-918-B check valve with cast iron body and bronze disk to prevent backflow.

Valves shall be provided loose for installation within the discharge piping by the installing contractor. Valve gaskets and hardware shall be supplied by the installing contractor.

Adhesive anchors of 304 stainless steel shall be provided for anchoring the pump.

ENDURA® SERIES AQUA-JET® AERATOR

Furnish one (1) Aqua-Jet mechanical floating aerator and related equipment accessories as described herein for each basin. Each aerator shall consist of a motor, a direct-drive impeller driven at a constant speed, and an integral flotation unit. The Aqua-Jet Aerator shall incorporate design enhancements that provide operation for five years without routine maintenance (greasing).

Aerator Drive Motor

The motor shall be rated for 3 horsepower, 1800 RPM and shall be wired for 460 volt, 60 cycle, three phase service. The motor shall be standard efficiency, vertical P base design, totally enclosed fan cooled TEFC and generally rated for severe chemical duty with a 1.15 service factor.

The motor windings shall be nonhygroscopic, and insulation shall equal or exceed NEMA Class "F". A labyrinth seal shall be provided below the bottom bearing to prevent moisture from penetrating around the motor shaft. A condensate drain shall be located at the lowest point in the lower-end bell housing. Unit shall have a one-piece motor shaft continuous from the top motor bearing, through the lower bearing and down to and through the propeller. The shaft will be manufactured from 17-4 PH stainless steel.

Motor bearings shall be regreasable. Sealed bearings are not acceptable. Top bearing shall be shielded on the bottom side only. Bottom bearing shall be open. The top and bottom motor bearings shall be of combined radial and axial thrust type. The lower motor bearing inner race shall be locked to the motor shaft via a special washer and locking nut arrangement. The shaft shall be threaded just below the lower bearing and shall have a keyway cut into the motor shaft. This key shall accept a tab from the inner diameter of the locking washer, and the locking nut shall have recesses to accept a tab from the outer diameter of the locking washer to prevent the nut from backing off. Snap ring type bearing retainers will not be acceptable.

Diffusion Head

The design of the diffusion head shall be such that the liquid spray shall discharge at an angle of 90 degrees to the motor shaft over a 360 pattern in the horizontal plane and shall be a 304 stainless steel monolithic casting. The diffusion head casting shall act as a base for the aerator motor and alignment of the motor to this base shall be controlled by machined index fittings that engage the P-base of the motor. To minimize vibration and provide adequate strength the diffusion head casting shall weigh not less than 44 lbs. Specifically, diffusion head designs that employ studs and spacers or shoulder bolts are not allowed. Load bearing flange-to-flange connections are mandatory. The diffusion head shall contain an anti-deflection journal insert to limit the radial deflection of the motor shaft. This anti-deflection journal insert shall be located in the lower extremity of the diffusion head approximately one-half the distance between the motor base and the lower end of the shaft. The journal insert shall be machined from Delrin or molded from moly-filled urethane and shall be a minimum of 0.060 inch diameter or larger through the bore than the diameter of the motor shaft. There shall be a fluid deflector located on the motor shaft immediately below the anti-deflection journal, which shall cover completely the anti-deflection journal insert and the lower portion of the diffusion head. This fluid deflector shall be molded from black neoprene and shall be press fit onto the motor shaft.

Impeller

The impeller shall be a precision casting of 316 stainless steel and shall be specifically designed for the application intended. Impeller shall be the self-cleaning type and shall be dynamically and hydraulically balanced. The propeller must be attached to the motor shaft with a hardened stainless steel pin and set screw.

Flotation

Each unit shall be equipped with a modular float constructed of fiberglass filled with closed cell polyurethane foam having a minimum 2.0 lbs./ft3 density. Float shall be completely sealed to prevent the foam from being in contact with the external environment. The minimum diameter of the float shall be 64 inches and the minimum thickness shall be 11 inches. The minimum reserve buoyancy shall be 850 pounds.

Volute

The impeller shall operate in a volute made of 304 stainless steel. It shall be round and true so that impeller blade tip clearance is uniform within the volute as it rotates. The volute shall have a minimum of 3/16-inch wall thickness and a minimum of four full-length stainless steel gussets shall be welded on 90° spacing around the circumference of the volute between the top and bottom flanges.

Intake Cone

The intake cone shall be fabricated from 304 stainless steel having a gradually expanding opening outward to the intake end. The length and inlet diameter shall be sufficient to provide uniform inlet hydraulics so that no increase in vibration is caused due to its shape or size.

Vibration

The entire rotating assembly including the motor rotor, shaft, shaft accessories, and impeller shall be dynamically balanced within 2.0 mils peak-to-peak horizontal displacement measured at the upper and lower motor bearing. Measurements shall be taken at a frequency equivalent to the motor RPM. Measurements shall be taken with the motor in a vertical, shaft down position with the entire power section mounted on resilient pads.

Cover

The cover shall be a minimum of 118 inches in diameter and shall be fabricated of approved fiberglass construction as later described herein. The cover shall be bolted to the diffusion head via a stainless steel attachment ring.

The cover shall have provisions for mooring around the outer circumference. The cover shall be constructed to withstand all stress imposed from wave action and mooring line tension. Covers shall be constructed of polyester fiberglass resins and shall have a resin/glass content of 65% resin and 35% glass. A minimum 0.015 inch thick gel coat shall be provided on all surfaces. A moisture inhibitor such as N.P.G. (neopenthal glycol) or equal, and an ultraviolet inhibitor, such as UV9 or equal, shall be used to protect the cover from moisture and sunlight damage.

Restrained Mooring System

A two (2) point restrained mooring system shall be provided for each unit. The system shall consist of two (2), 4 inch diameter Schedule 40 vertical pylons with base plate constructed of galvanized steel. Each pylon with base plate shall be affixed to the basin floor with 304 stainless steel adhesive anchors. Each pylon shall be filled with concrete by the installing contractor.

Furnished as part of the unit shall be a galvanized steel triangular mooring frame which shall permit the assembly to move up and down following the change in liquid level while restrained within the vertical pylons. Removable 304 stainless steel U-bolts shall be attached to each frame and fit around the pylons.

Restrained Mooring Electrical Power Cable

Each unit shall include #12-four conductor power cable wired into the motor conduit box and terminating at the basin wall. Electrical cable shall be supplied with kellems grips at the motor and basin wall terminations. Electrical cable floats for flotation of power cable shall be provided. Attachment of cable and supply of junction box/disconnect at the basin wall shall be the responsibility of the installing contractor.

304 stainless steel adhesive anchors for attachment of mooring system components to the basin wall shall be provided.

PRESSURE TRANSDUCER

Furnish one (1) KPSI Model 700 submersible pressure transducer unit constructed of stainless steel for each basin. Transducer shall utilize a diffused silicone semiconductor sensor protected by an integral stainless steel diaphragm with seal fluid. Transducer output shall be a 4-20 mA signal. Electrical connection shall be 2-wire, loop powered through a shielded integral cable comprised of 22 AWG conductors and separate drain wire. Attachment of the cable and supply of junction box/disconnect at the basin wall shall be the responsibility of the installing contractor. Transducers shall be suspended using 1/4" 304 stainless steel suspension cables and bracket. Field attachment of the cables and brackets to the basin shall be the responsibility of the installing contractor.

Adhesive anchors of 304 stainless steel shall be provided for anchoring the pressure transducer suspension cables and mounting bracket.

LEVEL SENSORS

Furnish one (1) level sensor assembly consisting of an Anchor Scientific model GSI 40NONC float switch with a smooth, chemical resistant polypropylene casing, and 316 stainless steel mounting bracket for each basin. Each float switch shall be provided with a three conductor electrical cable. Electrical cable shall terminate at a junction box/disconnect located at the basin wall. Field wiring and junction box/disconnect shall be provided by the installing contractor.

Adhesive anchors of 304 stainless steel shall be provided for anchoring the level sensor mounting bracket.

SBR STRUCTURE

The SBR system shall be field erected in two (2) basins as shown on the contract drawings:

Inside Dimensions: 20 ft. x 20 ft.

Side Water Depth:

Minimum Operating Level:	10.2 ft. SWD
Maximum Operating Level:	17 ft. SWD
Top Of Wall:	20 ft.

INFLUENT PLUG VALVE

Furnish one (1), 4 inch diameter electrically operated flanged plug valve for each basin to control the influent flow.

Valves shall be a Milliken 601-N0 125# flanged end connection, ASTM A-126 Class B cast iron body with welded in nickel seat, EPDM coated ductile iron plug, assembled and tested with an Auma SG07.1, 115 volt, single phase, 60 cycle open/close service electric actuator. The valve shall be a non-lubricated type with a port area of at least 80% of full pipe size. Valve actuator shall include a compartment heater.

Each valve shall include a manual override with limit switch feedback to the micro-processor in both the open and closed positions. Field wiring and junction/box disconnect shall be provided by the installing contractor.

Supply of the valve vaults with drain for the valves shall be the responsibility of the installing contractor.

SLUDGE WASTING PUMP

Furnish one (1) submersible non-clog sludge pump for each basin. Each pump shall be equipped with 2.4 HP, submersible electrical motor connected for 460 volt, three phase, 60 hertz operation. Pump housing shall be painted cast iron. Pump shall include an adequate length of multi-conductor chloroprene jacketed type SPC cable suitable for submersible pump applications. The power cable shall also be sized according to NEC and ICEA standards. The pump shall be supplied with a mating cast iron discharge elbow and be capable of delivering 40 GPM at 26.2 ft. TDH and 120 GPM at 20.7 TDH. Each unit shall be fitted with an adequate length of galvanized steel lifting chain of adequate strength to permit raising and lowering the pump.

Each pump shall include a "Seal Failure" and "Over Temperature" warning system.

The 3" diameter discharge connection elbow shall be permanently installed with the discharge piping. The pump shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service. There shall be no need for personnel to enter the basin or pump well. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump.

A galvanized steel upper guide bar bracket shall be provided with each pump. The entire weight of the pumping unit shall be guided by galvanized steel guide bars and pressed tightly against the discharge connection elbow with metal-to-metal contact. No sealing of the discharge interface by means of a diaphragm, O-ring, or other devices shall be acceptable. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 ft.

Supply of all discharge piping, supports, gaskets, and hardware beyond the flanged connection of the pump discharge connection elbow shall be the responsibility of the installing contractor.

Each pump shall include a manually operated discharge valve to control the design transfer flow rate.

Valve shall be a 3" diameter Milliken 601-N0, 125# flanged end connection, ASTM A-126 Class B cast iron body with welded in nickel seat, EPDM coated ductile iron plug. The valve shall be a non-lubricated type with a port area of at least 80% of full pipe size.

Each pump shall include a 3" diameter Nibco F-918-B check valve with cast iron body and bronze disk to prevent backflow.

Valves shall be provided loose for installation within the discharge piping by the installing contractor. Valve gaskets and hardware shall be supplied by the installing contractor.

Adhesive anchors of 304 stainless steel shall be provided for anchoring the pump.

Pump Hoist Assembly

Furnish one (1) 304 stainless steel portable hoist assembly. Each hoist shall be rated for a safe load of 500 lbs., lift of 30 feet, 36" minimum reach and a 60" maximum reach. Hoist shall consist of 1/4" diameter 304 stainless steel cable, painted steel lifting hook, and 304 stainless steel snap hook.
Furnish a total of six (4) 304 stainless steel platform socket assemblies.

Each socket assembly shall be mounted by the installing contractor.

AQUACAM-D®

Furnish one (1) mechanical floating aerator/mixer/decanter and equipment accessories as described herein for each basin. The aerator/mixer shall consist of a motor, direct-drive impeller driven at a constant speed, an integral flotation assembly, and aspirator volute. The impeller shall be designed to pump the liquid from near the surface and direct it down toward the basin bottom. No liquid spray or other liquid leakage upward onto the surface of the motor support surface or flotation chassis shall be allowed at any time.

The integral decanter shall consist of the flotation unit integral with the aerator/mixer unit, a stainless steel movable weir assembly, electric motor weir drive, spring-loaded operator to open and close the weir, and decant hose.

Aerator/Mixer Performance
Each aspirator aerator/mixer shall have a zone of complete mix of 20 feet square at 17 feet water depth. Complete mix shall be defined as maintaining biological suspension of all mixed liquor suspended solids with an MLSS of 4500 mg/l or less. The unit shall be capable of complete mix, both with and without the air being induced.

Aerator/Mixer Drive Motor
The aerator/mixer motor shall be rated at 25 horsepower at 1800 RPM and shall be wired for 460 volt, 60 cycle, three phase service. The motor shall be standard efficiency, vertical P base design, totally enclosed fan cooled TEFC, and generally rated for severe chemical duty with a 1.15 service factor. The motor windings shall be nonhygroscopic, and insulation shall equal or exceed NEMA Class "F". Submerged motors, jet pumps, submerged gear motors or gearboxes shall not be acceptable.

Impeller & Shaft
Unit shall have a one-piece motor shaft continuous from the top motor bearings, through the lower bearing, and down to and through the impeller. This shaft shall be manufactured from 17-4 PH stainless steel having a minimum yield strength of 100,000 psi.

The impeller shall be a precision casting of 316 stainless steel, and shall be specifically designed for the application intended. It shall be dynamically and hydraulically balanced.

Motor Mounting Base
The motor shall be securely mounted to a solid 304 stainless steel base which is integral with the motor base extension. All submersed wetted motor mounting base components to be constructed of 304 stainless steel. There shall be an anti-deflection insert in the lower portion of the motor base. This insert shall be located approximately one-half the distance from the motor flange to the impeller, and shall be used to prevent over-deflection of the shaft during overload conditions.

Intake Volute Assembly
The impeller shall operate in a volute made of 304 stainless steel. Air shall be induced into the flow below the impeller through air induction ports located on the volute. The air induction ports shall be manifolded into a common air intake assembly and attached to an actuated air valve. The volute shall be designed to provide horizontal flow for complete mixing.

Air Valve
A 4" diameter, electrically operated butterfly valve shall be used to control the air. When the air valve is open, the unit shall operate as an aerator/mixer. When the air valve is closed, no air shall be induced and the unit shall operate as a mixing unit only. Valve shall be a Keystone lugged style butterfly valve with cast iron body, EPDM seat, aluminum bronze disk, one piece stainless steel shaft assembled and tested with Keystone 115 VAC, 60 hertz, single phase, open/close service electric actuator. Valve actuator shall include

a compartment heater. Each valve shall include a manual override with limit switch feedback to the microprocessor in both the open and closed positions.

Decanter Assembly

Each decanter shall be capable of withdrawing decant fluid from 4-6 inches beneath the liquid surface, regardless of liquid depth, down to the minimum allowable water level specified below. The decant liquid shall be drawn through an adjustable weir opening of 2-6 inches. The weir shall be circular in shape and permit liquid to enter the decanter from the entire 360 degrees without obstruction.

Maximum allowable water level in the basin is 17 ft.
Minimum allowable water level in the basin is 10.2 ft.
The centerline of each decant pipe must be located 1 ft. below the low water level by the installing contractor.

Each decanter shall be rated for an average flow of 583 gallons per minute.

Weir Actuator

Weir actuator shall include a reversible electric motor operated linear actuator. The actuator shall be capable of operating with a closing force of 1500 lbs. and shall operate from a 115 volt, single phase, 60 hertz source. Adjustable limit switches shall be included to permit adjustment of the weir opening. A coil spring shall be included to provide for travel after the weir has closed and provide desired closure pressure. A corrosion resistant removable cover shall be included to provide protection to the actuator and motor during normal operation. The power section shall be painted steel.

Weir

The weir shall be constructed of 304 stainless steel, be circular in shape, and shall include vortex control baffles permanently affixed to the weir. The weir shall be attached to the actuator through a removable single shaft which shall also function as the torque restraint.

Decanter Discharge Hose

Each decanter shall include a 6" diameter discharge hose of sufficient size to permit vertical movement of the decanter and provide sufficient capacity to handle the design decant flow rate. Discharge hose shall be EPDM tube, tire chord braided with helix wire reinforcement. A painted cast iron 90 degree elbow shall be provided for attachment to the in basin piping and decanter hose. Through-the-wall pipe, in basin piping and supports shall be provided by the installing contractor. Proper flanged connections to the decanter and the discharge points shall be provided for trouble-free operation while permitting a means for disconnecting for service.

Float Mounting Frame

The aerator/mixer and integral decanter shall be mounted on a frame of 304 stainless steel construction. The frame shall support two floats. The floats shall be fiber reinforced polyester (FRP) skin foamed full of polyurethane foam of the closed cell type. Each float shall be sealed to prevent the foam from being in contact with the external environment. The float assembly shall have sufficient flotation to support the aerator/mixer and integral decanter.

Restrained Mooring System

The aerator/mixer and integral decanter shall be moored with a three-point restrained mooring system consisting of three 4" diameter Schedule 40 vertical pylons with base plate constructed of galvanized steel. Each pylon with base plate shall be affixed to the basin floor with 304 stainless steel adhesive anchors. The

pylons shall be filled with concrete by the installing contractor. Furnished as part of the aerator/mixer and integral decanter assembly shall be three removable 5/8" diameter 304 stainless steel U-bolts attached to each frame to fit around the pylons.

Electrical Service Cable

Each aerator/mixer motor shall include #8-four conductor power wired into the motor conduit box and terminating at the basin wall. Electrical cables shall be supplied with kellems grips at the motor and basin wall terminations. Electrical cable floats for flotation of power cables shall be provided. Each air valve shall include #14 AWG-ten conductor power cable from the air valve to a junction box/disconnect at the basin wall. Each decanter unit shall include #16 AWG-eight conductor power cable from the NEMA 4X junction box of the decanter to the basin wall. Attachment of cables and supply of all junction box/disconnects at the basin wall shall be the responsibility of the installing contractor.

DECANT FLOW CONTROL VALVE

Furnish one (1), 6" diameter electrically operated butterfly valve for each basin to control the decant rate.

Valve shall be a Milliken Fig. 511 AWWA C-504 Class 150B electrically operated butterfly valve with ANSI Class 125# flanged end ASTM A-536 ductile iron body, ductile iron disk with a 316 stainless steel edge, fully lined EPDM seat vulcanized in the body, 304 stainless steel shaft assembled and tested with an Auma SG10.1, 115 volt, single phase, 60 cycle open/close service electric actuator. Valve actuator shall include a compartment heater. Each valve shall include a manual override with limit switch feedback to the microprocessor in both the open and closed positions. Field wiring and junction/box disconnect shall be provided by the installing contractor.

Supply of the valve vaults with drain for the valves shall be the responsibility of the installing contractor.

DISSOLVED OXYGEN SENSORS

Furnish one (1) Hach Series SC100 Analyzer with Hach LDO series dissolved oxygen sensor per basin. A handrail bracket and PVC pipe shall be provided for each sensor for installation to the side of the basin. Field wiring, conduit, and installation of cable shall be the responsibility of the installing contractor.

PRESSURE TRANSDUCER

Furnish one (1) KPSI Model 700 submersible pressure transducer unit constructed of stainless steel for each basin. Transducer shall utilize a diffused silicone semiconductor sensor protected by an integral stainless steel diaphragm with seal fluid. Transducer output shall be a 4-20 mA signal. Electrical connection shall be 2-wire, loop powered through a shielded integral cable comprised of 22 AWG conductors and separate drain wire. Attachment of the cable and supply of junction box/disconnect at the basin wall shall be the responsibility of the installing contractor. Transducers shall be suspended using 1/4" 304 stainless steel suspension cables and bracket. Field attachment of the cables and brackets to the basin shall be the responsibility of the installing contractor.

Adhesive anchors of 304 stainless steel shall be provided for anchoring the pressure transducer suspension cables and mounting bracket.

LEVEL SENSORS

Furnish one (1) level sensor assembly consisting of a Anchor Scientific model GSI 40NONC float switch with a smooth, chemical resistant polypropylene casing, and 316 stainless steel mounting bracket for each basin. Each float switch shall be provided with a three conductor electrical cable. Electrical cable shall terminate at a junction box/disconnect located at the basin wall. Field wiring and junction box/disconnect shall be provided by the installing contractor.

Adhesive anchors of 304 stainless steel shall be provided for anchoring the level sensor mounting bracket.

AEROBIC DIGESTER/SLUDGE HOLDING BASIN STRUCTURE

The Aerobic Digester/Sludge Holding basin shall be field erected in one (1) basin as shown on the contract drawings:

Inside Dimensions: 20 ft. x 20 ft.

Side Water Depth:
Maximum Operating Level: 17 ft. SWD
Top Of Wall: 20 ft.

SLUDGE WASTING PUMP

Furnish one (1) submersible non-clog sludge pump for each basin. Each pump shall be equipped with 2.4 HP, submersible electrical motor connected for 460 volt, three phase, 60 hertz operation. Pump housing shall be painted cast iron. Pump shall include an adequate length of multi-conductor chloroprene jacketed type SPC cable suitable for submersible pump applications. The power cable shall also be sized according to NEC and ICEA standards. The pump shall be supplied with a mating cast iron discharge elbow and be capable of delivering 40 GPM at 26.2 ft. TDH and 120 GPM at 20.7 TDH. Each unit shall be fitted with an adequate length of galvanized steel lifting chain of adequate strength to permit raising and lowering the pump.

Each pump shall include a "Seal Failure" and "Over Temperature" warning system.

The 3" diameter discharge connection elbow shall be permanently installed with the discharge piping. The pump shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service. There shall be no need for personnel to enter the basin or pump well. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump.

A galvanized steel upper guide bar bracket shall be provided with each pump. The entire weight of the pumping unit shall be guided by galvanized steel guide bars and pressed tightly against the discharge connection elbow with metal-to-metal contact. No sealing of the discharge interface by means of a diaphragm, O-ring, or other devices shall be acceptable. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 ft.

Supply of all discharge piping, supports, gaskets, and hardware beyond the flanged connection of the pump discharge connection elbow shall be the responsibility of the installing contractor.

Each pump shall include a manually operated discharge valve to control the design transfer flow rate.

Valve shall be a 3" diameter Milliken 601-N0, 125# flanged end connection, ASTM A-126 Class B cast iron body with welded in nickel seat, EPDM coated ductile iron plug. The valve shall be a non-lubricated type with a port area of at least 80% of full pipe size.

Each pump shall include a 3" diameter Nibco F-918-B check valve with cast iron body and bronze disk to prevent backflow.

Valves shall be provided loose for installation within the discharge piping by the installing contractor. Valve gaskets and hardware shall be supplied by the installing contractor.

Adhesive anchors of 304 stainless steel shall be provided for anchoring the pump.

ENDURA® SERIES AQUA-JET® AERATOR

Furnish one (1) Aqua-Jet mechanical floating aerator and related equipment accessories as described herein for each basin. Each aerator shall consist of a motor, a direct-drive impeller driven at a constant speed, and an integral flotation unit. The Aqua-Jet Aerator shall incorporate design enhancements that provide operation for five years without routine maintenance (greasing).

Aerator Drive Motor

The motor shall be rated for 10 horsepower, 1800 RPM and shall be wired for 460 volt, 60 cycle, three phase service. The motor shall be standard efficiency, vertical P base design, totally enclosed fan cooled TEFC and generally rated for severe chemical duty with a 1.15 service factor.

The motor windings shall be nonhygroscopic, and insulation shall equal or exceed NEMA Class "F". A labyrinth seal shall be provided below the bottom bearing to prevent moisture from penetrating around the motor shaft. A condensate drain shall be located at the lowest point in the lower-end bell housing. Unit shall have a one-piece motor shaft continuous from the top motor bearing, through the lower bearing and down to and through the propeller. The shaft will be manufactured from 17-4 PH stainless steel.

Motor bearings shall be regreasable. Sealed bearings are not acceptable. Top bearing shall be shielded on the bottom side only. Bottom bearing shall be open. The top and bottom motor bearings shall be of combined radial and axial thrust type. The lower motor bearing inner race shall be locked to the motor shaft via a special washer and locking nut arrangement. The shaft shall be threaded just below the lower bearing and shall have a keyway cut into the motor shaft. This key shall accept a tab from the inner diameter of the locking washer, and the locking nut shall have recesses to accept a tab from the outer diameter of the locking washer to prevent the nut from backing off. Snap ring type bearing retainers will not be acceptable.

Diffusion Head

The design of the diffusion head shall be such that the liquid spray shall discharge at an angle of 90 degrees to the motor shaft over a 360 pattern in the horizontal plane and shall be a 304 stainless steel monolithic casting. The diffusion head casting shall act as a base for the aerator motor and alignment of the motor to this base shall be controlled by machined index fittings that engage the P-base of the motor. To minimize vibration and provide adequate strength the diffusion head casting shall weigh not less than 85 lbs. Specifically, diffusion head designs that employ studs and spacers or shoulder bolts are not allowed. Load bearing flange-to-flange connections are mandatory. The diffusion head shall contain an anti-deflection journal insert to limit the radial deflection of the motor shaft. This anti-deflection journal insert shall be located in the lower extremity of the diffusion head approximately one-half the distance between the motor base and the lower end of the shaft. The journal insert shall be machined from Delrin or molded from moly-filled urethane and shall be a minimum of 0.060 inch diameter or larger through the bore than the diameter of the motor shaft. There shall be a fluid deflector located on the motor shaft immediately below the anti-deflection journal, which shall cover completely the anti-deflection journal insert and the lower portion of the diffusion head. This fluid deflector shall be molded from black neoprene and shall be press fit onto the motor shaft.

Impeller

The impeller shall be a precision casting of 316 stainless steel and shall be specifically designed for the application intended. Impeller shall be the self-cleaning type and shall be dynamically and hydraulically

balanced. The propeller must be attached to the motor shaft with a hardened stainless steel pin and set screw.

Flotation

Each unit shall be equipped with a modular float constructed of fiberglass filled with closed cell polyurethane foam having a minimum 2.0 lbs./ft3 density. Float shall be completely sealed to prevent the foam from being in contact with the external environment. The minimum diameter of the float shall be 71 inches and the minimum thickness shall be 12 inches. The minimum reserve buoyancy shall be 995 pounds.

Volute

The impeller shall operate in a volute made of 304 stainless steel. It shall be round and true so that impeller blade tip clearance is uniform within the volute as it rotates. The volute shall have a minimum of 3/16-inch wall thickness and a minimum of four full-length stainless steel gussets shall be welded on 90° spacing around the circumference of the volute between the top and bottom flanges.

Intake Cone

The intake cone shall be fabricated from 304 stainless steel having a gradually expanding opening outward to the intake end. The length and inlet diameter shall be sufficient to provide uniform inlet hydraulics so that no increase in vibration is caused due to its shape or size.

Vibration

The entire rotating assembly including the motor rotor, shaft, shaft accessories, and impeller shall be dynamically balanced within 2.0 mils peak-to-peak horizontal displacement measured at the upper and lower motor bearing. Measurements shall be taken at a frequency equivalent to the motor RPM. Measurements shall be taken with the motor in a vertical, shaft down position with the entire power section mounted on resilient pads.

Cover

The cover shall be a minimum of 124 inches in diameter and shall be fabricated of approved fiberglass construction as later described herein. The cover shall be bolted to the diffusion head via a stainless steel attachment ring.

The cover shall have provisions for mooring around the outer circumference. The cover shall be constructed to withstand all stress imposed from wave action and mooring line tension. Covers shall be constructed of polyester fiberglass resins and shall have a resin/glass content of 65% resin and 35% glass. A minimum 0.015 inch thick gel coat shall be provided on all surfaces. A moisture inhibitor such as N.P.G. (neopenthal glycol) or equal, and an ultraviolet inhibitor, such as UV9 or equal, shall be used to protect the cover from moisture and sunlight damage.

Restrained Mooring System

A two (2) point restrained mooring system shall be provided for each unit. The system shall consist of two (2), 4 inch diameter Schedule 40 vertical pylons with base plate constructed of galvanized steel. Each pylon with base plate shall be affixed to the basin floor with 304 stainless steel adhesive anchors. Each pylon shall be filled with concrete by the installing contractor.

Furnished as part of the unit shall be a galvanized steel triangular mooring frame which shall permit the assembly to move up and down following the change in liquid level while restrained within the vertical pylons. Removable 304 stainless steel U-bolts shall be attached to each frame and fit around the pylons.

Restrained Mooring Electrical Power Cable

Each unit shall include #12-four conductor power cable wired into the motor conduit box and terminating at the basin wall. Electrical cable shall be supplied with kellems grips at the motor and basin wall terminations. Electrical cable floats for flotation of power cable shall be provided. Attachment of cable and supply of junction box/disconnect at the basin wall shall be the responsibility of the installing contractor.

304 stainless steel adhesive anchors for attachment of mooring system components to the basin wall shall be provided.

PRESSURE TRANSDUCER

Furnish one (1) KPSI Model 700 submersible pressure transducer unit constructed of stainless steel for each basin. Transducer shall utilize a diffused silicone semiconductor sensor protected by an integral stainless steel diaphragm with seal fluid. Transducer output shall be a 4-20 mA signal. Electrical connection shall be 2-wire, loop powered through a shielded integral cable comprised of 22 AWG conductors and separate drain wire. Attachment of the cable and supply of junction box/disconnect at the basin wall shall be the responsibility of the installing contractor. Transducers shall be suspended using 1/4" 304 stainless steel suspension cables and bracket. Field attachment of the cables and brackets to the basin shall be the responsibility of the installing contractor.

Adhesive anchors of 304 stainless steel shall be provided for anchoring the pressure transducer suspension cables and mounting bracket.

LEVEL SENSORS

Furnish one (1) level sensor assembly consisting of a Anchor Scientific model GSI 40NONC float switch with a smooth, chemical resistant polypropylene casing, and 316 stainless steel mounting bracket for each basin. Each float switch shall be provided with a three conductor electrical cable. Electrical cable shall terminate at a junction box/disconnect located at the basin wall. Field wiring and junction box/disconnect shall be provided by the installing contractor.

Adhesive anchors of 304 stainless steel shall be provided for anchoring the level sensor (mast)(mounting bracket).

UV SYSTEM CONTROL

The SBR control panel will send a signal to the UV system to control the UV based on decant time.

SBR CONTROL PANEL WITHOUT MOTOR STARTERS

The control system shall be designed to optimize the SBR process while minimizing operator attention and to accommodate the continuous maximum daily flow without adjusting cycle structures. The control software program shall be factory tested prior to installation at the jobsite.

The control system shall be a timer based system with level overrides and shall provide control, sequence, monitoring, and alarm annunciation capabilities. The operator shall be able to access the timer values and set points through the operator interface panel to allow for adjustment of cycle times and system flexibility. The control system shall be designed to automatically accommodate the plant's full range of loads and flows.

A complete control system shall be provided as described in the following and as shown on the contract drawings. The control system shall include 115 volt control circuit breaker, microprocessor control, operator interface display, indicator lights, and HAND-OFF-AUTOMATIC selector switches.

The incoming service of the control system shall be 115 volt, 60 hertz, single-phase. Controls for the equipment listed below shall be provided within the SBR control panel. Elapsed time indication shall be provided through the operator interface of the SBR control panel for equipment indicated by an asterisk(*).

QTY	PRE SBR EQUIPMENT DESCRIPTION
3	2.4 HP SBR Transfer Pumps*
1	3 HP Aerator*
1	4-20 mA Pressure Transducer
1	Level Sensor

QTY	SBR EQUIPMENT DESCRIPTION
2	2.4 HP Sludge Pumps*
2	25 HP AquaCAM-D Mixers*
2	Decant Valves
2	Decant Weirs
2	Aspirator Air Valves
2	Influent Valves
2	4-20 mA D.O. signals
2	4-20 mA Pressure Transducers
2	Level Sensors
1	Common Alarm

QTY	DIGESTER EQUIPMENT DESCRIPTION
1	10 HP Aerator*
1	2.4 HP Sludge Pump*
1	4-20 mA Pressure Transducer
1	Level Sensor

QTY	OTHER
1	UV System (start/stop)
2	Composite Samples (monitor only)
1	Influent Flow Meter
1	Effluent Flow Meter

Enclosure:

Free standing NEMA 12 steel enclosure - leg mounted.
Steel surfaces shall be cleaned, phosphate etched, and primed with a zinc rich enamel paint.
Finish paint shall be applied after all openings are completed and the surface is sanded and re-primed.
The exterior of the enclosure shall be painted with ANSI 61 Grey over a phosphatized surface.
The interior of the enclosure shall be painted white.
Lifting points shall be provided as required for convenient handling of the complete control enclosure.
The completed control panel shall meet NEMA 12 rating.
All seams shall be continuously welded and ground smooth.
All gasketing shall be oil resistant and securely held in place.
Dual door panels shall have a keyed handle operated three point latching mechanism with roller latch rods (two keys shall be provided).
Doors shall be mounted using continuous heavy gauge piano hinge.

Door and enclosure stiffeners shall be welded into the enclosure as required to maintain flat smooth surfaces.

One print pocket shall be provided on the control panel door. One complete set of electrical control drawings

shall be provided in the pocket.

Panel shall be UL listed and labeled.

CONTROL RELAYS

UL listed control relays for general control purposes shall be supplied with a pilot light to indicate when the coil is in an energized state. The relay socket shall be panel or DIN rail mounted inside the enclosure. The relays shall provide the following ratings: 120VAC coil, 10A contact rating (thermal), 250 VAC insulation rating, 6 million mechanical life cycles and an operating temperature of -22°F to 131°F. Relays shall be Allen-Bradley 700-HK or approved equal.

GROUND FAULT DUPLEX RECEPTACLE

A UL listed ground fault circuit interrupter (GFCI) duplex receptacle shall be provided within the panel for instrument (e.g. programming terminal, modem, etc.) use only. The receptacle shall be protected with a 5 Amp circuit breaker. The receptacle shall carry a 20A / 125VAC rating. The electro-mechanical circuit interrupter shall be double-pole and trip free (GFCI protection and shall not be overridden by holding reset button). Built-in transient suppression shall protect GFCI's internal circuitry from voltage transients. Receptacle shall be Hubbell DRUBGFI20 or approved equal.

Control Panel Wiring Components

All wires entering or leaving the control panel shall attach to the terminal strip.

All control panel wire shall be 16 AWG multi-strand machine tool wire minimum.

Insulation shall be MTW.

Wiring color continuation shall be:

120 VAC control power	-	RED
Neutral	-	WHITE
Ground	-	GREEN
Power from remote source		YELLOW
24 volt DC (+)	-	BLUE
24 volt DC (-)	-	BLUE W/WHITE STRIPE

All wires shall be clearly marked with an identification number consistent with the wiring schematic drawing. Wire markers shall be a thermal transfer printable type. The material shall be a self-laminating vinyl. Labels shall be Brady THT-9-427-10 or approved equal.

All terminals shall be strip mounted.

Voltage rating 600 volts.

Amperage rating 25 amps.

All terminals shall be numbered per the wiring schematic.

Wire terminations shall be tubular compression.

Switches/Pilot lights.

Selector switches shall be used on all automatic controlled equipment. Selector switches shall be rated NEMA

4X with contacts rated at 60 amp make, 6 amp break, 10 amp continuous. Pilot lights shall be 120/6 volt transformer type rated NEMA 4X. All switches and lights shall be clearly labeled with white plastic legend plates with black lettering.

PROGRAMMABLE LOGIC CONTROLLER

Automatic operation of the SBR shall be controlled through a programmable logic controller (PLC) mounted inside the main control panel. The PLC components shall consist of a panel mounted rack or chassis, power supply, CPU, discrete input and output modules and analog input and output modules. The processor unit shall include a DH+ and RS-232 communication port. All input and output points supplied (including unused) shall be wired to terminal blocks.

VENDOR/MODEL

Allen-Bradley/ SLC 5/04 – Processor
Allen-Bradley/1746-A13 – Chassis
Allen-Bradley/1746-P4 – Power Supply
Allen-Bradley/1746-IA16 – Discrete input (16 point) modules
Allen-Bradley/1746-OW16 – Discrete output (16 point) modules
Allen-Bradley/1746-NI8 – Analog input (8 channel) modules

DESIGN DESCRIPTION-5/04 PROCESSOR

Program memory size, 32K
High-speed performance – 0.90 ms/K typical scan time
Built-in DH+ and RS-232 channels
Built-in real-time clock/calendar
Battery backed RAM
Keyswitch – Run, REMote, PROGram (clear faults)
Ambient operating temperature of +32 degrees F. to +140 degrees F.
UL Listed

DIGITAL INPUT MODULE (16 POINT MODULE)

Input voltage 120 Volt (nominal)
85 - 132 VAC
47 - 63 Hertz
Switching response 35 ms on - 45 ms off

16 status light indicators.
Removable wiring terminal strip.
UL and CSA approved.

DIGITAL OUTPUT MODULE (16 POINT)

16 relay outputs rated at 1.5 amps.
Load voltage 1800 VA make, 180 VA break
No leakage current in the open state.
16 status light indicators
UL and CSA approved

ANALOG INPUT MODULE (8 POINT MODULE)

Input voltage: 4-20 mA
Resolution: 12 bit

Maximum ratings: -45 mA to + 45 mA
Conversion time: 0.4 ms
8 status light indicators
Removal wiring terminal strip

REMOTE ACCESS MODEM

A remote access modem shall be supplied for dial-up access to the PLC controller. This modem shall comply with FCC part 68, Part 15-class b and be UL/CSA certified. Line rates shall be 56K through 28K bps (V90) and 28.8K through 2400 bps (V.34). The modem shall provide an RJ11C phone interface connection and require an unconditioned PSTN dial-up phone line. Operation: Full Duplex over 2-wire dial up.

The unit shall be DIN rail mounted with power requirements of 24VDC/100mA. Operating temperature range shall be 32-140 degF (0-60 degC). The modem shall be the 9300-RADKIT manufactured by Rockwell
Automation.

OPERATOR INTERFACE DISPLAY

Panelview 600 Operator Touch Terminal, Model 2711T6A8L1
Display: Color active matrix, TFT with 320 x 240 pixel resolution
DH+ PLC Communication
Rating NEMA 4X (indoors).
UL Listed.
Real time clock
RS-232 Programming port
Power Requirement: 24VDC / 1A

Screens programmed:
- Process cycle current phase with time remaining in the phase
- Cycle structure presets
- Aeration cycle presets
- Alarm condition annunciation
- Auxiliary equipment presets

SOFTWARE

The PLC function shall be to control, sequence, and monitor the SBR.

PHASE CONTROL, the regulation of the process cycles of the SBR up to the maximum daily flow of the plant.

AERATION CONTROL, the regulation of the aeration and mixing systems to achieve optimum process control.

COMPONENT MONITORING, the monitoring of components for fault conditions and the orderly alarming and logging of the fault.

Section-11217

Residential Wastewater

Pumping Stations

SECTION 11217

RESIDENTIAL WASTEWATER PUMPING STATIONS

1. GENERAL

1.01 SCOPE

Provide all labor, materials, and equipment necessary for furnishing and installing underground residential submersible sewage pumping station(s) complete and in proper operating condition. The work includes all work shown or implied on the Drawings. The work includes (but is not limited to):

A. Coordination of final station location and controls location with resident and ENGINEER.

B. Furnishing, installation and start-up of factory built simplex submersible grinder pump station complete with enclosure, plumbing and controls.

C. All related electrical work required to place the pumping unit in service shall be the responsibility of the resident.

D. Connection of the resident's sewer lateral to the completed pump station shall be the responsibility of the resident

E. Furnishing and installation of the 1-1/4" service main isolation valve and check valve in a standard meter vault at the point of connection of the service main with the interceptor force main.

F. All related site work including clearing, grading, trenching, backfilling, surface restoration, clean-up, etc.

PLEASE NOTE - Installation of the Pumping Station 1-1/4" service main between the pump station and the main force main is covered under a separate section of these specifications and is not a part of this specification.

1.02 QUALITY CONTROL

A. These specifications and the Drawings are based the provision of a E-One submersible pumping unit or an approved equal

B. Guarantee: The manufacturer of the submersible pumping station shall guarantee all equipment supplied against defects in workmanship and material for a period of sixty (60) months, but no greater than sixty-five (65) months after receipt of shipment. The OWNER will report any defects found during the warranty period to the

MANUFACTURER. In the event a component fails to perform as specified or is proven defective in service during the warranty period, the Manufacturer shall repair or replace, at his discretion, such defective part without cost to the OWNER. He shall further provide, without cost, such labor as may be required to replace, repair, or modify major equipment components.

C. Start-Up: The manufacturer shall provide the services of a factory-trained representative for a minimum period of two weeks on-site to perform initial start-up of the pumping units and to instruct the OWNER'S operating personnel in the operation and maintenance of the equipment.

1.03 SUBMITTALS

Each pump manufacturer must provide to the ENGINEER the information listed below 10 calendar days prior to bid. Approved manufacturers will be notified through addendum. This submittal does not relieve the apparent successful bidder from full submittal responsibilities after award of the bid. Submit the following:

A. Manufacturer's warranty/guarantee, and warranty certification form bound in these specifications.

B. Pump station Shop Drawings complete with station drawing, electrical schematics, and accessory components.

C. Pump station O & M Manuals. Manuals are to provide basic instructions for preventative and cyclic maintenance, sources of spare parts, etc.

2.0 PRODUCTS

2.01 MATERIALS - WET WELL

Fiberglass Construction. The tank shall consist of a single wall, laminated fiberglass construction. The resin used shall be of a commercial grade suitable for the environment. The reinforcing material shall be a commercial grade of glass fiber capable of bonding with the selected resin. The inner surface shall have a smooth finish and be free of cracks and crazing. The exterior tank surface shall be relatively smooth with no exposed fiber or sharp projections present.

The tank wall and bottom shall be of sufficient thickness and construction to withstand the imposed loading due to saturated soil at the specified burial depth for each available tank height. All station components must function normally when exposed to the external soil and hydrostatic pressures developed at the specified burial depth. The tank bottom shall be reinforced with a fiberglass plate extending beyond the tank walls to support concrete anchoring, as required, to prevent flotation. The tank shall include a solid fiberglass cover, secured with threaded stainless steel fasteners, providing low profile mounting.

The pump discharge piping components shall be 1 1/4" HDPE IPS and consist of PVC pipe fittings, a PVC ball valve, rated at 200 psi, with integral union to facilitate piping disconnect. A 1 1/4" anti-siphon valve shall be integral to the piping inside the basin. Installation of the pump discharge piping shall require field assembly by the installing party. The tank shall have a discharge bulkhead, which terminates outside the tank wall with a 1 1/4" female pipe thread. The discharge bulkhead shall be factory installed and warranted by the manufacturer to be watertight. The tank shall be furnished with an EPDM grommet to accept a 4.50" OD (4" DWV or SCHD 40) inlet pipe. The power and control cable shall be 32' in length standard and shall connect to the pump by means of the provided NEMA 6P electrical quick disconnect (EQD) and shall enter the tank through a watertight strain relief connector supplied by the manufacturer. Junction boxes will not be acceptable. Installation of the inlet grommet and cable strain relief shall require field penetration of the tank wall by the installing party. Provision shall be made for tank venting in the 4" inlet line in accordance with national and local plumbing code requirements.

2.02 MATERIALS – PUMPS

Pumps shall be of the progressing cavity or centrifugal design. The pumps must be capable of operating at negative total dynamic head without overloading the motor. Under no conditions shall in-line piping or valving be allowed to create a false apparent head.

The pump(s) operations curve shall be as follows:

Ops Point 1	8 GPM	@ 176 Ft
Ops Point 2	10 GPM	@ 120 Ft
Ops Point 3	12 GPM	@ 70 Ft
Ops Point 4	14 GPM	@ 15 Ft

The pump(s) must be capable of delivering cleansing velocities as dictated by Division of Water of 2 feet/second against a continuous total dynamic head of up to 140 feet.

A. PROGRESSING CAVITY PUMP: The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with mechanical seal. The rotor shall be constructed of stainless steel. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. Buna-N is not acceptable as a stator material. The material shall be suited for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, good aging properties, and outstanding wear resistance.

B. MECHANICAL SEAL: The pump shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary

ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

C. GRINDER: The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece stainless steel motor shaft. The grinder impeller assembly shall be securely fastened to the pump motor shaft. The grinder will be of the rotating type with a stamped, stainless steel shredder ring assembly spaced in accurate, close annular alignment with the driven impeller assembly, which shall carry hardened, stainless steel cutter bars.

This assembly shall be dynamically balanced and operate without vibration over the entire range of specified operating pressures. The grinder shall be constructed so as to eliminate clogging and jamming under all normal operating conditions including pump starting. Sufficient vortex action shall be created by the grinder pump, to scour the tank free of deposits or sludge banks, which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:

1. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.

2. The grinder inlet shroud shall have a diameter no less than 5 inches.

The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects," such as paper, wood, plastic, glass, rubber and the like, to finely divided particles that will pass freely through the passages of the pump and the 1-1/4" diameter discharge piping.

2.03 MATERIALS - PUMP MOTORS

The motor shall be a 240 Volt 60 Hertz, 1 Phase, capacitor start, ball bearing, squirrel cage induction type with a low starting current. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor.

2.04 MATERIALS – CHECK & ISOLATION VALVES

A check valve and isolation valve shall be provided within the fiberglass wet well as depicted in the design drawings. The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve secured to the stainless steel pump discharge elbow. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow. Working parts will be made of a 300 series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A non-metallic hinge shall be an integral part of the flapper assembly providing

a maximum degree of freedom to assure seating even at a very low backpressure. The valve body shall be injection-molded parts made of glass filled thermoplastic.

A pump isolation valve and check valve shall also be provided in a standard meter box enclosure at the point of connection of the service main to the main pressure sewer header.

Provision of all isolation valves and check valves shall be considered an integral part of the unit price EACH for residential pump stations and shall not be considered for separate payment.

2.05 MATERIALS - CONTROLS

CONTROLS: All necessary controls shall be located in the control cover of the core unit. The control cover will be attached with stainless steel fasteners. The grinder pump will be furnished with a length of 6 conductor 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements. Non-fouling waste water level detection for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air-bell level sensor connected to a pressure switch. The level detection device shall have no moving parts in direct contact with the wastewater. High-level sensing will be accomplished in the manner detailed above by a second, independent, air-bell sensor and pressure switch of the same type. Float switches will not be acceptable

To assure reliable operation of the pressure sensitive switches, each core shall be equipped with a breather assembly, complete with a suitable means to prevent entry of water into the motor compartment.

ALARM/DISCONNECT PANEL: Each Grinder Pump Station shall include a NEMA 3R, Alarm/Disconnect Panel suitable for wall or pole mounting. The NEMA 3R enclosure shall be manufactured of corrosion resistant thermoplastic and be furnished with a hinged cover and pad lock.

For each core, the panel shall contain one (1), double pole circuit breaker of the appropriate amperage for the power circuit and one (1) single pole circuit breaker of the appropriate amperage for the alarm circuit. The Alarm/Disconnect Panel shall include a visual high-level alarm indicator. The visual alarm lamp shall be inside a red fluted lens mounted to the top of the enclosure in such a manner as to maintain NEMA 4 rating. The alarm sequence is to be as follows:

1. When liquid level in the tank rises above the alarm level, the contacts on the alarm pressure switch will close and the visual alarm will illuminate on the control panel.

2. The visual alarm will remain illuminated until the sewage level in the tank drops below the "off" setting of the alarm pressure switch.

2.06 MATERIALS – CORE UNIT

Pump units with slide away couplings shall be provided. The slide away coupling shall allow the pump to be installed or removed without requiring personnel to enter the wet well. The Grinder Pump Station shall have an easily removable core assembly consisting of the pump, motor, grinder, all motor controls, check valve, anti-siphon valve, EQD and wiring. The grinder pump core unit shall be furnished with a polypropylene lifting harness or stainless steel chain. In the event that guide rails are used to facilitate easy removal, guide rail material must be stainless steel. All mechanical and electrical connections must provide easy disconnect accessibility for core unit removal and installation.

2.07 MATERIALS - ACCESSORIES

A. All materials exposed to wastewater shall have inherent corrosion protection. Acceptable corrosion protection includes epoxy powder-coated cast iron, fiberglass, stainless steel, polyethylene, nylon, and PVC.

B. Spare core assemblies shall be included as set forth in the bid schedule.

C. Electrical Systems & Components - All electrical systems and components shall be in full accordance with the current edition of the National Electrical Code. All power supply lines and control lines to the pump station shall be fully encased in rigid conduit meeting NEC requirements. All electrical systems and components in wet wells and enclosed spaces shall comply with National Electrical Code requirements. All conduits extending from the wet well to the control panel shall be sealed at the entrance to the control panel to prevent the intrusion of corrosive gases! The control circuitry shall be provided with "Ground Fault" interruption protection, which will de-energize the circuit in the event of any failure in the electrical integrity of the pump power cable.

3.0 EXECUTION

3.01 INSTALLATION

A. Maintenance of Service: Wastewater service shall be maintained throughout the construction activity. No discharge to surface waters shall be allowed.

B. Installation shall be in accordance with the Manufacturer's requirements and the referenced codes and specifications.

C. Excavation: CONTRACTOR shall select means, methods, sequences and techniques of construction to both protect adjacent properties and to provide a stable, safe working environment. Decision as to whether to use sheet piles with wales and struts, manhole

trench box, piles and lagging, or other methods of excavation support shall be the CONTRACTOR'S.

D. Backfilling: Before backfilling is started, the excavated pit shall be cleared of all rubbish and debris and shall be de-watered. The backfill material shall be free of frozen lumps, vegetation and debris. Backfill material shall be placed in uniform horizontal layers not exceeding 6 inches in thickness (loose measure). As a precaution against the development of unbalanced stresses, the backfill shall be placed and compacted symmetrically about the excavation to 95% of Standard Proctor Density.

The grading shall be brought to the level of the existing topography or to the elevations established by the ENGINEER. Final dressing shall be accomplished by such methods as may be necessary to produce a uniform and smooth finish to all parts of the regrade. The surface shall be free from clods greater than two inches in diameter.

3.02 TESTING

A. Pump Test: The completed installation shall be given a running test of all equipment. While the pump(s) is/are running, all piping and seals shall be checked to insure that no leaks occur. All controls and warning indicators shall be checked for proper operation.

B. Smoke Test: The CONTRACTOR shall smoke test the resident's incoming sewer system (in the presence of the ENGINEER) to verify that roof leaders are not connected to the grinder system. A written report of all smoke testing, with emphasis on non-complying homeowners, shall be furnished to the ENGINEER at the completion of the project.

C. Repair: Any defects or failure to meet the requirements of these specifications shall be promptly corrected by the CONTRACTOR by replacement. The decision of the OWNER as to whether or not the CONTRACTOR has fulfilled his obligation shall be final and binding on all parties.

D. Factory Testing: Each grinder pump shall be submerged and operated for a minimum of 5 minutes. Included in this procedure will be the testing of all ancillary components such as, the anti-siphon valve, check valve, discharge line, level sensors and each unit's dedicated controls. All factory tests shall incorporate each of the above listed items. Actual appurtenances and controls which will be installed in the field, shall be particular to the tested pump only. A common set of appurtenances and controls for all pumps will not be acceptable. Certified test results shall be available upon request showing the operation of each grinder pump at two (2) different points on its curve, with the maximum pressure no less than 75 psi. The ENGINEER reserves the right to inspect such testing procedures with representatives of the OWNER, at the grinder pump manufacturer's facility.

END SECTION

Section-11225

Sewage Pumping Station

And Appurtenances

SECTION 11225

SEWAGE PUMPING STATION AND APPURTENANCES

PART 1 - SCOPE

Items covered under this section of the specification include materials, equipment and method of installation necessary for the construction of a duplex submersible sewage pumping station complete with all appurtenances shown on the Drawings and more fully hereinafter.

PART 2 - GENERAL

Duplex Submersible Sewage Pumping Station:

The principal items of equipment in each station shall include two (2) motor driven, non-clog submersible sewage pumps, plug valves, check valves, pressure gauges, influent isolation valves, required piping, electrical controls, automatic pumping level controls, access hatches, vent piping, slide rails and hoist, and other required appurtenances and wiring.

PART 3 - EARTHWORK

Requirements of Regulatory Agencies:

1. State and local code requirements shall control the disposal of trees and shrubs.

2. All burning shall be controlled by applicable local regulations.

A. Job Conditions

1. Weather-Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained on account of rain, snow, ice, drought or other adverse weather conditions.

2. Dust Control - Use all means necessary to control dust on or near the project site where such dust is caused by the Contractor's operation or directly results from conditions left by the Contractor.

B. Clearing and Grubbing

Work shall consist of cutting and removing designated trees, stumps, brush, logs, removal of fences, or other loose and projecting material. Unless otherwise specified, it shall also include the grubbing of stumps, roots and other natural obstructions which, in the opinion of the Engineer, must be removed to execute properly the construction work and operate properly the facility upon the completion of construction.

No cleared or grubbed materials shall be used in backfills or embankment fills.

All stumps, roots and other objectionable material shall be grubbed up so that no roots larger than 3 inches in diameter remain less than 18 inches below the ground surface.

All holes and depressions left by grubbing operations shall be filled with suitable material and compacted to grade.

Disposal shall be by methods satisfactory to the Engineer, however, burning will be permitted only when the Contractor has obtained written permission from the local regulatory agency.

The Contractor shall also remove from the site and satisfactorily dispose of all miscellaneous rubbish including, but not limited to, masonry, scrap metal, rock, pavement, etc., that is under the fill or to be removed as shown on the Drawings, specified herein, or directed by the Engineer.

Existing improvements, adjacent property, utility and other facilities, and trees, plants and brush that are not to be removed shall be protected from injury or damage resulting from the Contractor's operations.

Trees and shrubs, designated to remain or that are beyond the clearing and grubbing permits, which are injured or damage during construction operations shall be treated at the Contractor's expense by experienced tree surgery personnel.

C. Erosion Control

Temporary measures shall be applied throughout the construction period to control and to minimize siltation to adjacent properties and waterways. Such measures shall include, but not be limited to, the use of berms, baled straw silt barriers, gravel or crushed stone, mulch, slope drains and other methods. These temporary measures shall be applied to erodible material exposed by any activity associated with the construction of this project.

D. Excavation

All excavation required for execution of the work shall be done as part of the lump sum price for the complete pump station; no classification of excavation will be made.

Excavation of every description and of whatever substances encountered within the grading limits of the project shall be performed to the lines and grades indicated on the Drawings. All excavation shall be performed in the manner and sequence as required for work.

All excavated materials that meet the requirements for fill, subgrades or backfill shall be stockpiled within the site for use as fill or backfill, or for providing the final site

grades. Where practicable, suitable excavated material shall be transported directly to any place in the fill areas within the limits of the work. All excavated materials which are not suitable for fill, and any surplus of excavated material which is not required for fill shall be disposed of by the Contractor.

The site shall be kept free of surface water at all times. The Contractor shall install drainage ditches, dikes and shall perform all pumping and other work necessary to divert or remove rainfall and all other accumulations of surface water from the excavations. The diversion and removal of surface water shall be performed in a manner that will prevent that accumulation of water behind temporary structures or at any other locations within the construction area where it may be detrimental. The Contractor shall provide, install and operate sufficient trenches, sumps, pumps, hose piping, well points, deep wells, etc., necessary to depress and maintain the ground water level at two (2) feet below the base of the excavation during all stages of construction operations. The ground water table shall be lowered in advance of excavation and maintained a minimum of two (2) feet below the lowest excavation subgrade made until the structure has sufficient strength and weight to withstand horizontal and vertical soil and water pressures and natural ground water.

Excavations for concrete structural slabs on existing grade shall extend two (2) feet below the indicated bottom of slabs. The over-excavation shall be backfilled with 18 inches, compacted thickness, of overlot fill material or suitable material as herein specified. The remaining six (6) inches of over-excavation shall be backfilled with porous fill material. The porous fill layer shall extend beyond the limits of the concrete slab a minimum of two (2) feet on all sides as indicated on the Drawings. The porous fill shall be crushed stone or gravel and shall have the following U.S. Standard Sieve gradation:

Sieve	1-1/2	1	3/4	½	3/8
% Passing	Min 100	95+5	58+17	Max 15	Max 5

Excavation for the construction shall be carefully made to the depth as required. Bottoms for footings and grade beams shall be level, clean and clear of loose material, the lower sections true to size. Bottoms of footings and grade beams, in all locations, shall be at a minimum depth of 30 inches below adjacent exterior finished grade or 30 inches below adjacent existing grade, whichever is lower, whether so indicated or not. Footings and grade beam bottoms shall be inspected by the Engineer before any concrete is placed thereon.

In excavations for structures where, in the opinion of the Engineer, the ground is spongy or otherwise unsuitable for the contemplated foundation, the Contractor shall remove such unsuitable material and replace it with suitable material properly compacted.

Sheeting and shoring shall be provided as necessary for the protection of the work and for the safety of the personnel. The clearances and types of the temporary structures, insofar as they affect the character of the finished work, will be subject to the review of the

Engineer, but the Contractor shall be responsible for the adequacy of all sheeting, bracing and coffer damning. All shoring, bracing and sheeting shall be removed as the excavations are backfilled in a manner such as to prevent injurious caving; or, if so directed by the Engineer, shall be left in place. Sheeting left in place shall be cut off 18 inches below the surface.

Excavation for structures which have been carried below the depth indicated without specific instructions shall be refilled to the proper grade with suitable material properly compacted, except that in excavation for columns, walls or footings, the concrete footings shall extend to this lower depth. All work of this nature shall be at the Contractor's expense.

E. Fill

All existing fill below structures and paved areas must be stripped. The upper six (6) inches of the natural subgrade below shall be scarified and recompacted at optimum moisture to at least ninety-five percent (95%) of Standard Proctor Density ASTM D 698-78.

All vegetation, such as roots, brush, heavy sods, heavy growth of grass and all decayed vegetable matter, rubbish and other unsuitable material within the area upon which fill is to be placed shall be stripped or otherwise removed before the fill is started. In no case will such objectionable material be allowed to remain in or under the fill area.

Existing fill from excavated areas on site shall be used as fill for open and/or planted areas. Additional fill stockpiled at the site can be used for structural fill if approved by the Engineer. Any additional material necessary for establishing the indicated grades shall be furnished by the Contractor and approved by the Engineer. All fill material shall be free from trash, roots and other organic material. The best material to be used in fills shall be reserved for backfilling pipe lines and for finishing and dressing the surface. Material larger than 3 inches maximum dimension shall not be permitted in the upper 6 inches of the fill area. Fill material shall be placed in successive layers and thoroughly tamped or rolled in a manner approved by the Engineer, each layer being moistened or dried such that the specified degree of compaction shall be obtained. No fill shall be placed or compacted in a frozen condition or on top of frozen material. No fill material shall be placed when free water is standing on the surface of the area where the fill is to be placed and no compaction of fill will be permitted with free water on any point of the surface of the fill to be compacted.

Where concrete slabs are placed on earth, all loam and organic or other unsuitable material shall be removed. Where fill is required to raise the subgrade for concrete slabs to the elevations as indicated on the Drawings or as required by the Engineer, such fill shall consist of suitable material and shall be placed in layers. Each layer shall be moistened or dried such that specified degree of compaction is obtained. All compaction shall be accomplished in a manner and with equipment approved by the Engineer. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for adjacent fill.

F. Backfilling

After completion of footings, grade beams and other construction below the elevation of the final grades and prior to backfilling, all forms shall be removed and the excavation shall be cleaned of all trash and debris. Material for backfilling shall be as specified for suitable material, placed and compacted as specified hereinafter. Backfill shall be placed in horizontal layers of the thickness specified and shall have a moisture content such that the required degree of compaction is obtained. Each layer shall be compacted by mechanical tampers or by other suitable equipment approved by the Engineer to the specified density. Special care shall be taken to prevent wedging action or eccentric loading upon or against the structure. Trucks and machinery used for grading shall not be allowed within 45 degrees above the bottom of the footing or grade beams.

G. Compaction

Suitable material as hereinbefore specified shall be placed in horizontal layers. Compaction shall be performed by rolling with approved tamping rollers, pneumatic-tired rollers, three-wheel power rollers or other approved equipment. The degree of compaction required is expressed as a percentage of the maximum dry density obtained by the test procedure presented in ASTM D-698. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate opening the specified compaction. Compaction requirements shall be as specified below:

Fill Utilized For	Required Density (%)	Maximum Permissible Lift Thickness as Compacted, Inches
Backfill & Utility Trenches Under Foundations & Pavement	95-100	8
Backfill Around Structures	95-100	8
Fill & Utility Trench Backfill Under Sidewalks & Open Areas	90-100	8

Field density tests shall be performed in sufficient number to insure that the specified density is being obtained. Tests shall be in accordance with ASTM Standards D 1556 or D 2922/D 3017 and shall be performed as authorized by the Engineer.

H. Site Grading

Where indicated or directed, topsoil shall be removed without contamination with subsoil and spread on areas already graded and prepared for topsoil, or transported and stockpiled convenient to areas for later application, or at locations specified. Topsoil shall be stripped to full depth and, when stored, shall be kept separate from other excavated materials and piled free of roots, stones, and other undesirable materials.

Following stripping, fill areas shall be scarified to a minimum depth of six (6) inches to provide a bond between existing ground and the fill material.

Material shall be placed in successive horizontal layers not exceeding twelve (12) inches uncompacted thickness.

In general, layers shall be placed approximately parallel to the finished grade line.

In general and unless otherwise specified, the Contractor may use any type of earth moving equipment he has at his disposal, provided such equipment is in satisfactory condition and of such type and capacity that the work may be accomplished properly and the grading schedule maintained. The Contractor shall also furnish, operate and maintain graders, dozers, and other such equipment as is necessary to control uniform layers, section and smoothness of grade for compaction and drainage.

During construction, the Contractor shall route equipment at all times, both when loaded and empty, over the layers as they are placed, and shall distribute the travel evenly over the entire area.
The material in the layers shall be of the proper moisture content before rolling or tamping to obtain the prescription compaction. Wetting or drying throughout the layer shall be required. Should the material be too wet to permit proper compaction or rolling, all work on the fill thus affected shall be delayed until the material has dried to the required moisture content. If the material is too dry, it shall be sprinkled with water and manipulated to obtain the uniform content required throughout a layer before it is compacted.

Each layer of the fill shall be compacted by rolling or tamping to not less than 90% maximum density at optimum moisture content as determined by field density tests made by the Standard Proctor method in accordance with ASTM D 698.

In general and unless otherwise specified, the Contractor may use any type of compaction equipment such as sheepsfoot rollers, pneumatic rollers, smooth rollers and other such equipment he has at his disposal, provided such equipment is in satisfactory condition and is of such design, type, size, weight and quantity to obtain the required density in the embankment.

If at any time the required density is not being obtained with the equipment then in use by the Contractor, the Engineer may require that different and/or additional compaction equipment be obtained and placed in use at once to obtain the required compaction.

Samples of all fill and embankment materials, both before and after placement and compaction, will be taken by the Engineer, and from the tests made on such samples, certain corrections, adjustments and modifications of methods, materials and moisture content will be directed to obtain uniformity with the governing specifications for compaction and construct properly the fill and embankment.

The Contractor shall be responsible for the stability of all embankments and shall replace any portion which, in the opinion of the Engineer, has become displaced due to carelessness or negligence on the part of the Contractor.

PART 4 - WET WELLS AND VALVE VAULTS

Pumping stations and valve vault shall be constructed of circular precast concrete barrel

sections or precast reinforced concrete box sections or cast in-place. For cast in-place see details in drawing's.

A. Circular Precast Concrete Barrel Sections

Circular precast concrete barrel sections for wet wells and valve pits shall conform to ASTM C 478 except sections deeper than 12 feet shall have reinforcing equal to that of ASTM C76 Class III reinforced concrete pipe unless otherwise noted on the Drawings.

Joints shall be mortared or grouted; joined with AASHTO M-198-75 preformed flexible butyl type joint sealant, Hamilton-Kent "Kent-Seal No. 2", K.T. Synder Co. "Rub'r-Nek", Press Seal Gasket "E-Z Stik", or equal; or joined with bituminous mastic joint sealing compound meeting Kentucky Department of Transportation Specification 807.02.04. When making joints with mastic compound, prime and seal all joints with primer supplied with the joint compound. Joints shall be watertight.

B. Rectangular Precast Concrete Barrel Sections

Rectangular precast concrete barrel sections for wet wells and valve pits shall conform to ASTM C 850 and shall be designed for equivalent fluid pressures of 45 psf above the water table and 95 psf below the water.

Joints shall be mortared or grouted; joined with AASHTO M-198-75 preformed flexible butyl type joint sealant, Hamilton-Kent "Kent Seal No. 2" K.T. Snyder Co., "Rub'r-Nek" Press Seal Gasket E-Z Stik", or equal; or jointed with bituminous mastic joint sealing compound meeting Kentucky Department of Transportation Specifications 807.02.04. When making joints with mastic compound, prime and seal all joins with primer supplied with the joint compound. Joints shall be water tight.

C. Access Steps

See Section 2, Paragraph 2.04G.

D. Coating

The Contractor shall coat the wet well interior with a high solids catalyzed epoxy - two coat paint system:

1. First Coat - TNEMEC Series 104 H.S. Epoxy

2. Second Coat - Repeat First Coat

Manufacturer's recommendations shall be followed in regard to drying time between coats. Before the application of the first coat, care shall be taken to ensure that the concrete is free of all curing oils, form oils, laitance, soluble salts, and loose concrete. Concrete shall be clean and thoroughly dry before coating.

PART 5 - CONCRETE BASE AND TOP SLABS

Reinforced concrete base and top slab shall be 4000 psi concrete of the dimensions

shown on the Drawings. Cast-in-place concrete shall be as specified in Section 4.

A precast concrete top slab (for the wet well) may be used in lieu of the cast-in-place top slab shown on the Drawings. Reinforcing shall be equivalent to that shown on the Drawings. Wet well access hatchs and wet well vent shall be cast in the top slab.

PART 6 - ACCESS HATCH FOR WETWELL & VALVE VAULT

Access hatch shall be watertight, lockable with standard padlock assembly, and of aluminum construction. Hatch shall be constructed of 1/4" inch checkered plated with aluminum reinforcing to provide a 300 psf live load rating for the entire cover. Should multiple covers be in series without concrete support between each individual hatch, the cover shall be designed for 300 psf and be able to span the entire longitudinal direction of the multiple hatch assembly. All associated hardware shall be stainless steel.

PART 7 - PIPE, FITTINGS AND VALVES

All inside (pumping station and valve vault) piping shall be flanged ductile iron with threaded flanges in accordance with ANSI A21.15. All piping shall be rated for 150 psi and shall have ring gaskets, 1/8 inch thick.

The interior of all ductile iron pipe shall be cement-mortar lined with bituminous seal coat in accordance with ANSI A21.4. Thickness of the lining shall be as set forth in Section 4-10.1 of the aforementioned specification.

Ductile iron fittings shall conform to ANSI A21.10 with flanged faces and drilled ANSI B-161 125-pound.

Plug valves shall be non-lubricated eccentric type with synthetic rubber faced plugs (suitable for raw sewage) corrosion resistant metal seats, replaceable sleeve type bearings in the upper and lower journals and flanged faced and drilled ANSI B16.1 125-pound. Valves shall provide drip-tight shut-off up to the full rated pressure. All plug valves shall be provided with limit stops and rotate 90 degrees from fully opened to fully closed. Plug valves shall be manually operated, with worm gear operator handwheel. Eccentric plug valves shall be as manufactured by DeZurik, Clow, or equal.

Check valves shall be spring loaded swing type, bronze fitted and shall be as manufactured by M & H, Clow, or equal. Plug valves a check valve shall be provided on the discharge as shown on the Drawings.

A transition coupling shall be used to connect the ductile iron (plain end) discharge line to the force main. Transition coupling shall be Dresser Style 162, Rockwell Model 433, or approved equal. Pipe diameters shall be verified before ordering.

Flanged coupling adaptors shall have one end suitable for bolting to a pipe flange and the other end of flexible coupling similar to that described hereinbefore. All flanged adaptors shall be harnessed. The adaptors shall be furnished with stainless steel (304)

bolts, extending to the adjacent pipe flanges. The harness shall be designed for axial thrust due to a working pressure of not less than 250 psi. Not less than four special bolts shall be furnished for each adaptor. Flanges on flanged adaptor (unless otherwise indicated or required) shall be faced and drilled ANSI B16.1 Class 125. Flanged adaptors shall be as manufactured by Dresser, Rockwell, or equal. A pressure gauge with an isolation valve shall be provided on the discharge piping, as shown.

All inside valves and piping shall be painted with a polyamide Epoxy three coat system.

PART 8 - SUBMERSIBLE PUMPS AND APPURTENANCES

The pumps shall be non-clogging sewage pumps capable of operating in a partially or entirely submerged condition. The design shall be such that pumping units will be automatically connected to the discharge piping when lowered into place on the discharge connection. The pumps shall be easily removable for inspection or service, requiring no bolts, nuts or other fastening to be removed for this purpose and no need for personnel to enter the pump well. Each pump shall be fitted with a stainless steel chain (304) or stainless steel braided cable of adequate strength and length to permit raising the pump for inspection and removal.

All major parts, such as starter casing, oil casing, sliding bracket, volute and impeller shall be of gray iron. All surfaces coming into contact with sewage shall be protected by a coating resistant to sewage. All exposed nuts and bolts shall be stainless steel.

A wear ring system shall be installed to provide efficient sealing between the volute and impeller. the impeller shall be gray iron of non-clogging design, capable of handling solids, fibrous materials, and other matter found in normal sewage applications. The impeller shall be constructed with a long throughway without acute turns.

Each pump shall be provided with a tandem double mechanical seal, the upper running in an oil reservoir, composed of two separate lapped face seals. The lower consisting of one stationary and one rotating tungsten-carbide ring, the upper consisting of one stationary tungsten-carbide ring and one rotating carbon ring, with each pair held in contact by separate spring. The seals shall require neither maintenance nor adjustment, and shall be easily replaceable. Conventional double mechanical seals with a single or double spring between the rotating faces, requiring constant differential pressure to effect sealing and subject to opening and penetration by pumping forces will not be considered equal to the tandem seal specified and required.

A sliding guide bracket shall be an integral part of the pump unit. The volute casing shall have a machined discharge flange to automatically and firmly connect with the cast iron discharge connection, which when bolted to the floor of the sump and discharge line, will receive the pump discharge connecting flange without the need of adjustment, fasteners, clamps or similar devices.

No other motion of the pump unit, such as tilting or rotating, shall be required. Sealing of the discharge interface by means of a diaphragm, "O" ring or other devices will not be considered acceptable nor equal to a metal to metal contact of the pump discharge flange and mating discharge connection specified and required. No portion of the

pump unit shall bear directly on the floor of the wet well. there shall be no more than a 90° bend allowed between the volute discharge flange and station piping.

Pump motor shall be housed in an oil-filled watertight casing and shall have Class F insulated windings which shall be moisture resistant. The motor shall be NEMA Design B rated 155°C maximum. Pump motors shall have cooling characteristically, suitable to permit continuous operation, in a totally, partially, or non-submerged condition. The pump shall be capable of pumping dry continuously in a totally dry condition. Before final acceptance, a field running test at the jobsite demonstrating this ability, with 24 hours of continuous operation under the above conditions, shall be performed for all pumps being supplied, if required. Cable junction box and motor shall be separated by a stator-lead sealing gland or terminal board which shall isolate motor from any water or solids gaining access through pump top.

Pump motor cable shall be suitable for submersible pump applications and shall be permanently embossed on the cable. Enough cable shall be supplied for each pump to properly connect to the control panel (without splice).

Guide holders shall be integral with the discharge connections and guide bars shall be of standard weight stainless steel pipe (304). Discharge connections shall be cast iron. Piping from the discharge connections shall be as specified hereinbefore.

Location	Number of Pumps	Flow (GPM)	Design Head (ft)	Shutoff Head (ft)	Efficiency	Min Motor Hp	Morot Voltage	RPM
Contract 1 Non-Potable	1	29.4	88.6				240V, 3P 60 Hz, 4W	3490
Contract 1 On-Site WWPS	2	89.0	40				240V, 3P 60 Hz, 4W	3500
Contract 2 Chestnut Ridge Lift Station	2	180	13				240V, 3P 60 Hz, 4W	1670
Contract 2 Sportsplex Lift Station	2	20	25				240V, 3P 60 Hz, 4W	

All pumps and controls shall be completely wired at the factory for power and control and shall be color coded. All wiring outside the control cabinet shall be in rigid conduit. All accessory equipment shall be permanently wired with suitable disconnecting means and overload protections. Pumps shall be as manufactured by Flyst Pumps or equal.

All pump motors shall be provided with stator temperature sensor switches, and be suitable for reduced voltage starting.

The pumping station shall be provided with a platform socket for a portable hoist. One (1) portable hoist shall be provided for each station. The hoist shall be capable of lifting the pump from the station listed hereinbefore. Hoist shall have an adjustable length arm to enable any pump to be lifted vertically from the single socket. Multiple

sockets may be provided in lieu of adjustable arm length.

A. Start-up Service

The Contractor shall also provide from the submersible pump supplier the service of a qualified start-up engineer (factory representative) who has had prior on-site start-up experience to assist in performing start-up, check-out and initial operation services of the pumping units. The start-up engineer shall also instruct the Owner's personnel on the operation and maintenance for the station.

PART 10 - ACCESS ROADS AND SITE WORK

Provide an access road and all site work to the new pumping station site. The road shall be of the width and construction indicated on the plans. The roadway and the areas enclosed by fence shall receive a surface of a six (6) thick layer of No. 610 stone as specified by the Kentucky Department of Transportation. Crushed stone shall be placed on top of filter fabric.

PART 11 - SECURITY FENCE

The entire site shall be fenced as indicated on the Drawings. Seven (7) foot high chain link fencing with 1' foot of 3 rows of barbed wire (8 foot total) shall meet the following specifications.

1. Framework — Type 1 or 2 galvanized schedule 40 steel pipe

2. Line Posts — 2-1/2" Diameter

   Terminal Posts/Corner Posts — 3" Diameter

   Gate Posts 3" Diameter

3. Rails and Braces — 1-5/8" O.D. Type 1 or Type 2

4. Fabric — Aluminized or galvanized steel wire, 9 gauge, 2" diamond mesh

5. Bottom tension wire — 7 gauge

6. Top Tension wire — 7 gauge

7. Include 24-foot gates (2-12' Leaves) with latches for padlock and keepers as shown on the Drawings.

8. Provide 3 strands barbed wire at 45° outward angle at top of fence per KDOH specifications.

9. All posts (gate, corner, terminal and line) shall be set 3 feet deep and in concrete.

10. Post spacing shall be a maximum of 10 feet O.C. All post 3' in ground.

END OF SECTION

Section-11300

Ultraviolet Disinfection

System

SECTION 11300

ULTRAVIOLET DISINFECTION SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish and install a complete closed vessel, medium pressure, high intensity, ultraviolet disinfection (UV) system as described in this specification and as shown on the Drawings. The Contractor shall be responsible for equipment installation per directions of the Manufacturer. The Manufacturer will be responsible for verification of system installation, start-up, testing, and operation and maintenance training of the Owner's personnel.

B. The manufacturer shall guarantee that the system shall be capable of disinfecting secondary effluent flow of 896 gpm per unit as described in the operating parameters specified herein.

C. These specifications are intended to give a general description of what is required, but do not cover all details that will vary in accordance with the requirements of the equipment application. It is, however, intended to cover the furnishing, shop testing, delivery, complete installation and field testing of all materials, equipment and all appurtenances required to complete the Work of this Section, whether specifically mentioned in these Specifications or not.

PART 2 - MATERIALS

2.01 GENERAL

The Contractor shall furnish and install a complete high intensity, medium pressure disinfection system as described herein. The system shall include, but is not limited to, a stainless steel disinfection chamber, medium pressure, high intensity UV lamps, power, and control equipment. The Contractor shall provide the power source, electrical conduit, electrical conductors, and equipment base supports. The Contractor shall physically install the disinfection chamber, power modules, and control modules according to the Manufacturer's directions and the drawings. The Contractor shall provide all interconnecting cables. The Manufacturer shall be responsible for verification of installation including conductors, electrical hookup of equipment, start-up, testing, and operation and maintenance instruction of the Owner's personnel.

2.02 ACCEPTABLE MANUFACTURERS

Only companies with a minimum of 15 years experience and history of successful municipal wastewater installations of closed vessel medium pressure, high intensity UV systems will be considered. Pre-approved companies are as follows:

Aquionics Inc.
21 Kenton Lands Road
Erlanger, KY 41018
Phone: (859) 341-0710

2.03 OPERATING PARAMETERS

Fluid Evaluation: > 65 % transmission in a 1 cm quartz cell @ 253.7 nm
Total Suspended Solids: < 30 mg/l
Iron Concentration: <0.1 mg/l
Maximum Flow Rate: 895 gpm peak
Minimum Water Temperature: 32 deg F
Maximum Water Temperature: 113 deg F
Maximum Allowable Head Loss Through Chamber: < 3.5 in (@ maximum flow)

End of lamp life shall be defined to be when UV output of the lamp has decreased by 30%. Lamp life will be based upon system design.

2.04 ULTRAVIOLET DISINFECTION CHAMBER

A. Chamber

1. The UV system shall consist of two (2) UV chamber(s). The chamber(s) shall be capable of disinfecting up to 895 gpm of wastewater of characteristics described in section 2.03. Open channel systems shall not be considered.

2. The chamber(s) shall have a maximum laying length of 19 inches and width of 31 inches. Each chamber shall have isolation valves (supplied by others) installed upstream and downstream of the UV system.

3. The disinfection chamber(s) shall be the following model, or approved equal: InLine 400+

Model	**# lamps**	**lamp type**	**I/O flange**
400+	4	B2020	6"

4. The chamber(s) shall be constructed of 316 SS. All wetted parts shall be stainless steel, high purity quartz, Teflon, and/or Viton. The chamber(s) shall be provided pre-wired and only require field connections from the power/control module to the chamber.

5. UV lamp orientation shall be horizontal and perpendicular to the flow. Lamps shall be protected from contact with the water by high purity quartz sleeves. Lamps shall be removable from either end of the chamber without draining the unit.

6. The chamber(s) shall be designed in such a way that when properly installed and operated there is no possibility of direct operator exposure to UV light from the

UV lamps.

B. UV Lamps

1. Only medium pressure high intensity ultraviolet arc tubes shall be provided for disinfection. Maximum power consumption per lamp, including the transformer, shall be:
   - 2.5 kW for B2020 lamps

2. Lamp operating power levels shall be:
   - 1.5 kW, 1.8 kW, and 2.2 kW for B2020 lamps

3. Germicidal UV output from the lamps shall not be affected by temperature.

C. UV Intensity Monitor

1. One lamp in each chamber shall be equipped with a UV monitor, which measures the UV intensity of that lamp, providing continuous performance verification over the above specified water transmission range.

2. The monitor shall be fitted with a filter, which allows measurement of UV energy between 220 and 290 nm wavelengths only.

3. The wet portion of the monitor shall have a SS housing, viton "O" ring, and a high purity quartz probe over the monitor site hole.

4. The sensor shall be unaffected by static, electromagnetic fields, or short wave radio emissions that comply with current FCC regulations.

5. The monitor shall produce a 4-20 ma signal, which shall be sent to the control module.

D. Cleaning Mechanism

1. For periodic cleaning of the quartz sleeves and UV monitor probe, the chamber shall be fitted with an automatic/mechanical cleaning mechanism, which shall consist of a SS yoke and Teflon bosses. Each boss shall hold one viton molded wiper ring, which fits over the quartz sleeve. Wiper rings shall be replaceable.

2. The cleaning mechanism is electrical/mechanical and shall be operated by means of a two-pole bi-directional capacitor driven motor and an acme lead screw. Limit switches shall be provided at the ends of the chamber to signal the control system to stop the motor when it reaches the end of the chamber. No pneumatic cleaning mechanisms shall be acceptable.

3. The cleaning cycle shall be field adjustable. The cleaning cycle shall be activated from the control system or manually at the operator interface.

E. Temperature Sensor

A temperature sensor shall be fitted to the chamber for protection against heat buildup under no or low flow conditions. UV system will shut down and alarm in event of heat buildup in the chamber.

F. Access Hatch

A circular access hatch shall be provided on top of the chamber to allow easy, simple access for visual lamp/sleeve inspection and/or removal of foreign debris from the chamber without removing the lamps or quartz sleeves.

2.05 ELECTRICAL/INSTRUMENTATION AND CONTROLS

A. General

1. For each unit, one power/control module shall be provided. Cabinet(s) shall conform to NEMA12 (IP54), suitable for indoor installation in an environmentally controlled room.

2. Cabinet(s) shall be fan cooled and shall include louver covers with replaceable inlet filters. Cabinet(s) shall be constructed of epoxy coated steel. The cabinet shall be wall mounted with dimensions of 47.2"H x 31.5"W x 16"D.

3. The door of each cabinet shall be electrically interlocked so that the module is de-energized when the door is opened.

4. All wiring within the cabinets shall be harnessed or enclosed in wire channel.

5. Incoming circuits shall be protected by circuit breakers.

B. Power Requirements

- 230V 1-phase, 3 wire, 60 Hz

Maximum Connected Load: 11 kW @ Power level 3

- 2.6 kW per lamp

Minimum Connected Load: 7 kW @ Power level 1

- 1.7 kW per lamp

C. Power/Control Module

1. Each of the module(s) shall operate four B2020 lamps.

2. The power/control module shall contain a front panel mounted at eye level. This front panel shall consist of an alphanumeric display and membrane buttons for operator interface. All information, warnings, and alarms shall be presented on the alphanumeric display for ease of operation. The following information will be available on the screen:

a. Power
b. Mode
c. Language
d. Intensity (%)
e. Water temperature
f. Flow
g. Total hours of operation
h. Lamp hours
i. Number of wipe cycles

3. Each power/control module shall contain the following LED displays:

a. UV on
b. Power on
c. Warning
d. Alarm

2.06 MONITORING/INTERFACING AND CONTROL REQUIREMENTS

The control module shall contain the following output signals for remote monitoring, and input signals for control of that group:

A. Remote Start/Stop Input--Customer supply dry contact.

B. Remote Set Power High --Customer supply dry contact.

C. Remote Wipe --Customer supply dry contact.

D. Remote Clear Message -- Customer supply dry contact.

E. Alarm--dry contact; water temperature, cabinet temperature or temperature sensor.

F. Warning-- dry contact; lamp failure, water temperature, cabinet temperature, or low intensity.

G. 4-20 ma Output--Corresponding to the output of the UV intensity monitor (inline with the UV monitor). This may be connected to an input with maximum 250-ohm impedance. Should be galvanically isolated.

2.07 SPARE PARTS

The following spare parts shall be supplied with the equipment (no less than enough spares for one chamber). For an InLine 400+ this is:

4 Arc tubes
4 Quartz sleeves
8 O-ring seals
4 Wiper rings

2.08 MANUFACTURER ON-SITE SERVICES

A Manufacturer's representative shall as a minimum perform the following tasks:

A. Inspect, test and adjust the equipment after installation to verify mechanical, structural

and electrical integrity and conformance to the equipment specifications. This task shall be scheduled for a maximum of two days.

B. Instruct Owner's personnel in the proper operation and maintenance of the equipment.

C. Provide additional services at no cost to the owner to correct any operational problems due to the design and/or fabrication of the ultraviolet disinfection equipment.

PART 3 – EXECUTION

3.01 FABRICATION

The UV disinfection system specified herein should be factory assembled, to the largest extent possible, complete with all components specified.

3.02 INSTALLATION

A. The Contractor shall install the UV equipment.

B. The Manufacturer shall provide written installation instructions to the Contractor and answer any related questions that the Contractor may have.

3.03 TESTING

A Prior to startup, the Manufacturer shall inspect the installed UV disinfection system for proper alignment, correct operation, proper connection, and satisfactory function of all components.

B. After startup and as part of the equipment certification process, the Owner shall submit to the Manufacturer one month of collected data as indicated below.

1. Monthly operator's reports for 30 days following start-up.
2. Daily values for:

    a. Plant flow (at time sample was collected)
    b. Number of units in operation
    c. Power level
    d. Time sample was collected
    e. Fecal count / 100 ml (influent and effluent)
    f. Transmission
    g. TSS
    h. Sample collected by

C. Laboratory Tests

All laboratory tests necessary to confirm the Guaranteed Performance Requirements testing for the UV Disinfection System shall be performed in accordance with the applicable portions of the most recent edition of Standard Methods.

3.04 WARRANTIES

The Manufacturer shall provide a written warranty that provides for:

A. Full replacement of all defective lamps within the first 1000 hours of operation provided that the system is operated continuously and all three power levels are being utilized.

B. Full replacement of components against defects in materials and workmanship for a period of one year from date of start up not to exceed 18 months from date of shipment.

C. Performance warranty as outlined in Section 1.01.

END OF SECTION

Section-11372

Rotary Positive

Displacement Blowers

SECTION 11372

ROTARY POSITIVE DISPLACEMENT BLOWERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install complete, ready for operation and field-test TWO (2) new rotary positive displacement blowers with enclosures and appurtenances, as shown on the Drawings and as specified herein.

B. The entire blower package and its components shall comply with all applicable safety and environmental regulations.

1.02 RELATED WORK

A. N/A

1.03 SUBMITTALS

A. Submit five (5) copies of all materials required to establish compliance with this Section. Submittals shall include at least the following information:

1. Certified general arrangement drawings showing materials, details of construction, dimensions and connections.
2. Complete Blower Performance Data including:
    a. RPM
    b. Capacity – scfm and icfm
    c. Discharge pressure
    d. dB(A) noise pressure level
    e. Maximum gear tip speed and rotor tip speed (fpm)
    f. HP required at rated capacity and pressure
    g. Rated maximum pressure rise of blowers
3. List of recommended spare parts broken down into on hand parts and long term for 2 years operation and 3 to 5 years operation.
4. Descriptive Brochures
5. Performance Curves
6. Motor Data
7. Valves
8. ISO 1217 Performance Test Results

B. Complete blower package operating and maintenance instructions professionally published, hard copy and electronic copy, shall be furnished for all equipment included under these specifications.

1.04 QUALITY ASSURANCE

A. Qualifications

1. Package shall be Aerzen Generation 5 Delta Blower Model GM 3S, or approved equal.
2. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the Drawings.
3. The blower(s) shall be covered by a warranty for 24 months from date of commissioning, or a maximum of 30 months from date of shipment.

1.05 BLOWER PERFORMANCE CRITERIA

1.	Quantity of Blowers	2
2.	Rated Inlet/Standard (icfm/scfm)	34 / 29 per Blower
3.	Discharge Pressure Rise (psig)	5.0
4.	Inlet Filter Flange Pressure (psia)	14.13
5.	Motor Hp (Maximum)	3
6.	Maximum Blower Speed (rpm)	1,777 @ 37% of maximum
7.	Inlet Temperature	100°F
8.	Barometric Pressure (psia)	14.13
9.	Ambient Relative Humidity (%)	80%
10.	Free Field Noise Pressure @ 3Ft.	64 dB(A)

1.06 DELIVERY, STORAGE AND HANDLING

A. All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment.

B. All exposed flanges shall be covered and sealed with shrink-wrap to prevent the entrance of moisture. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

C. All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.07 MAINTENANCE

A. Spare Parts

1. Furnish the following spare parts for each blower package specified:
   a. Complete set of matched V-belts
   b. One filter element
2. Spare parts shall be properly bound and labeled for easy identification without opening the packaging.

PART 2 - PRODUCTS

2.01 GENERAL

A. Blower packages shall be designed to minimize the life-cycle costs and maximize plant reliability. The design and the selection of the components shall be based on a minimum useful life of 15 years and a Mean Time Between Overhauls of 5 years of continuous operation.

B. No special foundations shall be required. The blower packages will be installed directly on a concrete slab without grouting the base frame. There shall be only 4 easily accessible anchor points.

C. The blower casing shall be of one-piece construction, with separate sideplates that are bolted and pinned to the housing. Materials shall be close-grained cast iron ASTM A48 suitably ribbed to prevent distortion under the specified operating conditions. Minimum blower casing pressure rating shall be 36 psig. Inlet and outlet shall be flanged connections. The casing shall incorporate a proven means of pulsation cancellation. The vibration level as measured at the blower casing, in the X/Y planes of the bearings, shall not exceed ½ "/ sec RMS when operating at the specified maximum operating pressure and speed in the actual blower package.

D. Each blower stage shall be factory tested in accordance with ISO 1217 performance test to verify flow and brake horsepower at blower maximum conditions. A slip test shall not be acceptable. The acceptance criteria are +5% tolerance on power and –5% tolerance on flow regardless of the size of the machine.

E. Each impeller shall be of the "stiff" design with first lateral critical speed at least 120% of the maximum allowable operating speed. The impellers shall be of the straight, three-lobe type, and shall operate without rubbing or liquid seals or lubrication. Rotor/shaft shall be drop forged in one single piece of AISI 1043 or equivalent. Cast, hollow rotors shall be capped, dust tight. Open rotors are not acceptable. The impellers shall be statically and dynamically balanced per ISO1940/ANSI S2.19 G6.3.

F. Each impeller/shaft shall be supported by anti-friction bearings, and fixed to control the axial location of the impeller/shaft in the unit. Regardless of theoretical bearing life calculations, the bearings shall be sized for a minimum expected life of 5 years between overhauls.

G. The impellers shall be timed by a pair of single helical AGMA 12 quality gears with hardened and ground teeth; minimum AGMA service factor of 1.70. Gears shall be mounted on the shafts with a tapered interference fit, and secured by a locknut.

H. Seal shall be designed to prevent lubricant from leaking into the air stream as well as to prevent oil from leaking out of the machine. Four rotary piston ring shaft seals, an oil

slinger and an O-ring seal shall be provided at the point where the shaft passes through the sideplates. Further provision shall be made to vent the impeller side of the oil seal to atmosphere to eliminate any possible carry-over of lubricant into the air stream.

I. The timing gears and the bearings shall be splash lubricated. Grease lubrication shall be not acceptable.

J. A recessed oil sight glass must be provided on each oil sump. Protruding sight glasses are not acceptable.

K. Painting shall be per supplier's standard meeting the following criteria. Excepted for machined sealing and machined mounting surfaces, the package shall be painted dark blue. Aluminum, stainless steel, and brass shall not be painted. The supplied motor shall not be over sprayed and will be supplied with the motor manufacturer's standard protection and paint color. Painted Cast Iron and Carbon Steel shall be Alkyd Resin Primer and Final coat with a total dry film thickness of 70□m. Surface preparation SSPC10 or better. Sound enclosure shall be powder-coated polyester base total dry film thickness 80□m. Galvanized components may only be painted with appropriate surface preparation

2.02 BLOWER ACCESSORIES

A. Each package shall be supplied with one combination inlet filter silencer. The filter media efficiency must meet the requirements of ASHRAE 52.2 MERV7 50-70% @3-10 microns corresponding to EN779 G4. The inlet filter silencer shall be mounted directly to the inlet flange of the blower. The silencer portion shall be located upstream of the inlet filter. Filter and silencer performance losses shall be included in the blower performance calculation.

B. Each package shall be supplied with one combination base frame / discharge silencer.

1. The silencer shall be a chamber type design for maximum sound attenuation and shall not use fibrous or absorption materials of any kind. Fabricated of a single shell of pressure vessel quality steel with continuous welds, the silencer must be subject to a pressure test for tightness and strength at a minimum of 1.65 times the maximum blower operating pressure. The silencer shall have a machined inlet connection where the discharge flange of the blower stage bolts directly to, with no intermediary pieces. Discharge silencer performance losses shall be included by the blower vendor in the blower performance calculation.

2. The base frame is to be constructed from welded carbon steel or cast iron that shall be designed to maintain alignment of the blower internal components and the drive during operation. It shall be designed to resist distortion while being installed on vibration isolating mounts. The blower manufacturer shall supply a stainless steel grounding lug fully welded to the base.

C. Each package shall be connected to the plant piping via flexible connector(s) located downstream of the discharge silencer (and upstream of the inlet silencer if the specifications require the inlet air to be piped to the blower package). They shall prevent the transmission of noise and vibrations from the blower package into the piping. The flexible connectors shall be Unaflex "Supreme" Style 189, with a standard ANSI flange discharge connection.

D. Each package shall be supplied with a WEG manufactured TEFC, severe duty motor that shall operate on 230 Volts, single phase, 3,600 RPM. Motor to meet or exceed EPACT efficiency guidelines. All frame sizes shall be NEMA standard suitable for overhung belt drive, and with the conduit box location on top of the motor. IEC frame motors are not allowed. The motor will be mounted on a pivoting base to provide automatic tensioning of the belts. The motor nominal rating after any corrections for ambient conditions shall be 10% above the maximum operating bHp. The motor shall have a 1.15 service factor. Blower manufacturer shall be responsible for coordinating the starting torque requirement of the blower and the motor. Should an unloading valve be required, the blower manufacturer shall supply it. It shall be an automatic type mechanically operated valve requiring no electrical connections mounted upstream of the check valve.

E. Each package shall be supplied with a V-belt drive that shall be of the high capacity type, oil and heat resistant. Drive shall be designed for a minimum service factor of 1.4 times operating power (bHp), or 1.1 times the motor nameplate Hp, whichever is larger to allow a minimum of 1.4-service factor based on the maximum blower bHp. Belt tensioning shall be automatic without the use of any devices or interaction on the part of the operator. Neither slide rails nor load-adjusting springs shall be used. Sheaves shall be dynamically balanced regardless of the operating speed.

F. Each package shall be supplied with vibration isolating feet with a minimum efficiency of 80%. Blower manufacture shall be responsible for attenuating noise and vibration in the blower package such that no special installation base shall be required, nor shall any additional measures be required to reduce vibrations form the blower package being transmitted to the base or the piping.

G. The belt drive shall be guarded in compliance with OSHA regulations. Portions of the guard shall be easily removable allowing for belt inspection and replacement. Guard material shall be perforated carbon steel.

H. Each package shall be supplied with a single pressure safety valve on the discharge side of the blower mounted downstream of the discharge silencer and upstream of the check valve. The safety valve shall be set to protect the blower from exceeding its maximum pressure rating, and shall be sized to pass 100% of the design flow. The valve shall be field adjustable, spring loaded, and have a certificate of conformity to PED. The valve shall be manufactured by Aerzen. If the blower package is supplied with a sound enclosure, the pressure relief valve shall also be housed by the sound enclosure and shall relieve into a segmented section of the sound enclosure.

I. Each package shall be supplied with one check valve that shall be installed on the discharge line. It shall be of the full-bore low pressure-drop, flapper type design with a steel body, and steel flap embedded in EPDM with full-contact seal. The valve shall be removable without disturbing the piping. The valve shall be manufactured by Aerzen. Pressure losses produced by the check valve shall be included in the blower performance calculation.

J. Each package shall be supplied with the following instrumentation:

   1. One inlet vacuum gauge, Wika model 611.10 with 2 1/2" dial and scale from 0 to –60 millibar. Gauge to function as a filter maintenance indicator.

2. One discharge pressure gauge, Wika model 213.40 with 2 1/2" dial and scale from 0 to 23 psig. The pressure gauge shall have a forged brass case and be glycerin-filled for pulsation dampening. A pulsation snubber shall be provided.

3. One discharge temperature gauge / switch, Wika type SC15608S205-0 with 2 1/2" dial and scale from 32°F to 572°F. NEMA 4 enclosure, 5A @ 250volt, SPDT microswitch, and UL &CSA approved.

K. Each blower shall receive it initial oil filling at the factory. Oil to be fully synthetic Mobil SHC 629. For continuous discharge temperatures greater than 248°F, Mobil SHC 630.

L. Each package shall be supplied with a sound enclosure covering the entire blower package. The enclosure shall provide suitable protection for outdoor installation under the specified site conditions (wind load and snow load). The enclosure shall be designed so as to be able to install them side-by-side with all maintenance done from the front or back of the package. Details are as follows:

1. Panels shall be made of galvanized steel sheet, powder coated in a light reflecting, blue color per RAL 5001. The skid shall be of the same color. Sound enclosure acoustic material shall comply with UL 94 - HF1 for fire-retardant, self-extinguishing, non-dripping materials.

2. The enclosure and the blower package must be both mounted on a skid / oil-drip pan designed for meeting environment protection standards. Fork lift channels shall be included to allow for easy transportation and installation.

3. A grounding strap shall be installed between the blower base and the package skid to bypass any vibration isolating mounts.

4. Quick release panels, each less than 50 lb (as mandated by MSHA) must provide easy and quick access for routine maintenance of the blower and the package components.

5. A high efficiency blower shaft driven ventilation fan shall provide ventilation and cooling integral to the sound enclosure. Cooling fan shall be sized for sufficient heat removal from the sound enclosure, even when the blower is operated with a VFD.

6. Electrical components, instrumentation and instrument connections shall not be mounted or interface with moving panels of the sound enclosure.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Contractor shall install the blowers in accordance with the manufacturer's written instructions.

B. Representatives of the blower manufacturer shall verify and adjust blower and motor alignment.

C. The Contractor shall make all electrical and process connections to the blower package prior to the arrival of the manufacturer's representative.

3.02 FIELD TESTING

A. After installation of all equipment has been completed and as soon as conditions permit, the manufacturer shall provide one (1) trip for a total of one (1) 8 hour days to verify the installation and conduct an acceptance test under actual operating conditions. The test shall consist of 3 hours operation of each blower with readings taken and recorded at 30-minute intervals.

B. If required, Contractor shall make any changes, at his own expense, to the installation that may be necessary to assure satisfactory operation. Contractor shall be held liable for changes needed in the installation.

END OF SECTION

Section-11373

Fine Bubble Diffusers

SECTION 11373

FINE BUBBLE DIFFUSERS

1. GENERAL

1.1 APPROVED MANUFACTURERS

A. Ashbrook Simon-Hartley
B. Approved equals.

1.2 WORK INCLUDES

This section includes furnishing and installing a fine bubble membrane disc aeration systems in one (1) basin as shown on the plans.

A. General

1. It is the intent of the that the fine bubble membrane disc aeration equipment Supplier/Manufacturer shall furnish completely engineered systems suitable for the operating conditions as outlined in these Specifications. Fine bubble membrane disc aeration equipment features such as drop leg size, air manifold sizes, air header sizes and spacing, air manifold and header supports and spacing, diffuser spacing, etc., required to comply with all requirements of this section shall be defined by the Manufacturer and be furnished complete. The fine bubble membrane disc aeration equipment furnished under this section shall be supplied by one manufacturer in order to achieve standardization for operation, maintenance, spare parts, and manufacturer's service.

2. Definitions

a. SCFM: Standard cubic feet per minute is understood to be air at 68 degrees F, 14.7 psia, and 36 percent relative humidity flowing at a rate of 1 cubic foot per minute.

b. SOTR: Standard oxygen transfer rate is understood to be the rate of oxygen transferred to tap water (pounds of oxygen per hour) at standard conditions of 20 degrees C, 0.0 mg/l residual dissolved oxygen concentration, and a barometric pressure of 760 mm Hg (dry air).

c. SOTE: Standard oxygen transfer efficiency is understood to be the fraction of oxygen transferred to tap water under standard conditions of 20 degrees C, 0.0 mg/l residual dissolved oxygen concentration, and a barometric pressure of 760 mm Hg (dry air).

d. Side water Depth: Side water depth is understood to be the interior

dimensions from the structure base to the water surface.

3. The diffuser equipment system shall be of the fixed header, fine bubble, membrane disc air type. Tubular and panel designs are not acceptable. The system shall be suitable for installation in the structures shown on the Drawings.

   a. Each aeration basin shall be provided with 3 air diffuser zones. The locations and size of the drop pipes to each diffuser grid are shown on drawing P-6. The diffuser equipment for each zone shall include, but not be limited to, a vertical section of drop pipe, a flexible connection to the drop pipe, an air manifold, air headers, diffusers, supports, expansion joints, air manifold and header joints, gaskets, bolts, nuts, and washers.

2. PRODUCTS

2.1 DROP PIPE, AIR MANIFOLD and HEADERS

A. The installation contractor shall provide yard piping from the air supply main connection to the aeration basin. The drop pipe shall be 304L stainless steel, schedule 5, 12 gauge or schedule 10, to within 4 feet above the aeration basin floor. At that point, the Manufacturer shall provide a flex connector to connect to a PVC drop leg which shall extend to the PVC manifold or headers. The connection for the PVC manifold or diffuser header shall be an EPDM or butyl rubber flexible connection with stainless steel band clamps.

B. The air manifold piping shall be constructed of class 160 PVC conforming to ASTM D-2241 for diameters up to 6 inch diameter and schedule 40 PVC conforming to ASTM D-1785 for diameters of 8 inch and up. Both classes of pipe shall have a maximum SDR rating of 26. The air manifold shall be perpendicular to the air headers. Air manifolds shall be fabricated with fixed joint connections to each air header. Fabricate manifolds shall not exceed 25 feet in length for shipping. The ends of the manifolds shall have solvent welded end caps.

C. The air headers shall be constructed of Class 160 PVC conforming to ASTM D-2241. Pipe shall have a maximum SDR rating of 26. The headers shall connect to the air manifold as indicated above. The air headers shall be perpendicular to the air manifold. Headers shall be fabricated in sections up to a maximum of 25 feet in length. Sections shall be joined with fixed joints or expansion joints as required.

2.2 DRAINLINE, SUMP and AIRLIFT PURGE SYSTEM

A. Every diffuser shall be equipped with a liquid drainer stem to insure the evacuation of water from the entire submerged aeration piping system or each aeration zone shall be furnished with a PVC drain line, sump, and airlift purge

system.

2.3 DIFFUSER ASSEMBLIES

A. Air diffuser assemblies shall be of the round, non-clog, fine bubble type with a flexible perforated air release membrane. The perforations shall be die cut I-shaped slits. Tube shaped diffusers are not acceptable.

B. The diffuser membrane shall be constructed from injection molded EPDM rubber and be suitable for continuous or intermittent aeration. The membrane shall include UV inhibitor and compounds designed for resistance to chemical attack, weathering and aging.

C. The membrane shall be molded in a tapered thickness, becoming thicker in the center, in order to prevent ballooning and non-uniform bubble size. The maximum deflection of the center of the membrane under normal operating conditions shall be less than two (2) inches.

D. The diffuser assemblies shall have double backflow prevention to prevent liquid from passing into the aeration header.

E. The diffuser assembly shall have no metallic parts. Diffusers which utilize metallic center restraint bolts or metallic band clamps to secure the membrane to the base are not acceptable.

F. The diffuser assembly shall be shipped completely assembled to the job site. Diffusers which require field assembly are not acceptable.

G. The membrane exterior surface shall be smooth as to inhibit biological film growth. The membrane shall inflate during aeration and deflate when the airflow is discontinued, further restricting biological film growth. The membrane shall be cleanable in place with water from a high pressure wash. Acid or other chemical cleaning methods shall not be required to restore the diffuser to like-new performance conditions.

H. Diffuser membrane shall have a minimum thickness of 2mm and shall meet the following Specifications:
   i. Durometer, Shore A: 45+5.
   ii. Minimum Tensile Strength: 1,250 psi.
   iii. Minimum Elongation: 500 percent or greater.
   iv. Maximum Durometer, Shore A, Change Allowed: 10 points.
   v. Maximum Loss of Tensile Strength: 25 percent.
   vi. Maximum Loss of Elongation: 25 percent.
   vii. Maximum Compression Set: 25 percent.

I. The approved maximum airflow rate per diffuser shall be:
   10 inch diameter, 21 row = 7.0 SCFM

10 inch diameter, 34 row = 10.0 SCFM

J. If diffusers of alternate sizes are proposed, the following diffuser ratios shall be utilized for determining quantities to be furnished:
1each 20" diameter unit for every 2.5 each 10" units specified.
1 each 12" diameter unit for every 1.3 each 10" units specified.
1.6 each 9" diameter units for every 1 each 10" unit specified.

2.4 P IPE SUPPORTS

A. Supports shall be fabricated of Type 304 stainless steel for non welded and 304L for welded. The supports shall be designed to provide + 1/2-inch lateral and + 1-inch vertical adjustment of the header. Adjustment shall be continuous and possible without removing the air piping from the support. All pipe ends and joints shall be provided with a pipe support. Support height shall be sufficient to provide the diffuser elevation shown under PERFORMANCE REQUIREMENTS.

B. Air manifold piping shall have a maximum spacing between supports of 10 feet. Manifold supports shall be attached to the tank floor with anchor bolts and shall be designed for ten (10) times the normal uplift force.

C. Diffuser headers shall have a maximum spacing between supports of 8 feet. Header supports, shall allow longitudinal movement of the header section to prevent stress buildup in the header due to thermal expansion/contraction forces. Maximum horizontal thrust of 20 pounds or less shall initiate movement of the header relative to the mechanism under full buoyant up-lift load.

D. Anchor bolts for fastening the supports to the aeration basin concrete slab and walls shall by Type 304 stainless steel. Minimum anchor bolt diameter to be used is 3/8 inch. Supports shall be located such that concrete anchors are not installed within 6 inches of any concrete expansion joint.

E. All welded pipe supports and assemblies shall be shop fabricated from Type 304L stainless steel with a 2D finish conforming to AISI 304L and ASTM A240-78a. Unless specified otherwise, all non-welded pipe supports and pieces shall be shop fabricated from sheets and plates of 304 stainless steel conforming to AISI 304 and ASTM A240-78a.

2.5 HEADER JOINTS

A. Connections between sections of the air distribution header shall be flanged joints or union. These joints shall be designed so that individual header sections can be rotated independently of adjacent header sections for alignment purposes. The flanged joints shall be structurally designed to transmit the longitudinal forces caused by expansion and contraction in the air distribution header. Pipe supports shall slide to allow for expansion and contraction of the air distribution header.

B. Expansion joints shall be capable of handling the expansion and contraction of the air distribution system over a temperature range of 125 degrees F.

C. Gaskets: Expansion joints and couplings shall be provided with gaskets forming an airtight connection at 20 psig minimum. Gaskets shall be neoprene, 45 to 55 durometer.

D. Miscellaneous: Nuts, bolts, washers, and other non-welded parts directly exposed to the wastewater shall be Type 304 or 18-8 stainless steel. Threaded assemblies shall be chemically treated or lubricated prior to assembling to prevent galling.

3. INSTALLATION

3.1 GENERAL

A. Continuously weld both sides of face rings and flanges. All welding on the aeration equipment shall be completed in the factory. Field welding will not be permitted. All stainless steel welding shall be by the shielded arc,inert gas, MIG, or TIG method. Filler wire shall be added to all welds to provide a cross section of weld metal equal to, or greater than, the parent metal. Butt welds shall have full penetration to the interior surface, and gas shielding shall be provided to the interior and exterior of the joint.

B. The design, fabrication, and installation of the diffuser equipment shall be such that, upon completion of installation, all diffusers are leveled to within + 1/4 inch of a common horizontal plane.

C. Interior weld beads shall be smooth, evenly distributed, with an interior projection not exceeding 1/16 inch beyond the inner diameter of the air header or fitting.

D. All outside weld areas shall be wire-brushed to remove weld splatter. Brushes shall be of stainless steel and used only stainless steel.

E. Solvent weld all PVC joints in the factory.

F. The fine bubble membrane disc aeration equipment shall be designed for easy installation and shall include provisions for level adjustment, rotational adjustment, and thermal expansion.

G. The entire system shall be designed to allow for expansion and contraction over a temperature range of 125 degrees F when installed.

3.2 DIFFUSER CONNECTIONS

A. The connection between the air distribution header and the diffuser connector shall be capable of withstanding a horizontal or vertical moment of 1,000 inch-pounds, as well as an air pressure of 50 psi, without permanent deformation. This connection shall be a shock absorbent type that is unaffected by system vibration.

B. The EPDM compression-fit mounting saddle: Provide a 3 or 4 inch diameter header with a minimum thickness of SDR 26. EPDM mounting saddle shall have a 1.25" diameter barbed stem which is factory pressed into a 1.25" diameter hole in the crown of the header pipe. EPDM mounting saddle shall have a ¾" FPT to accept a ¾" MPT diffuser inlet nipple.

3.3. FACTORY DIFFUSER TESTING

A. In order to assure quality equipment and product longevity, the following tests shall be performed on the diffuser by a certified independent testing agency. This data shall be submitted for review by the Engineer with general submittal documents. Full size membranes, which have undergone the testing described below, shall be provided for examination by the Engineer. In lieu of the certified test data, the manufacturer shall supply 100% spare diffuser sites and 50% spare membranes.

B. Endurance Cycle Testing: The diffuser assembly shall be tested to a minimum of 200,000 expansion and contraction cycles. Minimum cycle time shall be 10 seconds on and 10 seconds off. The air rate during testing shall be 13.7 SCFM per square foot of perforated membrane area. Testing shall be done with a full sized membrane and base assembly. The assembly shall be submerged under a minimum of 12 inches of water column. The testing shall demonstrate that the membrane experiences less that 0.5% change in membrane volume.

C. Water Leakage Testing: The diffuser shall be placed in a test fixture with water covering the membrane and the base exposed to atmosphere pressure. The membrane shall then be subjected to 25 psig in order to insure that no water will leak through the membrane slits, check valve or membrane to base connection during shut down periods.

D. Burst Testing: A non-perforated membrane shall be installed on a standard diffuser base. Air shall be fed into the diffuser. The membrane to base connection shall withstand a differential pressure of 4.0 psig with no leakage or failure.

3.4 CLEAN WATER FUNCTIONAL TESTS

A. After installation of the fine bubble membrane disc aeration equipment is complete, witness functional testing conducted by the Installation Contractor to

check for leaks, uniformity of air release, and verification of level installation. Functional testing shall be performed with clean water at a depth over the diffusers as recommended by the aeration system Manufacturer. Any leaks in the headers, diffusers, pipes, or any part of the system shall be repaired by the Installation Contractor. The test shall be repeated until the installation is void of air leaks.

3.5 SUBMITTAL REQUIREMENTS

A. Five (5) copies of shop drawings shall be supplied to Engineer for review and approval.

B. Four (4) copies of Operations & Maintenance Manuals shall be submitted to the Engineer upon satisfactory installation and test results.

3.6 OPERATOR TRAINING

A. The aeration system equipment manufacturer shall provide training for the facility operating personnel covering complete operation and maintenance of the system. Basic troubleshooting for the system shall also be explained. The training shall be not less than 4 hours in duration and shall be coordinated with the facility owner and Engineer for a date and time convenient for both to attend.

END SECTION 11373.

Section-11500

Dewatering Container

Filter-Open Top

SECTION 11500

DEWATERING CONTAINER FILTER- OPEN TOP

MINIMUM STANDARDS FOR PROSPECTIVE BIDDERS

As a minimum the following standards shall apply for responsible prospective bidders. All prospective bidders must meet the following requirements and specifications.

1. The bidder must be actively engaged in the manufacture of the type of equipment specified, who can show proof and document equipment of their own design and manufacture in actual service for a period of not less than 5 years.

2. The manufacture shall provide proof of evidence of facilities, equipment and technical skills required to produce the equipment specified herein.

3. Bidders shall supply with proposal a list of at least five- (5) user references where like equipment is actively being used and their firm has supplied such equipment. Include name of firm, address, telephone number and name of representative familiar with the equipment sold.

4. Successful bidder shall have a trained factory representative within a 250-mile radius of the proposed installation or site.

5. Reasonable delivery for replacement parts must be available and declared.

6. Have proof of financial responsibility with respect to performance and delivery dates. In addition, have available means for adequate financial resources, or the ability to obtain such resources as required by the proposal.

7. Have a satisfactory record of performance for the construction/manufacturing and documents to support performance.

8. Have a satisfactory record of integrity and ethics.

CONTAINER CONSTRUCTION AND MATERIALS

Container Filter shall be a Sludge Mate™ Model SM-30-O-RB as manufactured by Flo Trend Systems, Inc. of Houston, Texas (800-762-9893), or approved equal. Unit shall be constructed per the following specifications:

- The container will be constructed of A-36 carbon steel plate with 7 gauge floor and 10 gauge walls and roof cover
- Floor cross members are structural channels spaced on 24" centers
- Rails are constructed of 6" x 2" x 3/16" structural tubing with 36½" inside spacing
- Wall gussets are 7 gauge plate
- Top rails are constructed of 3/16" structural tubing
- Door sealing face will be totally water tight and have a EPDM gasket on the surface area
- Door frame is made of 4" x 3" x 3/16" structural tubing and shall be side hinged (no exceptions)
- Door sealing binders are 1" ratchet chain binders, one on each side and one in the middle of the door
- Hinges are constructed of ½" wall tubes and 1" diameter hot rolled bar pins
- Internal filter system will be comprised of a support structure constructed of ¼" angles, 4" and 3" cold formed channels and 1-1/2 No. 9 flat both sides A-36 carbon steel expanded metal.
- The expanded metal shall be framed as removable panels and bolted to the internal support structure.
- The expanded metal shall cover the two long side walls of the interior of the container. In addition, a separate vertical panel will be installed in the center of the container running almost the length and extending upwards within one foot of the top edge. The vertical panel has filter media on both faces and will drain to the side panel drain cavity
- Filter media will be installed over the support panels.
- Filter media to be Poly-2000, a special weave, polyester blend having air permeability of 758 CFM @ ½" W.G., water permeability of 500 mm3/mm2 x s @ 20 mm W.P., 26% open area, .047" thickness, and 26.7 ounces per square yard. No substitutions or alternates will be accepted.
- The drainage system shall be constructed in such a way so the upper filter areas are independent and separate from the lower portion of the filter area. The lower portion will drain either by gravity or by a vacuum assist while simultaneously liquid drains from the upper portion into 4" NPTF threaded connections each side at opposing ends. The lower portion will also have two 3" NPTF threaded connections each side at opposing ends.
- Inlet manifold connection will be 3" NPTF threaded connection
- Welds are skip-welded on the bottom of the exterior supports, brackets, and braces
- Unit to be sandblasted per SSPC #6 commercial blast requirements
- Exterior coating will be a 2-part epoxy primer, Tile Clad II B62N7/B60V70, with a final application of Corothane II B65R428/B60V2 two component, aliphatic acrylic modified polyurethane high performance high build gloss red industrial coating.

- Interior coating to be coal-tar epoxy with minimum thickness of 5 mils.
- Final interior floor surface shall be coated with a good quality immersion type, abrasion resistant coating with good cake release characteristics.
- Removable filter support panels to be coated with epoxy coating or hot dipped galvanized.

Overall Dimensions:	23'-1" L x 6'- 11 3/8" H x 8'-6" W
Weight (Dry):	12,780 lbs.
Capacity:	27 cubic yards minimum

MANUFACTURER'S SERVICES

The successful bidder shall furnish the services of a qualified field engineer to perform the following functions in the designated periods of time as detailed by the contract. These services are to be performed at the jobsite. A minimum of one (1) visit to the job site shall be required. The visit will include equipment installation check, start up of the equipment and initial operators training.

OPERATION AND MAINTENANCE MANUALS

The manufacturer shall be responsible for supplying four (4) copies of written instructions, which shall allow the operator to operate and maintain the equipment supplied. Instructions shall assume that the operator is familiar with pumps, motors, piping, valves, and controls, but that he has not previously operated and/or maintained the exact equipment supplied.

The instruction shall be prepared as a system manual applicable solely to the equipment supplied by the manufacturer to these specifications, and shall include those devices and equipment supplied by him.

A minimum of four (4) operation and maintenance manuals with spare parts lists shall be provided at no additional cost.

FORMALITIES

IT IS UNDERSTOOD that the buyer reserves the right to reject any or all bids for any or all products and/or services covered in this bid request and to waive informalities or defects in bids or to accept such bids as it shall deem to be in the best interest of said buyer.

END OF SECTION

Section-11600

Wastewater Laboratory Furniture, Equipment and Supplies

SECTION 11600

WASTEWATER LABORATORY FURNITURE, EQUIPMENT AND SUPPLIES

PART 1: GENERAL

1.01 Scope of Work

A. Provide all labor, materials, equipment, supplies and services required to install and outfit the laboratory as shown on the Contract Drawings and as specified herein.

B. Equipment supplier shall supply all OSHA required guards and all OSHA recommended/required warning signs and their equipment.

1.02 Related work

A. Special requirements for materials and equipment are given in Sections 01300 and 01600.

1.03 Submittals

A. For laboratory furniture, analytical equipment and supplies, catalog numbers of various suppliers are given for convenience and to establish the quality required. Equal items from alternate supplies may be acceptable.

B. Complete catalog and descriptive data of laboratory cabinets, fixtures and accessories shall be submitted as required in Section 01300 – Submittals.

C. Where the submittals for analytical laboratory equipment and supplies to be furnished and installed are as specified, the CONTRACTOR shall issue a letter listing all materials and manufacturers proposed for use on the Contract. Should the materials proposed for use be other than a brand named in these Specifications, the CONTRACTOR shall submit descriptive literature and/or additional information as may be required to evaluate the proposed materials.

D. O & M instructions shall be submitted to the ENGINEER in accordance with Section 01600.

PART 2: PRODUCTS

2.01 Cabinets

A. All cabinet units shown on the Drawings shall be provided. All cabinets and counter tops shall be provided with a continuous monolithic, epoxy resin countertop, with backsplash as shown on the Drawings. The countertop shall be fabricated with all necessary openings for plumbing and electrical fixtures.

B. Cabinets shall be as manufactured by Browne-Morse, by Nations Laboratory Furniture, or approved equal.

C. Front Frame Construction. All front cross rails, top rails, side frames, toe spaces shall be 16 ga., steel, interlocked and welded for maximum load strength at front of cabinet.

D. Intermediate Cross Rails shall be welded into place between every major drawer opening for rigid drawer spacing and cabinet strength.

E. Finishes shall be of the highest laboratory quality available. The latest in epoxy powder coat technology are applied and baked-on in a controlled conveyorized baking oven.

F. One Piece Toe Construction shall be integral with the 16 ga. steel bottom front rail for easy cleaning, structural strength, and to prevent hidden areas of chemical attack.

G. Full Progressive Drawer Extension Slides with stops shall provide full drawer depth access. Easily removed for cleaning or replacement.

H. Cast Aluminum Drawer and Drawer Pulls shall be used to prevent chemical attack.

I. Insulated Doors shall be standard in all base units for sound deadened operation.

J. Solid Stainless Steel Hinges shall fasten with three screws each in the door and cabinet frame.

K. Adjustable Leveling Bolts shall provide easy adjustment to uneven floor conditions. Corner gusset plates 12 ga. steel with weld nuts, shall furnish full ½" of threading for adjustment bolts.

L. Nylon Roller Catches shall be adjustable to provide easy, quiet and positive door closing.

M. Rubber Bumpers shall prevent metal to metal contact in all strategic points. This feature in both drawers and doors shall assure quiet closing.

2.02 Work Surface and Fixtures

A. Epoxy Resin Work Surfaces shall be 1" (25mm) thick. Work surfaces shall be monolithic and molded from a modified epoxy resin. Work surfaces shall have a smooth, non-glare finish. Work surfaces shall be installed with a uniform 1" (25mm) overhang on the front and exposed ends. Work surfaces shall have a continuous drip groove 1/8" (3mm) wide 1/8" (3mm) deep on the underside of all exposed edges. All exposed edges shall be finished with a 1/8" (3mm) bevel or a 3/16" (4.7mm) radius. Work surfaces shall be provided in longest practical lengths to minimize joints. Work surfaces shall be as manufactured by DURCON, by Epoxyn Products, or equal.

B. Backsplashes shall be of the same material, thickness and finish as the work surface. Backsplashes are to be supplied loose for field application to assure proper fit at walls.

C. All rectangular sinks shall be lipped sinks molded in one piece with corners coved and bottom sloped to the outlet. All rectangular sinks shall include DURCON, or equal, modified resin SO-3R 1-1/2" (38mm) outlet, OE-R overflow, and SS-2R stopper. Sinks, outlets and stoppers are to be supplied loose for field application.

D. Color of work surfaces, sinks, accessories and fume hood tops (when required) shall be black.

E. Mixing Faucets with swing spouts and vacuum breakers shall be a brass deck mount, double service faucets as manufactured by Wolverine Brass, Inc., Water Saver, or equal.

2.03 Analytical Equipment and Supplies

Quantity	Catalog No.	Description	Unit
1	90-1696-01	Analytical Balance – A & D HR 200	EA
1	91-3967-02	Gast Vacuum Pump	EA
1	91-3947-01	Vacuum Pump - Oil	EA
2	90-7620-86	Flask, filtering, 1000 ml	EA
1	90-7461-21	Filtering Funnel, 300 ml, Gelman	EA
1	91-2356-04	Oven, Drying, 2.5 Cu. Ft. Precision Model 25 EG	EA
1	90-6400-25	D. O. Meter, YSI 95-10 Portable	EA
1	91-2650-01	PH Meter, Orion 230A With Starter Kit, Portable	EA
3	12-1704-03	Porc. Evaporation Dishes 70mm Coors	EA
1	12-1570-01	Weighing Dishes Aluminum 100/pk	PK
2	91-3792-23	Pipets, Volumetric 5ml	EA
2	91-3792-28	Pipets, Volumetric 10ml	EA
2	11-7688-53	Cylinders 1/pk 50ml	PK
2	11-7688-67	Cylinders 1/pk 100ml	PK
2	11-7688-78	Cylinders 1/pk 250ml	PK
1	Z91-6209-01	Sludge Judge	EA
1	22-4972-01	Settleometer Kit-Nalge	EA
1	72-3201-11	Centrifuge, Raven	EA
1	72-4004-19	Centrifuge Tubes	DZ
1	92-1830-01	Crucible Tongs 9", S.S.	EA
1	53-0025-01	Forceps – Gelman	EA
1	90-9252-97	Gloves 100/pk, Disposable	PK
2	92-1520-02	Thermometer, -20° to 110°C	EA
1	90-5946-0	Absorbent Pads Kit 1000/pk Gelman	PK
1	91-4825-01	Shower/Eye Wash Guardian G1902P	EA
1	91-4766-01	Safety Glasses	EA
1	91-4770-01	Safety Glasses	EA
1	13-9509-01	First Aid Safety Kit	EA

NOTE: Preiser Scientific, Inc. catalog numbers used in these descriptions are for reference of quality and size. Equipment and supplies furnished shall be as listed above, Fisher Scientific, or approved equal. In addition to the above items furnish 12 aprons with leg straps, 3 pair of rubber boots, safety harness and line, portable lighting equipment complying with the National Electric Code and 3 hard hats.

PART 3: EXECUTION

3.01 Delivery, Storage and Handling

A. Special provisions for materials and equipment are given in Section 01600.

3.02 Installation

A. It is intended that the units and parts listed shall produce a complete job, as shown on the Drawings. Any parts needed, but not listed, shall be furnished to provide a neat, finished installation.

3.03 Field Painting

A. Field painting is specified in Section 09902

3.04 Start-Up and Training

A. Training is required for the equipment as described in Section 01600.

3.05 Tools and Spare Parts

A. All special tools required for normal operation and maintenance of the laboratory equipment shall be furnished by the equipment manufacturer.

END OF SECTION

Section-13045

Plant Influent Flow Meter

SECTION 13045

PLANT INFLUENT FLOW METER

PART 1: GENERAL

1.1 SCOPE

A. This section describes the requirements for an electromagnetic flow metering.

B. Under this item, the Contractor shall furnish and install the flow meter equipment and accessories as indicated on the Plans and as here in specified.

1.2 SUBMITTALS

A. The following information shall be included in the shop drawing submittal for this section:

1. Data sheets and catalog literature for the flow meter and the amplifier.
2. Connection diagrams for equipment wiring.
3. List of spare parts and optional equipment.

B. Shop drawings and other items needed to establish compliance with the Drawings and Specifications for all products in this Section shall be submitted to the ENGINEER in accordance with Section 01300 – Submittals.

C. O&M instructions shall be submitted to the ENGINEER in accordance with Section 01600.

1.3 WARRANTY

A. The manufacturer of the flow meter shall guarantee for one year of operation that the equipment shall be free from defects in design, workmanship, or materials.

B. In the event a component fails to perform as specified or is proven defective in service during the guarantee period, the manufacturer shall promptly replace the defective part at no cost to the Owner.

PART 2: PRODUCTS

2.01 The flow meter will measure flow rates of solids-bearing and/or aerated fluids over a velocity span of 0.1 and 39.4 ft/s.

2.02 The instrument will provide a +1% total error band under reference conditions.

2.03 The electronics enclosure shall be environmentally protected with a powder coated die-cast aluminum NEMA 4X enclosure.

2.04 The electromagnetic flow meter shall be the Magnetoflow Mag Meter with the Primo amplifier as manufactured by BadgerMeter, Inc., or approved equal.

PART 3: EXECUTION

3.1 INSTALLATION

A. Install one 4" flow meter on the Plant Influent Line as shown on the PLANS. The Plant Influent flow meter each shall be able to accommodate a flow range of 5 to 1493 GPM.

B. All equipment furnished under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with detailed drawings, specifications, engineering data, instructions, and recommendations furnished by the equipment manufacturer.

3.03 SERVICES OF MANUFACTURER'S REPRESENTATIVE

A. The flow meter manufacturer shall provide the services of an experienced technical representative for the following functions:

1. ½ day on-site to perform the start-up operation and obtain the Engineer's acceptance of the flow meter equipment.

2. ½ day on-site to conduct plant operator training of the flow meter equipment.

END OF SECTION

Section-13046

Plant Effluent Flow Meter

SECTION 13046

PLANT EFFLUENT FLOW METER

PART 1: GENERAL

1.1 SCOPE

A. This section describes the requirements for an electromagnetic flow metering.

B. Under this item, the Contractor shall furnish and install the flow meter equipment and accessories as indicated on the Plans and as here in specified.

1.2 SUBMITTALS

A. The following information shall be included in the shop drawing submittal for this section:

1. Data sheets and catalog literature for the flow meter and the amplifier.
2. Connection diagrams for equipment wiring.
3. List of spare parts and optional equipment.

B. Shop drawings and other items needed to establish compliance with the Drawings and Specifications for all products in this Section shall be submitted to the ENGINEER in accordance with Section 01300 – Submittals.

C. O&M instructions shall be submitted to the ENGINEER in accordance with Section 01600.

1.3 WARRANTY

A. The manufacturer of the flow meter shall guarantee for one year of operation that the equipment shall be free from defects in design, workmanship, or materials.

B. In the event a component fails to perform as specified or is proven defective in service during the guarantee period, the manufacturer shall promptly replace the defective part at no cost to the Owner.

PART 2: PRODUCTS

2.01 The flow meter will measure flow rates of solids-bearing and/or aerated fluids over a velocity span of 0.1 and 39.4 ft/s.

2.02 The instrument will provide a +1% total error band under reference conditions.

2.03 The electronics enclosure shall be environmentally protected with a powder coated die-cast aluminum NEMA 4X enclosure.

2.04 The electromagnetic flow meter shall be the Magnetoflow Mag Meter with the Primo amplifier as manufactured by BadgerMeter, Inc., or approved equal.

PART 3: EXECUTION

3.1 INSTALLATION

A. Install one 6" flow meter on the Plant Effluent Line as shown on the PLANS. The Plant Effluent flow meter each shall be able to accommodate a flow range of 11 to 3361 GPM.

B. All equipment furnished under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with detailed drawings, specifications, engineering data, instructions, and recommendations furnished by the equipment manufacturer.

3.03 SERVICES OF MANUFACTURER'S REPRESENTATIVE

A. The flow meter manufacturer shall provide the services of an experienced technical representative for the following functions:

1. ½ day on-site to perform the start-up operation and obtain the Engineer's acceptance of the flow meter equipment.

2. ½ day on-site to conduct plant operator training of the flow meter equipment.

END OF SECTION

Section-15001

Plant Piping-General

SECTION 15001

PLANT PIPING - GENERAL

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install the plant piping specified herein and as further specified in the Detail Piping Specifications hereinafter.

B. Material provided hereunder shall be the end products of one manufacturer in order to achieve standardization for appearance and manufacturer's service.

1.02 RELATED WORK SPECIFIED

A. Trenching, backfilling, and compacting are included in Section 02221.

B. Concrete work is included in Division 3.

C. Painting is included in Division 9.

D. Pumps are included in Division 11.

E. Instrumentation is included in Division 13.

F. Valves are included in Division 15.

1.03 SUBMITTALS

A. In addition to the requirements of Section 01300 submittals the following information shall be provided:

1. A specific selection of pipe material and joint type for each pipeline.

2. Double-line drawings of each piping support system to the scale stated on the Contract drawings, locating each support and hanger, identifying by type by catalog number or shop drawing detail number, and showing anchor locations and identifying them by shop drawing detail number.

3. Detailed installation drawings, catalog information, and complete component selection list for metal framing pipe Support system in the pipe galleries, trenches, and other locations employing metal framing pipe support systems.

4. Pipe disinfection and leak test reports.

1.04 MANUFACTURER'S SERVICE

Not Used

1.05 PIPE IDENTIFICATION PAINTING

A. All non-submerged piping shall be painted, color coded, and labeled as specified in Section 09902, Finish Painting.

PART 2: PRODUCTS

NONE

PART 3: EXECUTION

3.01 PIPE PREPARATION AND HANDLING

A. Each pipe and fitting shall be carefully inspected before the exposed pipe or fitting is installed or the buried pipe or fitting is lowered into the trench. The interior and exterior protective coating shall be inspected, and all damaged areas patched in the field with material similar to the original. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.

B. Use proper implements, tools, and facilities for the safe and proper protection of the pipe. Carefully handle pipe in such a manner as to avoid any physical damage to the pipe. Do not drop or dump pipe into trenches under any circumstances.

3.02 INSTALLATION OF BURIED PIPING

A. Preparation of Trench

1. Provide pipe bedding material under all pipe for the full width of the trench. Minimum depth of bedding material below the pipe barrel shall be as specified herein.

2. Depth of pipe bedding material under the pipe bell shall not be less than 3 inches under normal trench conditions and not less than 6 inches in rock excavation areas.

3. Hand-grade bedding to proper grade ahead of pipe laying operation. Bedding shall provide a firm, unyielding support along the entire pipe length.

4. If the trench has been excavated below the required depth for pipe bedding material placement without direction from the Engineer, fill the excess depth with the pipe bedding material specified herein and specified in Section 02221, to the proper subgrade. Place the pipe bedding or foundation stabilization material for the full width of the trench in layers not exceeding 6 inches deep and compact each layer, until the material does not yield or move, to the grade established for the pipe bedding. Where the distance to stable ground is excessive, the Engineer reserves the right to order as an extra, in writing, such other types of foundation or pipe supports as he shall deem necessary.

5. Pipe bedding material shall be crushed stone except for polyethylene wrapped ductile iron pipes which shall have sand bedding and cover material.

B. Line And Grade

1. Do not deviate more than 1 inch from line or 1/4 inch from grade established by the Engineer. Measure for grade at the pipe invert, not at the top of the pipe, because of variations in pipe wall thickness.

2. Grade the bottom of the trench by hand to the line and grade to which the pipe is to be laid, with proper allowance for pipe thickness and for gravel cushion when specified or indicated. Remove hard spots that would prevent a uniform thickness of bedding. Before laying each section of the pipe, check the grade with a straightedge and correct any irregularities found. The trench bottom shall form a continuous and uniform bearing and Support for the pipe at every point between bell holes, except that the grade may be disturbed for the removal of lifting tackle.

C. Bell (Joint) Holes

At the location of each joint, dig bell (joint) holes of ample dimensions in the bottom of the trench and at the sides where necessary to permit easy visual inspection of the entire joint.

D. Removal of Water

1. Provide and maintain ample means and devices at all times to remove and dispose of all water entering the trench during the process of pipe laying.

The trench shall be kept dry until the pipe laying and jointing are completed. Removal of water shall be in conformance with specifications in Section 02221.

E. Prevent Trench Water And Animals From Entering Pipe

1. When the pipe laying is not in progress, including the noon hours, the open ends of pipe shall be closed by a plug or cap to prevent trench water, animals, or foreign material from entering the pipe.

F. Backfill In Pipe Zone

1. The pipe zone shall be considered to include the full width of the excavated trench from the bottom of the trench to 12-inch above the top outside surface of the barrel of the pipe.

2. Particular attention must be given to the area of the pipe zone from the flow line to the spring line of the pipe to insure that firm Support is obtained to prevent any lateral movement of the pipe during the final backfilling of the pipe zone.

3. Where the normal trench width below the top of the pipe is exceeded for any reason, the Contractor shall, unless the Engineer determines that the pipe being used is strong enough for the actual trench width, furnish an adequate support for the pipe. This may be accomplished by furnishing a stronger pipe or a concrete cradle, cap or envelope as approved.

4. For polyethylene wrapped pipe, place and carefully compact pipe with sand for the full width of the trench to the spring line of the pipe. Place the material around the pipe in 6-inch layers and thoroughly hand tamp with approved tamping sticks supplemented by compacting and slicing with a shovel to assure that all voids are filled. Special care shall be taken to avoid damage to the polyethylene wrap around the pipe during placement and compaction of the sand bedding and cover material.

G. Trench Backfill

1. Minimum pipe burial to the top outside surface of the pipe barrel shall be 4 feet unless otherwise noted. Trench backfill above the pipe cover material shall be common fill as specified in Section 02221.

3.03 INSTALLATION OF EXPOSED PIPING

A. Unless shown otherwise, piping shall be parallel to building lines. Hangers on adjacent piping shall be aligned where possible on common size ranges.

B. All pipe flanges shall be set level, plumb, and aligned. All flanged fittings shall be true and perpendicular to the axis of the pipe. All bolt holes in flanges shall straddle vertical centerline of pipes.

C. Unions shall be installed where required for piping or equipment installation, even though they are not shown on the plans.

D. Piping shall be installed without springing or forcing the pipe in a manner which would set up stresses in the pipe, valves, or connected equipment.

E. Required straight runs of piping upstream and downstream of flow measuring devices shall be smooth.

F. Where valve handwheels are shown, valve orientation shall be as shown. Where valve handwheels are not shown, valves shall be orientated to permit easy access to the handwheels, and to avoid interferences.

3.04 INSTALLATION OF WALL PIPES AND PIPE SLEEVES

A. Wall pipes and pipe sleeves embedded in concrete walls, floors, and slabs shall be embedded as shown, and shall be coated with system for interior non-submerged ferrous metal as specified in Section 09902, Finish Painting. Support all pipes embedded in concrete walls, floors, and slabs with form work to prevent contact with the reinforcing steel.

3.05 INSTALLATION OF FLEXIBLE COUPLINGS,FLANGED COUPLINGS ADAPTERS, AND SERVICE CLAMPS

A. Prior to installation, thoroughly clean oil, scale, rust, and dirt from the pipe to provide a clean seat for the gasket. Care shall be taken that the gaskets are wiped clean before they are installed.

B. If necessary, flexible couplings and flanged coupling adapter gaskets may be lubricated with soapy water or manufacturer's standard lubricant before installation on the pipe ends.

C. Install in accordance with the manufacturer's recommendations. Bolts shall be tightened progressively, drawing up bolts on opposite sides a little at a time until all bolts have a uniform tightness. Workmen tightening bolts shall use torque-limiting wrenches, of approved type.

3.06 INSTALLATION OF INSULATING FLANGES, COUPLINGS, AND UNIONS.

A. Install insulating flanges, couplings, and unions wherever copper and galvanized steel piping are connected, where stainless steel piping is connected to cathodically

protected mild steel piping, and wherever cathodically protected steel lines enter the buildings.

3.07 TESTING

A. General

1. Conduct pressure and leakage tests on all newly installed pipelines. Furnish all necessary equipment and material and make all taps in the pipe, as required. The Engineer will monitor the tests.

2. Unless otherwise noted, test pressures shall be as specified below:

All Pressure Lines	100 psig
All Gravity Lines	28 psig
All Chemical Piping	100 psig

3. New pipelines which are to be connected to existing pipelines shall be tested by isolating the new pipe with blind flanges.

4. Unless otherwise specified, all air and gas lines and exposed process piping shall be pneumatically tested and all other lines shall be hydrostatically tested.

5. Conduct final acceptance tests on buried piping that is to be hydrostatically tested after the trench has been completely backfilled. The Contractor may, if field conditions permit, as determined by the Engineer, partially backfill the trench and leave the joints open for inspection and conduct an initial service leak test. The acceptance test shall not, however, be conducted until all backfilling has been completed. Buried piping that is to be pneumatically tested shall have all joints exposed for the acceptance test.

6. Conduct the test on exposed piping after the piping has been completely installed, including all supports, hangers, and anchors, but prior to insulation.

B. Hydrostatic Leak Tests

1. Furnish the following equipment for the hydrostatic tests:

Amount	Description
2	Approved graduated containers.
2	Pressure gauges.
1	Hydraulic force pump. Suitable hose and suction pipe as required.

2. Water shall be used as the hydrostatic test fluid unless otherwise specified.

Test water shall be clean and shall be of such quality as to minimize corrosion of the materials in the piping system. Test water shall be acquired from a source within the plant as designated by the Owner's Operating Agent.

3. Vents at all high points of the piping system shall be opened to purge air pockets while the piping system is filling. Venting during the filling of the system also may be provided by the loosening of flanges having a minimum of four bolts or by the use of equipment vents.

4. All parts of the piping system shall be subjected to test pressure specified hereinbefore.

5. Process Piping

   a. Where any section of pipe is provided with concrete thrust blocking, do not make the pressure test until at least 4 days have elapsed after the thrust blocking is installed. If high-early cement is used for thrust blocking, the time may be reduced to 2 days.

   b. When testing cement-mortar lined piping, slowly fill the section of pipe to be tested with water and allow to stand for 24 hours under slight pressure to allow the cement-mortar lining to absorb water.

   c. Expel all air from the piping system prior to testing and apply and maintain the specified test pressure by means of the hydraulic force pump. Valve off the piping system when the test pressure is reached and conduct the pressure test for 2 hours, reopening the isolation valve only as necessary to restore the test pressure. The pump suction shall be in a barrel or similar device, or metered so that the amount of water required to maintain the test pressure may be measured accurately. This measurement represents the leakage, which is defined as the quantity of water necessary to maintain the specified test pressure for the duration of the test period.

6. No pipe installation will be accepted if the leakage is greater than the number of gallons per hour as determined by the following formula:

$$L = \frac{SD(P)^{1/2}}{133{,}200}$$

In this formula:

L = Allowable leakage, in gallons per hour.
S = Length of pipe tested in feet.
D = Nominal diameter of pipe, in inches.
P = Average test pressure during the leakage test, in pounds per square inch.

7. The Contractor shall correct any leakage greater than the allowance determined under this formula at no additional cost to the Owner.

C. Pneumatic Leak Tests

1. Furnish the following equipment for the pneumatic tests:

Amount	Description
1	Pneumatic compressor separator-dryer system capable of providing oil-free dry air and equipped with one or more full capacity safety relief valves set at a pressure of not more than 105% of the required primary test pressure.
1	Calibrated test gauge.

2. Pneumatic testing shall be performed using accurately calibrated instruments and oil-free, dry air. Tests shall be performed only after the piping has been completely installed, including all supports, hangers and anchors, and inspected for proper installation. All parts of the piping system shall be subjected to the test pressure specified. The Contractor shall take all precautions to protect test personnel. All piping to be tested shall be secured to prevent damage to adjacent piping and equipment in the event of a joint failure. Any appurtenant instruments or devices that could be damaged by the test shall be removed from the piping or suitably isolated prior to applying the test. Prior to starting the test, the Contractor shall notify the Engineer.

3. A preliminary pneumatic test not to exceed 25 psig shall be applied to the piping system prior to final leak testing, as a means of locating major leaks. Examination for leakage, detected by soap bubbles, shall be made at all joints and connections. After all visible leaks have been corrected, the pressure in the system shall gradually be increased to not more than ½ of the test pressure, after which the pressure shall be increased in steps of approximately 1/10 of the test pressure until the required test pressure has been reached. The pneumatic test pressure shall be continuously maintained for a minimum time of 10 minutes and for such additional time as may be

necessary to conduct a soap bubble examination for leakage. The piping system, exclusive of possible localized instances at pump or valve packing, shall show no evidence for leakage. Any visible leakage shall be corrected at no additional cost to the Owner.

4. Following pneumatic testing and final cleaning, lines which are to carry flammable gases shall be thoroughly purged with nitrogen or other approved gas to assure that no explosive mixtures will be present in the system during the filling process.

D. Initial Service Leak Tests

1. Equipment used for initial service leak testing may be the same as that specified under HYDROSTATIC AND PNEUMATIC LEAK TESTS hereinbefore, or the pump or compressor connected to the piping system.

2. The initial system leak test shall be performed by gradually bringing the piping system up to normal operating pressure and holding it there continuously for a minimum time of 10 minutes. Examination for leakage shall be made at all joints and connections. Soap bubbles shall be used to detect leaks in pneumatically-tested systems. The piping system exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of weeping or leaking. Any visible leakage shall be corrected at no additional cost to the OWNER.

E. Test Records

1. Records shall be made of each piping system installation during the test. These records shall include:

a. Date of test.

b. Description and identification of piping tested.

c. Test fluid.

d. Test pressure.

e. Remarks, to include such items as:

(1) Leaks (type, location).
(2) Repairs made on leaks.

f. Certification by Contractor

3.08 INTERIM CLEANING

A. Care shall be exercised during fabrication to prevent the accumulation of weld rod, weld spatter, pipe cuttings and fillings, gravel, cleaning rags, etc. within piping sections. All piping shall be examined to assure removal of these and other foreign objects prior to assembly. Shop cleaning may employ any conventional commercial cleaning method if it does not corrode, deform, swell, or otherwise alter the physical properties of the material being cleaned.

3.09 FINAL CLEANING

A. Following assembly and testing and prior to final acceptance, all pipelines installed under this section, except plant process air lines and instrument air lines, shall be flushed with water and all accumulated construction debris and other foreign matter removed. Flushing velocities shall be a minimum of 2.5 feet per second. Cone strainers shall be inserted in the connections to attached equipment and left there until cleaning has been accomplished to the satisfaction of the Engineer. For large diameter pipe where it is impractical or impossible to flush the pipe at 2.5 fps velocity, clean the pipeline in place from the inside by brushing and sweeping, then flush the line at a lower velocity. Accumulated debris shall be removed through drains 2-inch and larger or by dropping spools and valves.

B. Immediately following drainage of flushed lines, the piping shall be air dried with compressed air.

END OF SECTION

Section-15063

Copper Piping

SECTION 15063

COPPER PIPING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required and install copper piping as shown on the Drawings or as required by these Specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Valves and appurtenances are included in Section 15100.

B. Pipe hangers and supports are included in Section 15090.

C. Field painting is included in Division 9.

1.03 DESCRIPTION OF SYSTEMS

A. Copper piping, tubing, and fittings specified herein will be used for water and miscellaneous uses as shown on the Drawings.

1.04 QUALIFICATIONS

A. All copper pipe and fittings shall be preferably of domestic manufacturer and shall be the product of a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of the materials to be furnished.

B. The materials shall be manufactured and installed in accordance with the best practices and methods and shall be suitable for the intended service.

1.05 SUBMITTALS

A. Submit to the Engineer for approval, six (6) copies of shop drawing, technical specifications and detailed information on all materials to be furnished, including complete, dimensioned piping layout drawings.

PART 2: PRODUCTS

2.01 MATERIALS

A. Copper pipe shall include copper pipe, copper tubing, and fittings as specified herein.

B. Copper pipe and tubing for pressurized systems shall have a minimum working pressure of 150 psig.

C. Copper tubing for above ground water service shall be ASTM Specification B-88,Type L, Hard and Type K, Hard, for below ground service.

D. Copper tubing for connections between supply lines and instrumentation shall be ASTM B-88, Type L, soft. Fittings shall be compression type, flared copper or flareless brass as later specified herein.

E. Copper pipe requiring threaded joints shall be ASTM B-42, seamless, hard drawn regular weight. Fittings shall be of threaded, cast bronze.

F. Unions shall be brass with ground joints.

G. Soldered fittings shall conform to ANSI Bl6.18 and compression fittings shall be flareless equal to Crawford "Swagelok".

PART 3: EXECUTION

3.01 INSTALLATION

A. All piping shall be installed to proper line and grade and rigidly supported. Except as otherwise required, changes in direction shall be made using copper fittings, and piping shall run parallel and at right angles to walls. Systems shall be arranged with low points and drains to permit complete drainage of the system.

B. Where indicated by the Engineer, lines of soft annealed tubing may be bent and neatly installed without fittings, and securely fastened to supporting construction.

C. Unions shall be provided close to main pieces of equipment and in branch lines to permit ready dismantling of piping without disturbing main pipe lines or adjacent branch lines.

D. Joints for copper or bronze solder-type fittings shall be made with solder composed of 95 percent tin and 5 percent antimony. Joints underground shall be made up with 1000 deg. F silver solder. Screw joints shall be made tight with graphite paste or

other approved pipe compound. Once a joint has been made, it shall not be broken and remade without thorough cleaning of the pipe and joint.

E. Sleeves or wall castings of the sizes specified in the Drawings or by the Engineer shall be installed for all pipes passing through concrete or masonry floors or walls.

F. In soldered joints, surfaces of pipe and fittings to be joined shall be cleaned with fine sandpaper to bright metal. Both surfaces to be joined shall be completely covered with a soldering flux approved by the Engineer. Joints shall be evenly heated from all sides before applying solder. Excess flux shall be removed from the joint after the solder has hardened. In threaded joints, threads shall be clean and undamaged.

3.02 TESTING

A. Piping shall be flushed clean and tested with the fluid to be used in the pipe at 150 psi pressure, and shall be proved absolutely tight for a period of five minutes

B. The Contractor shall provide all testing equipment and shall conduct the test. Any leaks shall be repaired and the pipe retested.

END OF SECTION

Section-15064

Plastic Pipe and Fittings

SECTION 15064

PLASTIC PIPE AND FITTINGS

PART l: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install in the locations as shown on the Drawings, the plastic piping and appurtenances as specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Valves and appurtenances are included in Section 15100.

B. Pipe hangers and Supports are included in Section 15090.

1.03 DESCRIPTION OF SYSTEM

A. Plastic pipe shall be used for underground plant, potable and non-potable water piping, and other applications as shown on the Drawings.

1.04 QUALIFICATIONS

A. All plastic pipe shall be furnished by a single 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.

1.05 SUBMITTALS

A. Shop drawings shall be submitted to the Engineer for approval in accordance with Section 01300 and shall include dimensioning, methods and locations of supports, and technical specifications for all piping to be furnished.

PART 2: PRODUCTS

2.01 MATERIALS

A. Plastic pipe (PVC pipe as shown on the Drawings) shall be manufactured from

rigid, unplasticized, polyvinyl chloride and chlorinated polyvinyl chloride compound meeting ASTM D-l784, Type 1, Grade 1 (Class 12454-B) and manufactured in accordance with ASTM D-1785, PVC 1220 and CPVC where shown on the Drawings. The pipe shall have a design Stress rating of 2,000 psi at 73 deg. F and shall be suitable for field cutting and solvent welding. Pipe shall be of the sizes as shown on the Drawings and shall be Schedule 80 unless otherwise shown.

B. Fittings shall be the socket type for solvent welded joints as designated in ASTM D-2467 and D-2466, using solvent as specified in ASTM D-2564, except where threaded as shown on the Drawings, and as designated in ASTM D-2464 or flanged as shown on the Drawings and shall he compatible with the pipe where installed. Flanges shall be furnished with l/8-in thick full-faced gaskets. Flange bolts and nuts shall be ASTM A276, Type 304 or 316 stainless steel.

C. Fittings, specials, unions, and flanges shall be of the same schedule number and manufactured of the same materials as the pipe.

D. Caulking for plastic pipe in wall sleeves shall be by a mechanical, modular, rubber sealing element placed in between the sleeve and pipe and expanded to make a tight fit or other method approved by the Engineer.

E. Gaskets in plastic pipe shall be of a material suitably resistant to the fluid within the respective pipelines and shall be subject to the approval of the Engineer.

PART 3: EXECUTION

3.01 INSTALLATION

A. The installation of plastic pipe shall be strictly in accordance with the manufacturer's technical data and printed instructions.

B. Joints for plastic pipe shall be solvent welded except flanged or threaded where required. 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 the proper grade. Expansion joints shall be installed every 50 ft on long runs and in every straight run longer than 15 ft.

C. Installation of valves and fittings shall be strictly in accordance with manufacturers instructions. Particular care shall be taken not to over stress threaded connections at sleeves. In making solvent weld connections, the solvent shall not he spilled on valves or allowed to run from joints.

D. All piping shall have a sufficient number of unions to allow convenient removal of piping and shall be as approved by the Engineer.

E. All plastic pipe to metal pipe connections shall be made using flanged connections. Metal piping shall not be threaded into plastic fittings, valves, or couplings nor shall plastic piping be threaded into metal valves, fittings or couplings.

F. Concrete inserts for hangers and supports shall be furnished and installed in the concrete as it is placed. The inserts shall be set in accordance with the requirements of the piping layout and the Contractor shall verify these locations from approved piping layout drawings and the structural drawings.

G. Buried piping shall be snaked along the trench to provide for expansion and contraction. The pipe shall be backfilled with selected fine excavated material and thoroughly compacted to one foot above the top of the pipe and thereafter backfilled as specified in Section 02221.

3.02 INSPECTION AND TESTING

A. All pipelines shall remain undisturbed for 24 hours to develop complete strength at all joints. All pipelines shall be subjected to a hydrostatic pressure test.

END OF SECTION

Section-15072

Ductile Iron Pipe and Fittings

SECTION 15072

DUCTILE IRON PIPE AND FITTINGS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install, in the locations inside and outside of structures as shown on the Drawings, all ductile iron piping, cast iron or ductile iron fittings, and appurtenances as shown on the Drawings and as specified herein.

1.02 RELATED WORK SPECIFIED

A. Excavation, backfill, fill and grading is included in Section 02221.

B. Concrete work is included in Division 3.

C. Painting, except as specified herein, is included in Division 9.

D. Pipe hangers and supports are included in Section 15090.

E. Valves and appurtenances are included in Section 15100.

1.03 DESCRIPTION OF SYSTEMS

A. Piping shall be installed in those locations as shown on the Drawings.

B. The equipment and materials specified herein is intended to be standard types of ductile iron pipe and cast-iron or ductile iron fittings for use in transporting water, sludges, and other liquids.

1.04 QUALIFICATIONS

A. All of the ductile-iron pipe and cast-iron or ductile iron fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed, installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

1.05 SUBMITTALS

A. Submit to the Engineer within fifteen (15) days after execution of the Contract a list of materials to be furnished, the names of the suppliers and the date of delivery of materials to the site.

B. All ductile-iron pipe and cast-iron or ductile iron fittings to be installed under this Contract shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured. Furnish in duplicate to the Engineer sworn certificates of such tests and their results..

C. Shop Drawings including piping layouts within the structures shall be submitted to the Engineer for approval in accordance with Section 01300 and shall include dimensioning, methods and locations of supports and all other pertinent technical specifications for all piping to be furnished.

PART 2: PRODUCTS

2.01 MATERIALS

A. Ductile iron pipe for underground installation shall meet the following requirements.

1. Ductile iron pipe shall conform to ANSI A2l.51 and AWWA C 151, Class 51, or as shown on the Drawings.

2. The pipe shall be supplied in lengths not in excess of 20 ft. Pipe shall be the rubber-ring type push-on joint, the standard mechanical joint or the flange joint as shown on the Drawings. Fittings shall be ductile iron or cast iron Class 150. Fittings shall meet the requirements of ANSI and AWWA Specifications as applicable. Rubber gasket joints shall conform to ANSI A21.51 for mechanical and push-on type joints. Flanged joints shall be 125 pound ANSI flanges and conform to ANSI B16.l. All pipe and fittings shall have a cement mortar lining and bituminous seal coat on the inside and a coal tar enamel coat on the outside in accordance with ANSI A21.5l except that cement mortar lining shall be 1/8-inch in thickness for pipe 2-in to 12-in diameter, and 3/16-inch for 14-in to 24-in diameter pipe and 1/4-in for 30-in diameter pipe and larger. A plus tolerance of 1/8-in will be permitted.

3. Pipe and fittings shall be as manufactured by the American Cast Iron Pipe Company, U.S. Pipe and Foundry Company, Clow Corp. or equal.

4. All fittings for push-on joint pipe shall have mechanical joints.

B. Ductile-iron pipe for interior use shall meet the following requirements:

1. Flanged ductile-iron pipe shall conform to current ANSI Specification A21.51 with factory applied screwed long hub flanges except as otherwise specified hereinafter. Flanges shall be faced and drilled after being screwed on the pipe, with flanges true to 90 degrees with the pipe axis and shall be flush with end of pipe.

2. Mechanical-joint ductile-iron pipe shall be as specified for the flanged pipe except the joints shall conform to ANSI Specification A21.11 as applicable. Mechanical-joint pipe shall be furnished with sufficient quantities of accessories as required for each joint.

3. Fittings shall be ductile iron or cast-iron as specified above. Except as specified below, flanges and flanged fittings shall conform to ANSI A21.10 for 150 psi pressure rating.

4. Pipe thickness classes shall be Class 51 for all sizes of pipe.

5. Pipe and fittings shall be cement mortar lined and bituminous seal coated on the inside in accordance with ANSI Specification A21.4 except that the cement lining thickness shall be not less than 1/8-in for 3-12 inch pipe, 3/16-in for 14-24 inch pipe and 1/4-in for pipe 30-in and larger. A plus tolerance of 1/8-in will be permitted. Ring gaskets shall be of approved composition suitable for the required service.

6. Pipe and fittings exposed to view in the finished work shall not receive the standard tar or asphalt coat on the outside surfaces but shall be shop primed on the outside with one coat of rust inhibitive primer as specified in Section 09901. All other pipe and fittings shall be shop coated on the outside with coal tar enamel in accordance with the above referenced ANSI Specifications and will not require any other coating. Should portions of the pipe inadvertently be given the outside coating of coal tar enamel instead of the rust inhibitive primer as required for exposed piping the surfaces shall be sealed with a non-bleeding sealer coat such as Inertial Tar Stop, or Mobil Anti-Bleeding Aluminum Sealer or equal. Sealing shall be a part of the work of this Section.

C. Sleeve Type Couplings

1. Sleeve-type couplings shall be as made by Dresser Mfg. Div., Bradford, Pa., Smith-Blair, Inc., San Francisco, California, R.H. Baker & Co., Inc., Huntington Park, California, or equal.

2. Couplings for buried pipe shall be of cast iron and shall be Dresser Style 53, Smith-Blair Style 431, Baker Allcast, or equal. The couplings shall be provided with stainless steel bolts and nuts unless indicated otherwise.

3. Couplings for exposed pipe shall be of steel and shall be Dresser Style 38 or 138, Smith-Blair Style 413, Baker Allsteel, or equal. When installed in force mains, harness couplings or joint harnesses shall be provided. The couplings shall be provided with black steel bolts and nuts unless indicated otherwise.

4. All couplings shall be furnished with the pipe stop removed.

5. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe.

D. Wall Castings

1. Wall castings shall be of the sizes and types as shown on the Drawings. Flanges and mechanical joint bells shall be drilled and tapped for studs where flush with the wall.

2. Wall castings shall be provided with an intermediate wall collar. The collar shall be located at the center of the overall length of casting for castings set flush with the wall. For castings which extend through the wall, the collar shall be located such that it is within the middle third of the wall. Collars shall either be cast integrally with the casting or shall be of the assembled type as manufactured by U.S. Pipe & Foundry Company, or equal consisting of two (2) mechanical joint retainer glands with gasket.

E. Base bends and base tees shall have machined and drilled bases.

F. Filler flanges and beveled filler flanges shall be furnished and installed as required. Filler flanges and beveled filler flanges shall be furnished faced and drilled complete with extra length bolts. Filler flanges shall be Clow Fig. F-1984 or equal and beveled filler flanges shall be Clow Fig. F-1986 or equal.

G. Blind flanges shall be furnished and installed as required. Blind flanges shall be furnished faced and drilled to ANSI Bl6.1 125 lb Standard.

PART 3: EXECUTION

3.01 HANDLING PIPE AND FITTINGS

A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired.

B. All pipe and fittings shall be subjected to a careful inspection and hammer test just prior to being laid or installed.

C. If any defective pipe is discovered after it has been laid it shall be removed and replaced with a sound pipe in a satisfactory manner at no expense to the OWNER. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.

3.02 LAYING EXTERIOR PIPE AND FITTINGS

A. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA Standard Specification C600 except as otherwise provided herein. A firm, even bearing throughout the length of the pipe shall be constructed by tamping selected material at the sides of the pipe up to the springline. BLOCKING WILL NOT BE PERMITTED.

B. All pipe shall be sound and clean before laying. When laying is not in progress, including lunchtime, the open ends of the pipe shall be closed by watertight plug or other approved means. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by manufacturer. Fitting , in addition to those shown on the plans, shall be provided, if required, in crossing utilities which may be encountered upon opening the trench. Solid sleeves shall be used only where approved by the Engineer.

C. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a Tyton bell or equal shall be beveled to conform to the manufactured spigot end. Cement lining shall be undamaged.

D. Joint restraint shall be provided at all fittings and other locations as shown on the Drawings. Where otherwise shown on the Drawings, restraint shall be provided either by concrete thrust blocks or the type of joint shown. Where pipe is installed in locations where there is insufficient undisturbed material, joint restraint shall be used. For concrete thrust blocks, bearing area shall be adequate to prevent any movement of the fitting. Minimum bearing areas shall be as shown on the Drawings. Joints shall be protected by felt roofing paper prior to placing concrete. Concrete shall be no leaner than 1 part cement, 2-1/2 parts sand, and 5-1/2 parts stone. Concrete shall be placed against undisturbed material, and shall not cover joints, bolts or nuts, or interfere with the removal of any joint. Wooden side forms shall be provided for thrust blocks.

E. Unless otherwise shown or approved by the Engineer all outside pipe lines shall have a 4 foot minimum cover.

F. Jointing Ductile-Iron Pipe

1. Push-on joints shall be made in strict accordance with the manufacturer's instructions. Pipe shall be placed with bell ends looking ahead in the direction it is being laid. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe to be entered shall then be inserted in alignment with the bell of the pipe to which it is to be joined, and pushed home with a jack or by other means. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.

2. Mechanical joints at valves, fittings, and where designated shall be in accordance with the "Notes on Method of Installation" under ANSI Specification A 21.11 and the instructions of the manufacturer. To assemble the joints in the field, thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening the bolts. Bolts shall be tight to the specified torques. Under no condition shall extension wrenches or pipe over handle or ordinary ratchet wrench be used to secure greater leverage.

3. Flanged joints shall be made using ring gaskets of rubber with cloth insertion. Gaskets 12-in in diameter and smaller shall be 1/16-in thick; larger than 12-in 3/32-in thick. Flanged joints shall be made with bolts, bolt studs with a nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same American Standard as the flanges. Bolts and nuts shall, except as otherwise specified or noted on the Drawings, be Grade B conforming to the ASTM Standard Specification for Low-Carbon Steel, Externally and Internally Threaded Standard Fasteners, Designation

A307-68. Bolt studs and studs shall be of the same quality as machine bolts.

a. Bolts in flanged joints or mechanical joints shall be tightened alternately and evenly. After installation two heavy bitumastic coatings comparable to Inertial No. 66 Special Heavy shall be applied to bolts and nuts.

4. Prior to installation of sleeve-type couplings, the pipe ends shall be cleaned thoroughly for a distance of 8-in. Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6-in from the end, and the middle ring shall be placed on the already laid pipe end until it is properly centered over the joint. The other pipe end shall be inserted into the middle ring and brought to proper position in relation to the pipe already laid. The gaskets and followers shall then be pressed evenly and firmly into the middle ring flares. After the bolts have been inserted and all nuts have been made up finger tight, diametrically opposite nuts shall be progressively and uniformly tightened all around the joint, preferably by use of a torque wrench of the appropriate size and torque for the bolts. The correct torque as indicated by a torque wrench shall not exceed 75 ft-lb for 5/8-in. bolts and 90 ft-lb for 3/4-in. bolts.

5. If a wrench other than a torque wrench is used, it should be no longer than 12-in, so that when used by the average man the above torque values shall not be exceeded. After assembly and inspection and before being backfilled, all exterior surfaces of buried sleeve-type couplings, including the middle and follower rings, bolts, and nuts, shall be heavily and thoroughly coated with an approved heavy-bodied bituminous mastic. Care shall be taken and appropriate devices used to ensure that the underside, as well as the more readily accessible parts, is well coated.

Where flanged pipe joints are to be on either side of a sleeve-type coupling in the piping, sleeve-coupling bolts should not be made up until the flanged joints have first been made.

To prevent sleeve-type couplings from pulling apart under pressure, a suitable flange clamp assembly shall be provided and installed where shown on the drawings.

6. All valves, fittings and other appurtenances needed upon the pipe lines shall be set and jointed as indicated on the Drawings or as required.

3.03 INSTALLING INTERIOR DUCTILE-IRON PIPE AND FITTINGS

A. All piping and fittings shall be installed true to alignment and rigidly supported thrust anchors shall be provided where required. Any damage to linings shall be repaired to the satisfaction of the Engineer before the pipe is installed. Each length of pipe shall be cleaned out before erection.

B. Sleeves shall be installed of proper size for all pipes passing through floors or walls as shown on the Drawings. Where indicated on the Drawings or required for liquid or gas-tightness the pipe shall be sealed with a mechanical seal equal to Link-Seal as manufactured by Thunderline Corp., Wayne, Michigan.

C. Concrete inserts for hangers and supports shall be furnished and installed in the concrete as it is placed. The inserts shall be set in accordance with the requirements of the piping layout and jointing method and their locations shall be verified from approved piping layout drawings and the structural drawings.

D. Except as otherwise shown on the Drawings either split type couplings or flange joints may be used. Prior to approval of jointing method, layouts for hanger and supports shall be submitted to the Engineer for approval.

Pipe for use with non-restrained sleeve type couplings shall have plain ends.

E. Flanged joints shall be made with bolts, bolt studs with a nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same American Standard as the flanges. Bolts and nuts shall, except as otherwise specified or noted on the drawings, be Grade B conforming to the ASTM Standard Specification for Low-Carbon Steel, Externally and Internally Threaded Standard Fasteners, Designation A307-68. Bolt studs and studs shall be of the same quality as machine bolts.

Gaskets shall be ring gaskets of rubber with cloth insertion. Gaskets 12-in in diameter and smaller shall be 1/16-in thick; larger than 12-in in diameter 3/32-in thick.

F. All valves, fittings, equipment, and appurtenances needed upon the pipelines shall be set and jointed as indicated on the Drawings or as required. 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, a certification shall be submitted stating that such requirements have been complied with.

3.04 TESTING

A. All pipe lines shall be hydrostatically tested for leakage.

3.05 SURFACE PREPARATION AND PAINTING

A. All piping and fittings exposed to view shall have its surface prepared and be shop painted as specified in Section 09901. Surface preparation and shop priming is a part of the work of this Section. Pipe marking is included in Section 09902, but it shall be part of the work of this Section to assist as required by the Engineer in identifying pipe contents, direction of flow and all else required for proper marking of pipe.

END OF SECTION

Section-15090

Pipe Hangers and Supports

SECTION 15090

PIPE HANGERS AND SUPPORTS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals and install pipe hangers, supports, concrete inserts, and anchor bolts including all metallic or fiberglass hanging and supporting devices for supporting exposed piping.

1.02 RELATED WORK SPECIFIED

A. Concrete is included in Division 3.

B. Miscellaneous metal is included in Division 5.

C. Painting is included in Division 9.

D. Pipe and fittings are included in respective sections of Division 15.

1.03 QUALIFICATIONS

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 times the ultimate tensile strength of the material, assuming 10 ft 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, submit a certification stating that such requirements have been complied with.

1.04 SUBMITTALS

A. Submit to the Engineer for approval, as provided in Section 01300, shop drawings of all items to be furnished under this section. Submittals shall include pipe support loading calculations, a location plan, and a complete total bill of materials.

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 secure 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. Any structural steel members required to brace any piping from excessive dislocation shall conform to the requirements of Division 5 and shall be furnished and installed under this Section. All pipe supports shall be approved prior to installation.

B. 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.

C. Unless otherwise specified herein, pipe hangers and supports shall be as manufactured by Aickinstrut, Inc., Unistrut, Corp., 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 PIPE HANGERS AND SUPPORTS FOR METAL PIPE

A. Suspended single pipes shall be supported by hangers suspended by steel or fiberglass rods from galvanized concrete inserts as follows:

1. Hanger rods shall be machine threaded and the strength of the rod shall be based on root diameter.

2. Where applicable concrete inserts for hanger rod sizes up to and including 3/4-in diameter shall be continuous metal inserts designed to be used in ceilings, walls or floors as manufactured by the Unistrut Corp., Aickinstrut, Michigan or equal. Series P3200 inserts shall be used where supports are parallel to the main slab reinforcement and Series P3300 where the supports are perpendicular to the main slab reinforcement. Spot inserts shall be equal to Catalogue No. P3245 or M24 as applicable.

3. All hanger rods shall have turnbuckles to permit vertical adjustment after erection- Turnbuckles shall be equal to Grinnell rig. No. 230.

B. Wall or column supported pipes shall be supported by welded steel brackets equal to Grinnell Fig. 194, 195, and 199 as required. Additional wall bearing plates shall be provided where required.

1. 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 Grinnell Fig. 120 and 137.

2. Where the pipe is located below the bracket, the pipes shall be supported by hangers suspended by steel rods from the bracket. Hangers and steel rods shall be as specified above.

3. Wall or column supported pipes 2-inches and smaller may be supported by hangers equal to Carpenter and Patterson Figures 74, 179, or 237 as required.

C. Floor supported pipes 3-inches and larger in diameter shall be supported by either cast-in-placed concrete supports or adjustable pipe saddle supports. In general, concrete supports shall be used when lateral displacement of the pipes is probable (unless lateral support is provided), and pipe stanchion type supports shall be used where lateral displacement of the pipes is not probable

1. 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. Top edges and vertical corners of each concrete support shall have 1-in bevels. Each pipe shall be secured on each concrete support by a 316 stainless steel anchor strap anchored to the concrete with cast-in-place anchor bolts or with expansion bolts as shown on the Drawings. 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 5 feet.

2. Concrete piers used to support base elbows and tees shall be similar to that specified above. Piers may be square or rectangular.

3. Each adjustable pipe saddle support shall be screwed or welded to the corresponding size 150 lb 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 4 anchor bolts per flange. Adjustable saddle supports shall be equal to Grinnell Fig. No. 264. Where used under base fittings, a suitable flange shall be substituted for the saddle.

4. Floor supported pipes less than 3-inches shall be supported by fabricated steel supports.

D. Vertical piping shall be supported as follows:

1. 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.

2. 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.

3. 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 Grinnell Fig. 261.

E. 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.

2.03 PIPE HANGER AND SUPPORTS FOR NON-METAL PIPE

A. Single plastic pipes shall be supported by pipe supports as previously specified herein.

B. Multiple, suspended, horizontal plastic pipe runs, where possible, 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. 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 equal. Spacing between clamps shall not exceed 9 ft. The cable trays shall provide continuous support along the length of the pipe.

C. 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.

D. Pipe supports shall be provided to support the vertical runs of all plastic pipes. The pipes shall be supported by means of a supporting framework suitably anchored into the floor or curbing. The vertical piping shall be suitably secured to horizontal support members connected at each end to vertical support members and spaced as required to provide a rigid installation.

1. The complete supporting system shall be as manufactured by the Aickinstrut.

2. Vertical and horizontal supporting members shall be U-shaped channels similar to Unistrut Series Pl000. Vertical piping shall be secured to the horizontal members by pipe clamps or pipe straps equal to UniStrut Series P1100M and Series P2558. All Components shall be of mild steel.

3. The assemblies shall be furnished complete with all nuts, bolts, and fittings required for a complete assembly.

4. The design of each individual framing system shall be the responsibility of the Contractor. Shop drawings shall show all details of the installation, including dimensions and types of supports.

2.04 SPECIAL SUPPORTS

A. Any required pipe supports for which the supports specified in this section are not applicable shall be fabricated or constructed from standard structural steel shapes, concrete and anchor hardware similar to items previously specified herein and shall be subject to the approval of the Engineer.

PART 3: EXECUTION

3.01 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 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 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 ft-0-in. with a minimum of one support per pipe section at the joints.

2. Supports for multiple PVC pipes shall be continuous wherever possible. Individually supported PVC pipes shall be supported as recommended by the manufacturer except that support spacing shall not exceed 3 feet.

3. Support spacing for copper tubing and pipe shall not exceed 5 -feet. Support spacing for steel pipe greater than 2-in shall not exceed 10 ft.

4. All vertical pipes shall be supported at each floor or at intervals of not more than 15 ft by approved pipe collars, clamps, brackets, or wall rests, and at all points necessary to insure rigid construction.

E. Pipe supports shall not result in point loadings but shall distribute pipe loads evenly along the pipe circumference.

F. Effects of thermal expansion and contraction of the pipe shall be accounted for in pipe support selection and installation.

G. 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.

H. Continuous metal inserts shall be embedded flush with the concrete surface.

3.02 PAINTING

A. Surface preparation and shop priming is a part of the work of this Section and shall be as specified in Section 09901.

B. Finish coating is included in Section 09902.

END OF SECTION

Section-15100

Valves and Appurtenances

SECTION 15100

VALVES AND APPURTENANCES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install complete and ready for operation all valves and appurtenances as shown on the Drawings and specified herein.

B. The equipment shall include but is not limited to the following.

1. Solenoid valves
2. Plastic ball valves for polymer solution
3. Plastic check valves for polymer solution
4. Gate valves
5. Check valves for water and natural gas service
6. Check valves for compressor service
7. Service clamps
8. Dielectric pipe couplings
9. Plug valves
10. Reduced pressure backflow preventer
11. Emergency shower and eyewash station
12. Wafer Butterfly Valves for Blowers
13. Small Valves

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Piping is included in the respective sections of Division 15.

B. Pipe hangers and supports are included in Section 15090.

1.03 DESCRIPTION OF SYSTEMS

A. All of the equipment and materials specified herein is intended to be standard for use in controlling the flow of wastewater, sludge, water, air, or chemicals, depending on the applications.

1.04 QUALIFICATIONS

A. All of the types of valves and appurtenances shall be products of well established firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

1.05 SUBMITTALS

A. Complete shop drawings of all valves and appurtenances shall be submitted to the Engineer for approval in accordance with the requirements of Section 01300.

B. Furnish all information required in Section 01010.

1.06 OPERATING

A. Manufacturer's operating and maintenance instructions in four (4) sets shall be furnished to the Engineer for equipment furnished under this Section and shall be in accordance with Section 1600.

1.07 TOOLS

A. Special tools, if required for normal operation and maintenance shall be supplied with the equipment.

PART 2: PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. General

1. All valves and appurtenances shall be of the size shown on the Drawings and as far as possible all equipment of the same type shall be from one manufacturer.

2. All valves and appurtenances shall have the name of the manufacturer, flow directional arrows, and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

3. All valve operators shall be as shown on the PLANS.

2.02 PRODUCTS

A. Solenoid Valves

1. Solenoid valves shall be packless piston type direct acting, 2-way or 3-way, valves and shall be ASCO Valve Red Hat as manufactured by Automatic Switch Co., or equal.

2. All valves shall be of the normally closed or normally open as required to perform their operations.

3. Valves shall have forged brass bodies, NPT end connections of the size shown on the Drawing, 300 or 400 series stainless Steel internal parts, and Buna N or Ethylene Propylene valve Seats. Valves shall have a 150 psig (minimum) safe working pressure and zero minimum operating pressure differential. Connections are to be threaded.

4. Except as otherwise specified herein, valves shall have NEMA 4 solenoid enclosures, shall be suitable for operation on a 120V, 60 Hz, single phase power supply, and shall be provided with a continuous duty Class F coil and manual operator.

B. Plastic Ball Valves for Polymer Solutions

1. Ball valves for polymers solutions 3 inches and smaller shall be rated for safe operation at 150 psi WOG, 68 degrees F.

2. The valves shall be of solvent weld or true union type with PVC body and ball, TFE seats and EPDM 'O' rings.

3. Valve shall be mounted in such a position that valve position indicators are plainly visible when standing on the floor.

4. Ball valves for polymer solutions shall be Chemtrol TU series, GF Plastic systems type 342, Plastic Engineering Products, Inc. or equal.

C. Plastic Check Valves for Polymer Solutions

a. Check valves for polymer solutions 3" and smaller shall be of the ball check, true union type rated for safe operation at 150 psi working pressure.

b. The valve body and ball shall be PVC, the ball seal and body seal shall be Viton.

c. Check valves for polymers and caustic solutions shall be GF Plastic type 360, Chemtrol Series BC or equal.

D. Gate Valves

1. Gate valves 2-1/2-in in diameter and smaller in size, shall have flanged, threaded, or solder ends as required; and shall be bronze, solid wedge, rising-stem type gate valves as manufactured by Kennedy Valve Mfg. Co. or equal. These valves shall be rated for safe operation at 125 psi saturated steam and 200 psi non shock cold water, oil or gas (WOG).

2. Gate valves 3-in to 12-in shall be iron body, bronze mounted, resilient wedge gate valves with flanged or mechanical joint ends conforming to the Standard Specification for Gate Valve for Water and Sewage Systems, Designation C509 latest revision. Gate valves larger than 12-in shall be iron body, bronze mounted, double disc gate valves conforming to the Standard Specification for Gate Valve for Water and Sewage Systems, Designation C500 latest revision. The following additional requirements apply:

   a. Rated working pressure of valves installed shall be 200 psi unless otherwise noted on the PLANS.

   b. Valves for interior service shall be outside screw and yoke type with rising stem.

   c. Bronze gate rings shall be fitted into grooves of dovetail or similar shape in the gates. For grooves or other shapes, the rings shall be firmly attached to the gates with bronze rivets.

   d. Valves shall turn counterclockwise to open the valves. Handwheels shall be of ample size and shall have an arrow and the word "0PEN' cast thereon to indicate the direction of opening.

   e. Stuffing box follower bolts shall be steel and the nuts shall be of bronze.

   f. The design of the valves shall permit packing the valves without undue leakage while they are wide open and in service.

   g. O-ring stuffing boxes may be used.

   h. Valves shall be as manufactured by Clow, Mueller Co., Kennedy Valve Co., or approved equal.

E. Check Valves for Water and Natural Gas Service

1. Check valves for ductile iron and steel pipelines shall be swing type and shall meet the material requirements of AWWA Specification C508 latest revision. The valves shall be iron body, bronze mounted, single disc, 150 psi working water pressure, nonshock, and hydrostatically tested at 300 psi. Ends shall be l25 lb ANSI B16.1 flanges.

   a. When there is no flow through the line the disc shall hang lightly against its seat in practically a vertical position. When open, the disc shall swing clear of the waterway.

   b. Check valves shall have bronze seat and body rings, extended bronze hinge pins and bronze nuts on the bolts of bolted covers.

   c. Valves shall be constructed so that disc and body seat may easily be removed and replaced without removing the valve from the line. Valves shall be fitted with an extended hinge arm with outside lever and weights.

2. Check valves 2-in and smaller for installation in copper and steel pipes shall be bronze, swing type, 200 psi with solder or screwed ends.

F. Check Valves for Compressor Service

1. Check valves for the discharge of reciprocating compressors shall be in-line type rated for safe operation for pneumatic or light liquid service to 750 psig. The valve shall have a maximum pressure drop of 1.01 psig at an inlet pressure of 100 psig.

2. The valve body, spring seat and cages shall be brass. The spring shall be stainless steel and the seat disc and packing TFE.

3. Check valves for compressor service shall be Rego Series CV or equal.

G. Service Clamps

1. Service clamps shall have malleable or ductile iron bodies which extend at least 160 degrees around the circumference of the pipe and shall have neoprene gaskets cemented to the saddle body. Bodies shall be tapped for either corporation stop threads or IPS as required. Clamps with tap sizes 1-in and smaller shall be of the single strap design. Clamps with tap sizes larger than 1-inch shall be of the double strap design.

2. Service clamps shall be Style 91 or 291 as manufactured by Dresser Industries, Inc., Type 311 or 313 as manufactured by Smith-Blair, Inc., or equal.

H. Dielectric Pipe Couplings

1. Dielectric Pipe Couplings shall be used wherever copper pipe connects to steel or cast iron pipe and appurtenances. Couplings shall have steel bodies with non-conducting bushings on both ends. Ends shall have standard pipe threads. Couplings shall be rated for at least 200 psi at 220 deg. F. Couplings shall be as manufactured by Thermodynamics Corp., Needharn, MA, Water Vallett Co., Detroit, MI, or equal.

I. Plug Valves

1. Valves shall be non-lubricated, eccentric type with neoprene resilient faced plugs and flanged or mechanical joint ends as shown on the PLANS. Port areas of the valve shall be at least 80 percent of full pipe area. Valves shall be semi-steel or cast iron body and plug, raised eccentric seat, with a welded in overlay of not less than 90 percent pure nickel on all surfaces contacting the plug face. The valves shall have cylindrical seating surfaces that are eccentrically off-set. Valves shall have permanently lubricated, stainless steel bearings in the upper and lower plug stem journals and shall be of the bolted bonnet design.

2. The valve shall be capable of being repacked without removing the bonnet and the packing shall be adjustable without requiring disassembly of the valve. Valve seats shall comply with AWWA Standard C-507, Section 8, Paragraph 7.2 and with AWWA Standard C-504, Section 9, Paragraph 9.4. Bearings shall comply with AWWA Standard C-507, Section 3, Paragraphs 8, 8.1, 8.3, and 8.4 and with AWWA Standard C-504, Section 10. Valve shaft seals shall be Buna and shall comply with AWWA Standard C-507, Section 10, and with AWWA C-504, Section 11. All valve seats shall beinstalled opposite to the normal direction of the flow. They shall be DeZurik Eccentric Plug Valves or equal.

J. Reduced Pressure Backflow Preventer

1. The reduced pressure backflow preventer, with two independently, manually operated check valves, shall be designed for installation either a horizontal or vertical flow installation. An independent relief valve shall be located between the two check valves. Valves and assembly shall be in compliance

with AWWA C511 and be as approved by the local and state plumbing codes.

2. Isolation gate valves, one on each end, complying with AWWA C500, shall be provided, all as part of a single assembly.

K. Emergency Shower and Eyewash Station

Install an emergency shower and eyewash station as shown on the drawings. The eyewash station shall be a Guardian Model G1902P or approved equal. The eyewash station shall have a 10" safety orange ABS plastic shower head, a 1" chrome plated brass stay open ball valve, two gentle spray eye wash outlet heads, 12" safety orange ABS plastic eye wash bowl, and ½" IPS chrome plated brass stay open eye wash valve. Install weather resistant sign reading "EMERGENCY EYEWASH FOUNTAIN" on the eyewash station behind valve handle as shown on the PLANS. Furnish and install all piping, fittings and valves necessary for complete installation of emergency shower and eyewash.

L. Wafer Butterfly Valves for Blower Service

1. Butterfly valves for the discharge of blowers shall have a cast iron body, ductile iron disc, stainless steel shaft, Buna N seat and be suitable for mounting between ANSI 125 pound standard flanges. The valves shall be lever operated with positive lever position locking arrangement. They shall be as manufactured by Allis-Chalmers Valve Division, DeZurik, or approved equal.

M. Small Valves

1. Unless otherwise shown on the PLANS, gate valves shall be bronze, single wedge disc, non-rising stem design for use in confined space. Gate valves shall be handwheel operated and designed to operate fully opened or fully closed. They shall have solder joints or screwed ends as required for the installation and be as manufactured by Crane, Lunkenheimer, or approved equal.

2. Check valves 2 inches and smaller shall be bronze body, composition disc, with screwed ends, similar to Crane No. 34-1/2, Lunkenheimer Figure 230-70, or approved equal.

3. Standard screwed end globe valves 2 inches and smaller shall be bronze valves with plug disc and shall be Crane No. 14-1/2 P, Lunkenheimer Figure 73-PS, or approved equal. Needle point globe valves ¾ inch and smaller shall be bronze valves similar to Crane No. 88, Jenkins, or approved equal.

PART 3: EXECUTION

3.01 INSTALLATION

A. All valves and appurtenances shall be installed in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Engineer before they are installed.

B. After installation, all valves and appurtenances shall be tested at the same duration and pressure as the piping system they are in. If any joint proves to be defective, it shall be repaired to the satisfaction of the Engineer.

C. Install all brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures which have a direct bearing on their location and he shall be responsible for the proper location of these valves and appurtenances during the construction of the structures.

D. All materials shall be carefully inspected for defects in workmanship; all debris and foreign material cleaned out of valve openings, etc.; all operating mechanisms shall be operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves and other equipment which do not operate easily, or are otherwise defective, shall be repaired or replaced at no additional cost to the OWNER.

3.02 SHOP PAINTING

A. Interior surfaces of all valves except the exterior surfaces of buried valves and miscellaneous piping appurtenances shall be given a shop finish of an asphalt varnish conforming to Federal Specification TT-V5le for Varnish Asphalt.

B. The exterior surface of various parts of valves, operators, floor stands and miscellaneous piping shall be thoroughly cleaned of all scale, dirt, grease or other foreign matter and thereafter one shop coat of an approved rust-inhibitive primer such as Inertol Primer No. 621 shall be applied in accordance with the instructions of the paint manufacturer.

C. Ferrous surfaces obviously not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating.

D. Field painting is specified under Division 9.

3.03 INSPECTION AND TESTING

A. The various pipe lines in which the valves and appurtenances are to be installed are specified to be field tested. During these tests any defective valve or appurtenance shall be adjusted, removed and replaced, or otherwise made acceptable to the Engineer.

END OF SECTION

Section-15250

Mechanical Insulation

SECTION 15250

MECHANICAL INSULATION

PART 1-GENERAL

1.01 SCOPE OF WORK

A. This Section includes pipe and duct insulation.

1.02 RELATED WORK SPECIFIED ELSEWHERE

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

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 15 Section HVAC Ductwork.
2. Sections 15010 General HVAC Requirements.

1.03 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1. Product data for each type of mechanical insulation identifying k-value, thickness, and accessories.
2. Identify insulation thickness and type used for each size of pipe or piece of equipment.

1.04 SEQUENCING AND SCHEDULING

A. Schedule insulation application after testing duct systems are completed.

PART 2-PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Glass Fiber:

a. CertainTeed Corporation.
b. Knauf Fiberglass GmbH.
c. Manville.
d. Owens-Corning Fiberglas Corporation.
e. USG Interiors, Inc. -Thermafiber Division.
f. Or equal.

2. Flexible Elastomeric Cellular:

a. Armstrong World Industries, Inc.
b. Halstead Industrial Products.
c. IMCOA.
d. Rubatex Corporation
e. Or equal

2.02 GLASS FIBER

A. Material: Inorganic glass fibers, bonded with a thermosetting resin.

B. Jacket: All-purpose, factory-applied, laminated glass-fiber-reinforced, flame-retardant

C. Board: ASTM C 612, Class 2, semi-rigid jacketed board.

1. Thermal Conductivity: 0.26 average maximum) at 75 deg F mean temperature.

2. Density: 12 psf average maximum.

D. Blanket: ASTM C 553, Type II, Class F-l , jacketed flexible blankets.

1. Thermal Conductivity: 0.32 average maximum, at 75 deg F mean temperature.

E. Preformed Pipe Insulation: ASTM C 547, Class 1) rigid pipe insulation, jacketed.

1. Thermal Conductivity: 0.26 average maximum at 75 deg F mean temperature.

2. Density: 10 psf average maximum.

F. Adhesive: Produced under the UL Classification and Follow-up service.

1. Type: Non-flammable, solvent-based.

2. Service Temperature Range: Minus 20 to 180 deg F .

G. Vapor Barrier Coating: Waterproof coating recommended by insulation manufacturer for outside service.

2.03 FLEXIBLE ELASTOMERIC CELLULAR

A. Material: Flexible expanded closed-cell structure with smooth skin on both sides.

1. Tubular Materials: ASTM C 534, Type I.

2. Sheet Materials: ASTM C 534, Type II.

B. Thermal Conductivity: 0.30 average maximum at 75 deg F .

C. Coating: Water based latex enamel coating recommended by insulation manufacturer.

2.04 ADHESIVES

A. Flexible Elastomeric Cellular Insulation Adhesive: Solvent-based, contact adhesive recommended by insulation manufacturer.

B. Lagging Adhesive: MIL-A-3316C, non-flammable adhesive in the following Classes and Grades:

1. Class 2, Grade A for bonding glass fiber insulation to metal surfaces.

2.05 JACKETS

A. General: ASTM C 921, Type 1, except as otherwise indicated.

B. Foil and Paper Jacket: Laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

1. Water Vapor Permeance: 0.02 perm maximum, when tested according to ASTM E 96.

2. Puncture Resistance: 50 beach units minimum, when tested according to ASTM D781.

2.06 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Woven glass fiber fabrics, plain weave, presized a minimum of 8 ounces per sq. yd.

1. Tape Width: 4 inches.
2. Cloth Standard: MIL-C-20079H, Type I.
3. Tape Standard: MIL-C-20079H, Type II.

B. Bands: 3/4-inch wide, in one of the following materials compatible with jacket:

1. Stainless Steel: Type 304, 0.020 inch thick.
2. Galvanized Steel: 0.005 inch thick.
3. Aluminum: 0.007 inch thick.
4. Brass: 0.01 inch thick.
5. Nickel-Copper Alloy: 0.005 inch thick.

C. Wire: 14-gage nickel copper alloy, 16-gage, soft-annealed stainless steel, or 16-gage, soft-annealed galvanized steel.

D. Corner Angles: 28-gage, l-inch by l-inch aluminum, adhered to 2-inch by 2-inch kraft paper.

E. Anchor Pins: Capable of supporting 20 pounds each. Provide anchor pins and speed washers of sizes and diameters as recommended by the manufacturer for insulation type and thickness.

2.07 SEALING COMPOUNDS

A. Vapor Barrier Compound: Water-based, fire-resistive composition.

1. Water Vapor Permeance: 0.08 perm maximum.
2. Temperature Range: Minus 20 to 180 deg F .

B. Weatherproofing Sealant: Flexible-elastomer-based, vapor-barrier sealant designed to seal
metal joints.

1. Water Vapor Permeance: 0.02 perm maximum.
2. Temperature Range: Minus 50 to 250 deg F .

3. Color: Aluminum.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean, dry , and remove foreign materials such as rust, scale, and dirt. B. Mix insulating cements with clean potable water. Mix insulating cements contacting
stainless-steel surfaces with demineralized water.

1. Follow cement manufacturer's printed instructions for mixing and portions.

3.02 INSTALLATION, GENERAL

A. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each mechanical system.

B. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.

C. Install vapor barriers on insulated pipes, ducts, and equipment having surface operating temperatures below 60 deg F.

D. Apply insulation material, accessories; and finishes according to the manufacturer's printed instructions.

E. Install insulation with smooth, straight, and even surfaces.

F. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier.

G. Seal penetrations for hangers, supports, anchors, and other projections in insulation
requiring a vapor barrier.

H. Seal Ends: Except for flexible elastomeric insulation, taper ends at 45 degree angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive.

I. Apply adhesives and coatings at manufacturer's recommended coverage-per-gallon rate.

J. Keep insulation materials dry during application and finishing.

K. Items Not Insulated: Unless otherwise indicated do not apply insulation to the following systems, materials, and equipment:

1. Metal ducts with duct liner.

2. Factory-insulated flexible ducts.

3. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.

4. Flexible connectors for ducts.

5. Vibration control devices.

6. Testing laboratory labels and stamps.

7. Nameplates and data plates.

8. Access panels and doors in air distribution systems.

3.03 PIPE INSULATION INSTALLATION, GENERAL

A. Tightly butt longitudinal seams and end joints. Bond with adhesive.

B. Stagger joints on double layers of insulation.

C. Apply insulation continuously over fittings, valves, and specialties, except as otherwise indicated.

D. Apply insulation with a minimum number of joints.

E. Roof Penetrations: Apply insulation for interior applications to a point even with the top of the roof flashing. Seal with vapor barrier coating. Apply insulation for exterior applications butted tightly to interior insulation ends. Extend metal jacket for exterior insulation outside roof flashing at least 2 inches below top of roof flashing. Seal metal jacket to roof flashing with vapor barrier coating.

F. Interior Walls and Partitions Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions. Apply an aluminum jacket with factory-applied moisture barrier over insulation. Extend 2 inches from both surfaces of wall or partition. Secure aluminum jacket with metal bands at both ends. Seal ends of jacket with vapor barrier coating. Seal around penetration with joint sealer.

G. Fire-Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire-rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with firestopping or fire-resistant joint sealer. Refer to Section 15305 for firestopping and fire-resistant joint sealers.

3.04 GLASS FIBER PIPE INSULATION INSTALLATION

A. Bond insulation to pipe with lagging adhesive.

B. Seal exposed ends with lagging adhesive.

C. Seal seams and joints with vapor barrier compound.

3.05 DUCT INSULATION

A. Blanket Insulation: Install tight and smooth. Secure to ducts having long sides or diameters as follows:

1. Smaller Than 24 Inches: Bonding adhesive applied in 6-inch-wide transverse strips on 12-inch centers.

2. 24 Inches and Larger: Anchor pins spaced 12 inches apart each way. Apply bonding adhesive to prevent sagging of the insulation.

3. Overlap joints 3 inches.

4. Seal joints, breaks, and punctures with vapor barrier compound.

3.06 JACKETS

A. Foil and Paper Jackets (FP): Install jackets drawn tight. Install lap or butt strips at joints with material same as jacket. Secure with adhesive. Install jackets with 1-1/2-inch laps at longitudinal joints and 3-inch-wide butt strips at end joints.

1. Seal openings, punctures, and breaks in vapor barrier jackets and exposed insulation with vapor barrier compound.

3.07 FINISHES

A. Paint finished insulation as specified in Division 9 Section "Painting."

B. Flexible Elastomeric Cellular Insulation: After adhesive has fully cured, apply 2 coats of protective coating to exposed insulation.

3.08 APPLICATIONS

A. General: Materials and thicknesses are specified in schedules at the end of this Section.

B. Interior, Exposed Piping Systems: Unless otherwise indicated, insulate the following piping systems:

1. Domestic cold water.

2. Domestic hot water.

3. Sanitary drains for fixtures accessible to the disabled.

C. Interior, Concealed Piping Systems: Unless otherwise indicated, insulate the following piping systems:

1. Domestic cold water.

2. Domestic hot water.

D. Equipment: Unless otherwise indicated, insulate the following indoor equipment:

1. Domestic cold water equipment, tanks, and pumps.

2. Domestic hot water equipment, tanks, and water heaters.

E. Duct Systems: Unless otherwise indicated, insulate the following duct systems:

1. Interior concealed supply, return and outside air ductwork.

2. Interior exposed supply outside air ductwork.

F. Items Not Insulated: Unless otherwise indicted do not apply insulation to the following systems, materials and equipment:

1. Flexible connectors for ducts and pipes.

2. Vibration control devices.

3. Testing laboratory labels and stamps.

4. Nameplates and data plates.

5. Sanitary drainage and vent piping.

6. Drainage piping located in crawl spaces, unless indicated otherwise.

7. Below grade piping.

8. Chrome-plated pipes and fittings.

9. Piping specialties including air chambers, unions, strainers, check valves, plug valves and flow regulators.

END OF SECTION

CONTRACT 1

ELECTRICAL SPECIFICATIONS

Section-16000

General Provisions

And Requirements

SECTION 16000

GENERAL PROVISIONS AND REQUIREMENTS

PART 1 - PERMITS, CODES, INSPECTIONS, APPROVALS, ETC.

1.1 The Contractor shall obtain all permits necessary and shall bear all costs involved.

1.2 All electrical work shall be performed in accordance with the requirements of the latest revision of the National Electrical Code (NFPA 70), National Electrical Safety Code, and Ky. Building Code. Similarly, all electrical equipment, where applicable, shall conform to all other NFPA Pamphlets, NEMA, ANSI, IPCBA and U.L. requirements. Whenever and wherever the design or State and local regulations require higher standards than the current National Electrical Code, then these shall be followed. Division 1 of the Architectural specifications shall apply to all electrical work.

1.3 The Architect/Engineer shall be notified twenty-four (24) hours in advance when any tests are to be made and before any work is concealed. The Contractor shall notify the Architect/Engineer when he is ready for final inspection.

1.4 The fronts of all electrical panels shall be removed for final punch list inspection.

1.5 All electrical items on this project shall bear the Underwriters Laboratories (UL) label and/or FM (Factory Mutual).

1.6 Provide electrical inspection by a licensed and recognized Electrical Inspector. Notify Electrical Inspector in writing, immediately upon start of work with a copy of notice to Architect. Schedule inspection for rough as well as finished work. Approval from Electrical Inspector will not be allowed as reason for deviation from Contract Documents. All costs incidental to Electrical Inspection shall be borne by Contractor. Prior to final acceptance of work and release of final payment, deliver to Architect the certificate of final inspection.

PART 2 - CLEANING AND PAINTING

2.1 The Contractor shall remove all temporary stickers, tags, etc. from all items installed under this Contract and shall thoroughly clean all equipment or materials installed under this Contract. Scratched and damaged paint and/or other finishes shall be touched up and/or repainted as required. All equipment shall be cleaned and made ready for painting by others.

2.2 Upon completion of the work, the Contractor shall thoroughly clean and lubricate all equipment.

2.3 Surplus material, rubbish and equipment resulting from the electrical work shall be removed from the building and premises by the Contractor upon completion of the work in accordance with the Architectural specifications.

2.4 All permanent nameplates on equipment shall be kept clean and exposed for easy reading. If field conditions warrant (in the opinion of the Architect) the Contractor shall vacuum clean all equipment and installed materials.

PART 3 - IDENTIFICATION OF ELECTRICAL EQUIPMENT

3.1 The equipment services, feeder and branch circuits shall be marked in accordance with the National Electrical Code. Mark with moisture and fungus resistant wire markers and nameplates. All conductors that are not color coded shall be marked with colored tapes to denote phases.

3.2 Identification of Motor Control Center (MCC) and Main Electric Panelboard (MEP) and branch circuit panelboards shall be labeled with a machine cut lamacoid plate with 1/4" high letters, indicating the panel designation, voltage and phase (i.e.: Panelboard "A" - 120/208V., 3-Phase, 4W). Branch panelboards in finished areas shall have plate installed inside of door.

3.3 All switches or breakers in main switchboard shall be labeled to indicate equipment served with ½" wide machine cut lamacoid plate with 1/8" high letters.

3.4 All remote disconnects, safety switches, motor starters, etc. shall have the name of the motor/equipment which it is controlling engraved on lamacoid plate, ½" wide with 1/8" high letters. Exact name of system or motor shall be coordinated with Architect/Engineer prior to manufacture.

3.5 Identify circuits contained in each box on exterior cover w/permanent marker.

3.6 Mark all conduit housing currents with greater than 300 volts phase to phase every 20'. ½" high letters to be used.

3.7 All lighting and power panels shall have each breaker (including spares and spaces) identified with typed directory cards covered in plastic.

PART 4 - SLEEVES, ESCUTCHEONS AND INSERTS

4.1 Sleeves shall be installed through masonry and concrete walls and floors for the passage of electrical raceways, cables, etc. Sleeves shall be placed and sized to permit installation and removal of the assembly. All electrical raceways larger than 1" shall be sleeved. Sleeves are not required where raceway bends into wall.

4.2 Cast iron sleeves shall be installed through all walls where conduit enters the building below grade. All other sleeves shall be standard weight steel. Sleeves shall be flush with each face of the wall. Sleeves for conduit through outside walls shall be packed with oakum for weatherproofing.

4.3 All sleeves through floors shall extend ¾" above finished floors. All sleeves shall be ½" larger than the outside diameter of the duct or conduit. All sleeves shall be equal to Schedule 20 pipe or heavier.

4.4 Escutcheon shall be installed around all openings in exposed finished area. This includes all raceways whether they are sleeved or not. Escutcheon shall be equal to Benton & Caldwell, No. 40.

4.5 Inserts shall be installed as required, with location coordinated with other Contractors.

PART 5 - CIRCUIT NUMBERS AND CIRCUITRY

5.1 Circuit numbers, and breaker numbers shall be coordinated on panel identification card as shown on the Drawings.

5.2 The exact routing of circuits as shown on the drawings from receptacle to receptacle, light to light, etc. is schematic only. If the Contractor desires to change the routing of any circuits, he may do so within the scope of good engineering practice, and with the permission of the Architect/Engineer. All outlets shall be on the same circuit number as shown on the Drawings. Any change in routing shall be shown on the "Record" Drawings. Contractor shall not run more than (3) circuits (one circuit per phase) in any conduit even if conductors are derated (1 neutral per run of conduit).

PART 6 - SPARE CIRCUITS

6.1 All spare breakers or switches shown in the Panelboard Schedule shall have conduits stubbed above ceiling and/or down below slab as described hereinafter.

A. Recessed Panels - All spare conduit shall be stubbed above ceiling. If area has no ceiling, spare conduit shall ell out 2" below slab above.

B. Surface Panels - Spare circuits shall have knockouts only in top of tub available for spare circuits.

6.2 Number of conduit required for spare circuits shall be figured at three (3) 115 volt circuits per ¾" conduit. Cap all spare conduits.

PART 7 - PROTECTION

7.1 All work, equipment and material shall be protected at all times. All conduit openings shall be closed with caps or plugs during construction. All equipment and accessories shall be tightly covered and protected against dirt, water or other injury during period of construction.

7.2 The Contractor shall cover all installed receptacles, switches, etc. with a plastic or equal cover prior to the painting of the areas. No device plate shall be installed prior to the finish painting. Any receptacle, switch, device plate, etc. with paint on it shall be removed and replaced by this Contractor. It shall be the Contractor's responsibility to coordinate with the Painting Contractor with regard to the scheduling of the installation of switches, outlets, device plates, etc.

PART 8 - TESTING AND ADJUSTING

8.1 When the work included is complete, the Contractor shall start up and adjust all parts of his system. All equipment items of the various systems shall be adjusted for proper operation within the framework of design intent, and the operating characteristics as published by the equipment manufacturer.

8.2 No equipment shall be operated for any purpose until properly lubricated and brought into service condition.

8.3 The Contractor shall provide all equipment, materials and labor required to make the necessary tests.

8.4 The Architect/Engineer reserves the right to require the services of an authorized representative of the manufacturer in the event the Contractor is unable to so adjust any piece of equipment. The Contractor shall arrange for such services and bear all incurred costs thereof. After completion of adjustments, the Contractor shall advise the Architect/Engineer that the work is ready for the final acceptance test.

8.5 Upon completion of the installation, the Contractor, at his expense, shall conduct complete performance tests in the presence of the Architect/Engineer and Owner to fully demonstrate the capacity and all other characteristics of the systems. The test shall be run for a length of time sufficient to demonstrate the ability of each system to perform as required by design drawings and specifications.

8.6 The Electrical Contractor shall perform the following tests:

A. All branch circuits of No. 8 wire and larger and main feeders shall be megged for ground and insulation resistance before connecting to equipment. (Megger to be 500 volts).

B. All motors larger than ½ HP shall be megged before conductors are connected thereto and again after they have gained running temperature.

C. A record of all megging shall be delivered to the Engineer before final acceptance. Architect/Engineer shall be notified in advance so that he may witness the test.

8.7 Refer to respective equipment sections for special tests such as Sound Systems, Fire Alarm, Television, etc.

PART 9 - CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS

9.1 The Architectural, Structural, Electrical, Plumbing, Heating, Ventilating and Air Conditioning Drawings and Specifications are complementary to one another.

A. The Contractor shall rough-in for and furnish all labor and materials necessary to make final connections to all equipment furnished by the Owner or any other Contractor or Sub-Contractor which requires electrical connections, including heating controls and all control and interlock wiring.

9.2 The Contractor making the required connections shall be responsible for any damages caused by erroneously connected equipment.

PART 10 - MOTORS AND APPARATUS BY OTHER TRADES

10.1 The Contractor shall obtain from the other trades all necessary information regarding motors, and wiring connections of apparatus furnished by these trades.

10.2 Furnish and install all necessary wiring and raceways required for satisfactory testing and operation of all controllers, starters, motors, control boards, alarm boards and related equipment, etc. The other trades supplying apparatus on which there are motors will supply and deliver to the Contractor at the sidewalk or building receiving quarters all control equipment specified under their section of the specifications for erection and connection of all such equipment in their designated places under this section of the specifications. (The equipment furnished by others is shown on the Motor Schedule).

10.3 The Contractor shall carefully examine the Architectural, Structural, Plumbing, Heating, Ventilating and Air Conditioning Drawings and Specifications to determine the extent, type and locations of all wiring required and shall obtain from the respective Contractors the wiring diagrams and other necessary information to properly install his part of the work.

10.4 Motor sizes shown on the Drawings are nominal sizes with some variation anticipated in the final installations. Under this section of the specifications, the Contractor is to coordinate the work with all other trades by obtaining all final data from each supplier and install wiring, circuit and motor protection and equipment in accordance with the actual equipment nameplate data regardless of sizes, etc. shown on the drawings. Undersized wiring, conduit, disconnects, etc. connected to equipment shall be the responsibility of the Contractor. Coordinate with the Engineer on any differences found between drawings and actual load data.

PART 11 - ELIMINATION OF NOISE AND VIBRATION

11.1 During the construction of this project, if any system or piece of equipment produces noise or vibration which, in the opinion of the Architect is objectionable to the Owner, the Contractor shall, at his own expense, make changes in equipment and do all work necessary to eliminate the objectionable noise or vibration.

PART 12 - GROUNDING OF SYSTEM

12.1 All metallic conduit, supports, cabinets and equipment shall be grounded in accordance with the latest issue of the National Electrical Code and as shown on the Drawings.

12.2 The size of the grounding conductor for service equipment shall not be less than that given in Article 250-94 and 250-95 of the National Electrical Code or as shown on the Drawings.

12.3 Ground bus and non-current carrying metallic parts of all equipment and conduit shall be securely grounded by connection to common ground bus insofar as possible or as shown. Jumper all noise or vibration isolators to insure ground potential.

12.4 The above ground bus shall not be less than #350 MCM copper or as per code with all connections made with pressure connectors.

12.5 No ground wires smaller than No. 12 solid copper shall be used; all wires larger than No. 8 shall be bare copper, stranded cable. All flexible conduit shall have a green insulated jumper bonded at each end.

12.6 The main ground electrode shall be a bare #350 MCM (or as shown on the drawings) copper conductor laid in bottom of footer trench. This electrode shall be as shown, but no less than

100' long and shall be thermal welded to building steel at each column it passes with both ends tied back to ground terminal in main gear. Ground resistance shall not exceed 5 ohm. (If ground electrode cannot be installed in bottom of footer trench, then the Contractor shall provide ground rods necessary, (minimum of six (6)), no less than 15' (center to center) to meet the ohmic value mentioned above).

12.7 The main water pipe shall be bonded to the service equipment enclosure, the grounded conductor at the service and the grounding electrode conductor in footer trench.

12.8 All connections to main ground conductors shall be thermal welded.

12.9 All raceways with ground lug bushings shall be grounded to their respective boxes with an approved jumper wire.

12.10 All EMT runs to receptacles, light fixtures, power outlets or any equipment shall have a code size insulated green ground wire connected to respective receptacle, light fixture outlet or equipment. All PVC (if allowed) shall have code sized ground wire.

PART 13 - SAMPLES

13.1 There will be no samples required by the Architect under this section of the specifications, unless a substitution is questioned. Any samples submitted may be subsequently installed on the project providing it is approved.

PART 14 - SHOP DRAWINGS

14.1 Submit Shop Drawings in bound sets on all items furnished under this Contract in sufficient number to satisfy the Architect's requirements. Shop Drawings should be submitted within 30 days after the work order to proceed. All shop drawings submitted for review shall bear an "approved stamp" and signed by the Contractor. All shop drawings not bearing the Contractor's "approved" stamp will be returned without comment.

PART 15 - CUTTING AND PATCHING

15.1 Any cutting and patching in the building required to install the equipment, etc. shown on Drawings shall be accomplished by the Contractor. He shall meet all requirements of the Architectural Section and at his expense.

15.2 The Contractor shall be responsible for all openings and chases he may require in floors, walls or ceilings of any type construction (whether under construction or existing). All work necessary as a result of failure on the part of the Contractor to provide the required openings and chases and to set sleeves and inserts shall be performed at his own expense. When shown, these openings and/or chases will be formed or provided for in the work of the General Contractor. However, the Contractor shall be responsible for cooperation with the General Contractor in locating and sizing such openings. Openings required and not shown on Drawings shall be brought to the attention of the General Contractor promptly and the Architect/Engineer for approval.

PART 16 - ACCESS DOOR

16.1 The Contractor shall refer to the Architectural Drawings to ascertain which rooms have removable ceilings. Where removable ceilings are specified, access to equipment may be obtained by removing the ceiling pieces. Where non-removable ceilings are specified, the Contractor shall furnish all required access doors for servicing disconnect switches, etc.

16.2 Access doors shall be equal to L.M. Walsh Company "Way-Loctor". No. 3 shall be used for concrete block or tile walls having no plaster finish and No. 2 shall be used for plastered walls and ceilings for acoustical tile ceilings. All doors shall be prime coated and key operated and keys shall be the same for plumbing and heating work. Doors by Miami or Milcor will be acceptable.

16.3 Installation of doors will be done by the General Contractor. However, the Contractor shall be responsible for the correct location of them for servicing equipment. These access doors shall be sized large enough to service the equipment with a minimum size of 20" X 20".

PART 17 - COORDINATION OF WALL OUTLETS

17.1 The Contractor shall plan his work in such a manner that wall outlets that are adjacent to each other or within a given area, shall be installed at the same height, and with a symmetrical appearance.

PART 18 - FOUNDATIONS AND ANCHOR BOLTS

18.1 The Contractor shall be responsible for the location of all concrete pads required for all equipment installed under this Contract. All pads required will be poured at the expense of the Contractor.

18.2 The Contractor shall furnish anchor bolts for all equipment installed on concrete slabs and/or bases. Bolts shall be placed in exact positions prior to pouring concrete. Sizes of bolts shall be determined by the manufacturer's recommendations for the equipment served.

PART 19 - OPERATING AND MAINTENANCE INSTRUCTIONS

19.1 Deliver to the Architect three (3) copies of shop drawings and all Operating and Maintenance Instructions for all equipment furnished and installed under this Contract, including parts lists for all new major equipment items. Each set shall be provided in a hard back binder with table of contents and divider for each section.

PART 20 - FIRESTOPPING

20.1 All openings required for conduit in walls, floors, ceilings, partitions, etc., where such construction is required for fire protection, shall be firestopped to preserve the fire rating of the construction. Firestopping shall be mineral wool or other non-combustible insulating material tightly placed and filling the space around such conduit. All materials used shall be approved for use as fire stop equal to 3M Fire Barrier. (Caulk CP-25, putty 303 and 7904 Barriers), or equal by Hilti (Caulk CS240, putty CB 120 Foam, CS2420 barrier material.

PART 21 - SUSPENDED CEILINGS

21.1 The Contractor shall insure that framing members of suspended ceiling systems used to support fixtures shall be securely fastened to each other and shall be securely attached to the building structure at necessary intervals (NEC).

21.2 If the above items are not covered, the Contractor shall immediately alert the Architect. Fixtures shall not be installed until all questions concerning the above are answered.

21.3 All recessed light fixtures shall be clipped to ceiling structure.

PART 22 - ELECTRICAL DRAWINGS AND SPECIFICATIONS

22.1 The drawings and specifications are intended to cover all work enumerated under the respective headings. The drawings are diagrammatic only as far as final location of raceways, equipment, etc. is concerned. Any item of work not clearly included, specified and/or shown, any errors or conflict between plans (Mechanical, Electrical, Architectural or Structural) specifications, codes and field conditions, shall be clarified by a written request to the Architect by the Bidder before bidding; otherwise, the bidder shall, at his own expense, supply the proper labor and materials to make good any damages or defects in his work caused by such error, omission or conflict.

22.2 Schematics, risers and details shown on the drawings are for the equipment specified. All revisions, modifications or changes in circuitry, accessories, etc. due to using equipment of a different manufacturer than specified hereinafter, shall be the responsibility of the Bidder and shall be made at no additional cost to the Owner. All modifications or changes shall be submitted to the Architect in writing and meet his approval before the equipment is released for shipment.

22.3 The Contractor shall be responsible for all revisions, modifications or changes necessary in the Structural, Architectural or Mechanical/Electrical systems to accommodate the equipment to be furnished under this section of the specifications. This shall be made at no additional cost to the Owner.

PART 23 - APPLICATION FOR PAYMENT

23.1 Line items and description of electrical work shall be as follows:

Item No.	Description of Work
1	Bond & Permits
2	Mobilization
3	Distribution Equipment
4	Lighting
5	Wiring Devices
6	Fire Alarm
7	Conduit & Boxes
8	Wiring
9	Excavation & B.F.
10	Electrical Inspection
11	Modular Wiring System (if used)

Section-16025

Scope of Work

SECTION 16025

SCOPE OF WORK

PART 1 - GENERAL

1.1 Except as otherwise hereinafter specified, the work under this Contract consists of furnishing all labor, materials, tools, elevating apparatus, transportation permits, certificates and equipment and performing all operations relevant to the installation of the Electrical Systems complete and working (unless otherwise noted) in strict accordance with this Specification and the applicable drawings, and all applicable codes, and subject to the terms and conditions of the Contracts. All systems shall be turned over to the Owner in a workable and usable condition.

PART 2 - WORK INCLUDED

2.1 Without restricting the generality of the foregoing, the work to be performed under this Contract shall consist of furnishing, installing and connecting the following items:

A. Power and Lighting Distribution.
B. Conduit, Fittings, Pull Boxes, Junction Boxes, Terminal Boxes.
C. Safety Switches as required by Code.
D. Wire and Cable installations and terminations.
E. Installation of Wiring of Starters, Switches and other electrical equipment furnished under other sections of these Specifications or Owner.
F. Lighting Fixtures and Lamps.
G. Motor Controls and Motor Control Center.
H. Grounding.
I. Connection to equipment furnished by others.
K. Voice/data system is rough-in only.
L. SCADA system.
M. Emergency Generator
N. Connection to WWTP equipment.
O. CCTV System.

END OF SECTION

Section-16050

Basic Materials and Methods

SECTION 16050

BASIC MATERIALS AND METHODS

PART 1 - RACEWAYS (CONDUIT, ETC.)

1.1 RIGID

A. Rigid, threaded steel conduit shall be used in concrete, underground in hazardous locations or where called for on the Drawings. All main feeders to panelboards to be rigid. All underslab branch circuits shall be rigid, (unless otherwise noted.) All wiring above 600V. shall be rigid, unless otherwise noted. In addition PVC coated rigid shall be used as shown on the drawings.

1.2 INTERMEDIATE

A. Intermediate grade conduit may be used in lieu of rigid.

1.3 ELECTRIC METALLIC TUBING (EMT)

A. Metallic tubing may be used where permitted by code, except for panel feeders or unless otherwise noted as rigid. No raceway smaller than ¾" will be permitted except for vertical drops to switch legs, or receptacles which may be ½".

1.4 PVC CONDUIT

A. Nonmetallic schedule 40 PVC rigid conduit conforming to ANSI, NEMA specifications with each length U.L. labeled may be installed under concrete floor slabs buried deep enough to allow for vertical code bends for branch circuits when the following conditions are adhered to:

1. Provide rigid steel conduit or IMC conduit where under-floor conduits penetrate the slab and above floor.

2. Install equipment grounding conductors as required by N.E.C. and size conduits for number of conductors installed.

3. P.V.C. conduit may also be used for telephone and television service entrance. (Encased in 3" concrete under roadways). Use long radius steel ells.

4. P.V.C. conduit may also be used for primary service (from service pole to transformer) (Encased in 3" concrete under roadways). Use long radius steel ells.

5. P.V.C. conduit shall not otherwise be allowed unless shown or noted on drawings.

1.5 All metallic conduit shall be electro-galvanized, sheradized, hot-dipped galvanized or metallized galvanized. Conduit shall be concealed, where possible, depending upon the structure of the building. All (exposed and concealed) runs of conduit shall have supports spaced not more than 8' apart and shall be installed with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings, with right angle turns

consisting of cast metal fittings or symmetrical bends as shown on the Drawings. Expansion fittings or other approved devices shall be used to provide for expansion and contraction where conduit crosses expansion joints. Jumper for ground continuity in all cases. Conduit shall be installed so as to insure against trouble from collection of trapped condensation.

1.6 Flexible conduit for motors shall be liquid tight single strip, neoprene covered, and shall be used from motor terminal boxes to outlet or conduit for vibration purposes. Lengths of this flexible conduit shall not exceed 24" and shall be installed in such a manner so as to isolate vibration from the conduit. Connectors, as manufactured by Efcor, Thomas and Betts or Appleton will be acceptable.

1.7 All conduit systems, except those otherwise specifically shown to the contrary, shall be concealed in the building construction or run above suspended ceiling.

1.8 Runs of conduit shall not have more than the equivalent of three (3) 90 degree bends. Junction boxes shall be installed in conduit runs exceeding 100', whether shown on Drawings or not. Length requirement does not apply to underground circuits to outside lights.

PART 2 - CABINETS, OUTLETS AND JUNCTION BOXES

2.1 CABINETS, JUNCTION AND PULL BOXES

A. Cabinets for lighting and power, telephone, clocks or any other purposes specified or shown on the Drawings shall be constructed of panelboard code gauge, galvanized steel with sides formed and corner seams riveted or welded before galvanizing. Boxes constructed with sheet metal screws or bolts will not be accepted.

B. Pull boxes shall include all boxes used to reduce the run of conduit to the required number of feet or bends for cables, supports, taps, troughs and other similar applications and shall also be constructed as specified above.

C. All cabinets and boxes shall be provided with knockouts as required by the manufacturer, or shall be cut in the field by approved cutting tools which will provide a clean symmetrically cut opening. Such boxes shall be provided with code gauge fronts which shall have hinged doors with ¼ turn fasteners.

2.2 OUTLET BOXES

A. Lighting fixture outlet boxes shall be galvanized steel, 4" octagonal, not less than 2-1/8" deep, with lugs or ears to secure covers and those for use with ceiling lighting fixtures shall be fitted with 3/8" fixture studs fastened to the back of the boxes, where applicable.

B. Outlet boxes for switches, receptacles, telephone, etc., installed in walls of glazed tile, brick or other masonry which will not be covered by wood wainscot or paneling shall be sized as per code in U.L. listed box and they shall be completely covered with plates or lighting fixtures. All exposed boxes shall be FS type. No box will be allowed with the ears on the outside. The Contractor shall cooperate with the brick layers and carpenters to insure that the outlet boxes are installed straight and flush in the walls. Jumbo plates will not be allowed.

C. Boxes for more than two devices shall be for number of devices required and shall be one piece. No ganging of single switch boxes will be allowed.

D. Outlets for use on this project shall have only the holes necessary to accommodate the conduits at the point of installation and shall be rigidly secured in position.

E. The location of fixtures, outlets and/or equipment, as shown on the drawings, shall be considered as approximate only. It shall be incumbent upon the Contractor to study the general building drawings, with relation to spaces surrounding each outlet, in order to coordinate this work with the work of others and in order that when the fixtures, outlets and/or equipment are installed, they will be symmetrically located and will not interfere with any other work or equipment. Any change in fixture layout shall be coordinated with the Architect before the change is made.

F. Refer to separate articles for any special outlet boxes, etc. required for individual equipment.

PART 3 - CONDUCTORS

3.1 All conductors on this project shall be copper. All circuits shall be sized as the load requires or as shown on the drawings. No conductor shall be less than #12 AWG. All conductors shall have THHN/THWN insulation. All conductors within fixture or equipment housing shall have temperature rating not less than recommended by fixture or equipment manufacturer. All wiring shall be installed in conduit unless otherwise noted.

3.2 Conductors No. 10 and smaller sizes of wire shall be solid. Conductors No. 8 and larger sizes of wire shall be stranded. The pulling of all wires and cable on this project shall be performed in strict compliance with Section 300 of the National Electrical Code. No conductor entering or leaving a cabinet or box shall be deflected in such a manner as to cause excess pressure on the conductor insulation. (See NEC).

3.3 All wire on this project shall be new, in good condition, and shall be delivered in standard coils. The color of the wire shall be selected to conform with the latest edition of the National Electrical Code with conductors phase color coded at each termination (red, blue and black). Neutral to be white and ground wire to be green. #12 and #10 wiring shall be supplied with colored insulation.

PART 4 - SUPPORTS AND HANGERS FOR CONDUIT AND FIXTURES

4.1 The Contractor shall be responsible for the support of all fixtures specified hereinafter. He shall not relocate them from the locations shown on the Drawings for the purpose of supporting them from existing angles, tee bars, bulb tees, etc.

4.2 Recessed fixtures supported from suspended ceiling framing members shall be securely fastened to the ceiling framing member as per N.E.C.

4.3 Raceways shall be run at least 6" from parallel flues, steam pipes, or hot water and refrigeration pipes. Raceways shall be supported each 8' unless special conditions require closer spacing. Individual horizontal runs of raceways shall be supported by Kindorf's C-144, C-147, C-149, C-247, C-248, C-249, HS-100, HS-400, HS-900, or equivalent as approved. Exposed runs shall be installed with runs parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings, and have all right angle turns

consisting of constant radius bend or threaded fittings. Where two or more conduits run parallel or where specified, they shall be supported by a rack, trapeze or framework constructed of B-900 series channel. Wherever hanger rods are used in conjunction with channel to form a trapeze, B-900 series channel with holes such as B-903, B-905-2A, B-905, B-907 and B-995 shall be used and, in all cases, rigid conduit shall be fastened to the channel with C-105 straps, E.M.T. and C-106 straps, and O.D. tubing with C-107 straps.

4.4 Copper or steel wire hangers will not be acceptable to support any item under this Contract.

4.5 Strap iron, properly installed, may be used for 1¼" conduit and smaller.

4.6 Where pipe supports and inserts have been specified by a particular manufacturer, pipe supports and inserts of equal quality and size, as manufactured by Elcen Metal Products or the Auto-Grip Division of Automatic Sprinkler Corporation will be acceptable.

PART 5 - SPECIALTIES

5.1 All EMT terminations at junction boxes, panels, etc. shall be made with locknuts, case hardened, and appropriate fittings as manufactured by Thomas and Betts, Efcor, or ETP. All rigid conduit shall have double locknuts.

5.2 All conduit, except main and branch feeders, shall have insulated metallic bushings equal to OZ Type B. All branch and main feeders #6 and larger and all raceways entering a box thru concentric knockouts shall have insulated bushings with grounding lugs equal to Type BL as manufactured by OZ. Jumper ground lugs to box. All rigid conduit fittings shall be threaded metal type, not set screw type.

5.3 All EMT terminations shall have insulated throat fittings equal to Thomas and Betts "Insulined" fittings.

5.4 All conduit stubbed through floor during construction shall have openings protected with plastic caps approved for this purpose. Connections on both ends of all flexible conduit shall be equal to Efcor.

5.5 All EMT fittings up to 2" shall be compression type, steel, malleable iron or equal. Pressure cast or die cast fittings will not be acceptable. 2½" and larger shall be set screw type, malleable or equal.

5.6 Dead spring type pressure connectors will not be acceptable on this project. All connections shall be made with insulated pressure type connectors (live spring) as manufactured by Thomas and Betts, (connectors with rigid body will not be acceptable). All connections on conductors No. 8 and larger shall be made with Burndy Type KS.

5.7 Items as manufactured by OZ, Gedney, Thomas and Betts, Midwest, Efcor or ETP will be considered equal.

END OF SECTION

Section-16140

Wiring Devices

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.1 The work under this section consists of furnishing and installing all materials, equipment and services necessary for the installation of all wiring devices shown on the drawings and herein specified.

1.2 All receptacles and switches, insofar as possible, shall be of one (1) manufacturer.

1.3 All receptacles and switch coverplates shall be stainless steel.

1.4 All receptacles shall be grounded type.

1.5 All outlets behind water coolers shall be concealed by water cooler when viewed from the front of the cooler. Refer to Shop Drawings furnished by Mechanical Contractor.

PART 2 - DUPLEX RECEPTACLES

2.1 Duplex receptacles shall be 20 amp, 120 volts, 2-pole, 3-wire, NEMA 5-20R configuration, unless otherwise shown. Receptacles shall have the following characteristics:

A. "T" Type contacts for phase and neutral female connection.

B. Female ground connection shall be riveted to the bridge.

C. The bridge shall be of hot dipped steel.

D. The receptacle body shall be of heat resistant thermoset material.

E. Rivet connecting the face plate to bridge shall be spun brass.

2.2 Duplex receptacles shall be 5352 Series equal to Hubbell, Arrow Hart, Bryant, P&S, or Leviton.

2.3 Weatherproof receptacles shall be the same as "B" above with Hubbell, #HBL5206-WO lift cover plate.

PART 3 - GROUND FAULT INTERRUPTER RECEPTACLES

3.1 Ground fault interrupter receptacle shall be duplex type suitable for mounting in a standard outlet box, rated 20 amps., 125 volts, 2-pole, 3-wire grounding type.

3.2 Device shall have a nominal sensitivity to ground leakage current of five milli-amperes and shall function to interrupt the current supply for any value of ground leakage current above five milli-amperes on the load side of the device. Device shall have a minimum nominal

tripping time of 1/30th. of a second. All receptacles within 6 foot of a sink shall be GFI type, as well as other locations shown on the drawings.

3.3 Device shall be equal to Hubbell, #GF-5352 or P&S 2091-S.

PART 4 - FLOOR RECEPTACLES

4.1 FLUSH FLOOR RECEPTACLES

A. Floor boxes on or below grade shall be P.V.C. type.
1. Concrete pours greater than 3" shall be Hubbell B4214 fully adjustable.

B. COVERS
1. Where indicated for flush mounting - use S3925 cover and Hubbell 5352 receptacle with proper box for tile floor.

2. For carpet - use S3925 cover + 5352 Hubbell receptacle with proper box and carpet flange S3182.

PART 5 - SWITCHES

5.1 All switches shall be rated 20 amps. for 120 and 277 volt lighting circuits and shall be specification grade, back and side wired, with automatic ground clip and one piece contact arm. Switches shall be single pole, three or four way, or furnished with pilot where shown on the drawings.

5.2 Switches shall be equal to Hubbell 1221 Series, Arrow Hart, 1990 Series, Bryant 4900 Series, P&S Series 20AC or Leviton Series 1220, or GE # 5951 Series.

5.3 Mullion Switch - shall be a P&S 20A., 120-277V. single pole (#2241-S) or three-way (#2243-S) with vertical despard opening plate (301 stainless steel) #SWK-4-IN and #347 bracket.

PART 6 - DEVICE PLATES

6.1 All outlet boxes shall have a cover plate.

6.2 All device plates shall be stainless steel.

6.3 All unused telephone outlets shall have a one-hole cover plate.

PART 7 - REQUIRED SUBMITTALS

7.1 Submit manufacturer's data on all wiring devices and cover plates.

END OF SECTION

Section-16195

Electrical Identification

SECTION 16195

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 General Provisions of Contract and other Special Conditions and General Requirements apply to this Section.

1.2 Requirements of Section 16000 Electrical General Provisions govern work specified in this section.

PART 2 - DESCRIPTION OF WORK

2.1 Provide labor, materials, equipment and accessories necessary to provide required identification of electrical equipment, boxes, panelboards, conduit, etc.

2.2 Equipment disconnect switches, motor starters, pushbutton stations, panels, switchgear, special device plates, and similar material shall be clearly marked.

PART 3 - QUALITY ASSURANCE

3.1 Comply with National Electrical Code (NFPA 70) as applicable to provision and installation of electrical identification.

PART 4 - EQUIPMENT

4.1 CONDUIT MARKERS: Conduit markers shall be self-adhesive vinyl tape, a minimum of 3 mils thick by 1.5" wide, and color-coded orange, unless otherwise noted on the Drawings.

4.2 UNDERGROUND PLASTIC LINE MARKER TAPE: Acid and alkali-resistant polyethylene film tape, 6" wide with minimum thickness of 0.004". Tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3' deep. Tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect corrosion. Tape color shall be as specified below and shall bear a continuous printed inscription describing the specific utility:

Red:	electric.
Orange:	telephone, data, television, security, and fire communications.

4.3 PLASTICIZED TAGS: Tags shall be pre-printed or partially pre-printed accident prevention and operational tags, on plasticized card stock with matte finish for writing, approximately 3¼" by 5-5/8", with brass grommets and wire fasteners, and appropriate wording.

4.4 EQUIPMENT IDENTIFICATION: Equipment identification shall consist of black core plastic laminate nameplates with white engraved lettering. Signs for individual devices shall

have ¼" high letters. Mark panelboards, switchboards, motor control centers, and equipment giving panel designation in ½" high letters and voltage in ¼" high letters..

PART 5 - INSTALLATION

5.1 Where identification is applied to surfaces which require a finish, identification shall be installed after surface has been finished.

5.2 CONDUIT MARKERS: Identify electrical conduit with color-coded conduit markers where exposed in spaces with exposed mechanical piping which is color-coded. 277/480V.- Orange, 120/208V.- Yellow, Emergency - Green, Fire Alarm - Red, Telephone/Data - Blue.

5.3 UNDERGROUND PLASTIC LINE MARKER TAPE: During backfilling, install marker tape continuously at 6" to 8" below finished grade, above all buried power, communications, or signal cables or conduits. Install multiple markers where cables are installed in groups exceeding 16" width.

5.4 OPERATIONAL IDENTIFICATION AND WARNINGS: Install signs for instruction or warnings on switches, outlets, controls, devices and covers of electrical enclosures.

5.5 DANGER SIGNS: Install in areas constituting a danger for persons in or about the Project. All doors, hinged bolted panels, and screen doors giving access to equipment high voltage compartments or bus work shall be provided with a "DANGER-HIGH VOLTAGE-KEEP OUT" sign.

5.6 EQUIPMENT IDENTIFICATION:. Install engraved signs at or on each circuit breaker, switch, motor controller, panelboard, switchboard, special apparatus, and communications and signal systems, unless equipment is specified herein with its own self-explanatory identification. Text shall match terminology and numbering of the contract documents and shop drawings as close as practicable. Signs shall not cause interference with operation and maintenance of equipment. Attach signs with rustproof screws.

5.7 Identification of main entrance panelboard, distribution panelboards and branch panelboards shall be labeled indicating the panel designation, voltage and phase. Branch panelboards in finished areas shall have plate installed inside of door.

5.8 All remote disconnects, safety switches, motor starters, etc. shall have the name of the motor/equipment which it is controlling. The identification numbers on all junction or terminal boxes in finished areas shall be inside of cover or door.

5.9 CIRCUIT IDENTIFICATION: Install type written directories in all branch circuit panelboards describing the load served by each circuit. Identify spaces and spares in pencil. If room numbers assigned by the Owner do not match those on the drawings both sets of numbers must be cross referenced and identified in the panel directory.

5.10 JUNCTION BOX IDENTIFICATION: Identify circuits contained in each junction box on exterior cover w/permanent marker.

END OF SECTION

Section-16400

Distribution Equipment

SECTION 16400

DISTRIBUTION EQUIPMENT

PART 1 - INCOMING SERVICE

1.1 Service to this building shall originate at the new pole mounted transformer as shown on utility site plan, and riser diagram. All secondary conduit, duct system, secondary cable, cable connectors, opening and closing of primary and secondary trenches, to be provided by this contractor. Contractor shall also provide primary conduit with pull string. Utility company will supply and install the primary conductors and transformer. Service to this building shall be 120/208V., 3 Phase, 4W. 60 Hz. Contractor shall backfeed the existing electrical service at the existing building.

PART 2 – MOTOR CONTROL CENTER (MCC)

2.1 Furnish and install with a UL service entrance label where required. The MCC shall be free standing in a NEMA 3R enclosure. The panelboard bussing is to be tin plated copper. The panelboard, as a complete unit, shall have a short circuit rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or drawing. Provide starters for motors as shown.

PART 3 – BRANCH PANELS

3.1 Furnish and install circuit breaker panelboards as indicated in the panelboard schedule and where shown on the plans. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or drawings. The panelboard is to be 20"W x 5-3/4"D and shall be listed by UL. Panels shall be separate neutral and ground bus with lockable door. Panelboards shall be equal to Square D type NEHB, General Electric type NHB or Siemens.

PART 4 - BRANCH PANELS (120/208V)

4.1 Furnish and install circuit breaker panelboards as indicated in the panelboard schedule and where shown on the plans. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or drawings. The panelboard is to be 20"W x 5¾"D and shall be listed by UL. Panelboards shall be Square D type NQOD or equal.

PART 5 - BREAKERS

5.1 Breakers for branch panels shall be molded case bolt-in type. Single pole breakers in branch panels shall have an interrupting capacity of not less than 10,000 amp. symmetrical at 208/120V. unless otherwise noted on plans. Tandem breakers will not be allowed.

5.2 Breakers used for switching of lights shall be rated for switch duty and so noted.

PART 6 - DISCONNECT SWITCHES (NOT IN MAIN SWITCHGEAR)

6.1 Provide disconnect switches where indicated on drawings or where required by Code although not indicated on Drawings.

6.2 Disconnect switches shall be fused or unfused as required by Code as indicated on the Drawings or as specified. They shall be housed in an enclosure suitable for the location in which they are installed. For instance, all outdoor units shall be NEMA 3R.

6.3 All fusible switches shall be heavy duty. All unfused switches shall be general duty.

PART 7 - LOW VOLTAGE FUSE

7.1 Fuses 600 volts and less. Fuses shall not be shipped in switches in electrical equipment nor shall they be shipped to the job until the equipment is ready to be energized. All fuses shall be of the same manufacture to retain selectivity as designed. All fuses shall be installed by an Electrical Contractor.

A. All fuses shall be current limiting with 200,000 amperes interrupting capacity.

B. U.L., Inc. Class L fuses (bolt-type dimensions 601 to 6000 amps) shall have minimum time delay of 10 seconds at current of 5 times rating and shall have O-ring gas seals at the end bells and silver links. Bussmann KRP-C HI-CAP Time-Delay Fuse or Littelfuse KLP-C Time-Delay Fuse.

C. U.L., Inc. Class RK1 fuses (standard dimensions 600 amperes or less) shall be installed in the switches serving circuit breaker panels unless otherwise noted. Bussmann LPN-RK or LPS-RK LOW PEAK Dual-Element Fuses or Littelfuse LLN-RK or LLS-RK LittelPeak Dual-Element Fuses.

D. U.L., Inc. Class RK1 fuses (standard dimensions 600 amperes or less) shall be installed in all other switches and shall be dual-element, time-delay type with a spring actuated thermal overload element that operates at 284°F. temperature. Bussmann LPN-RK or LPS-RK LOW PEAK Dual-Element Fuse or Littelfuse LLN-RK or LLS-RK LittelPeak Dual-Element Fuses.

E. Motor protection dual-element fuses installed in individual circuits shall be sized at 125% of motor nameplate current rating or the next standard fuse size. Where excessive ambient temperature, high inertia motor loads or frequent "On-Off" cycling requires larger fuses, consult the Electrical Designer. Use fuse reducers where fuse gaps are larger than fuse dimension. Bussmann LPN-RK or LPS-RK LOW PEAK Dual-Element Fuse or Littelfuse LLN-RK or LLS-RK Littelpeak Dual-Element Fuse.

F. Ten percent spare fuses or a minimum of three of each size and type shall be placed in a spare fuse cabinet wall mounted near the electric service. Mount a spare fuse cabinet similar to the "Bussmann Spare Fuse Cabinet", Catalog No. SFC or "Littelfuse Spare Fuse Cabinet" Catalog # LSFC.

G. Lighting Fixture Fuse Protection.
   1. Fluorescent fixtures (1 Fuse/Fixture) shall be protected with Littelfuse LGR Fuse (LHR Holder) Type GLR fuses (HLR holders) installed at the fixture in addition to any internal ballast thermal protection. Size the fuse according to manufacturers recommendations.

2. Other lighting fixtures, H.I.D. fixture ballasts, etc. shall be protected individually with KTK (Littelfuse KLK fuses) fuses, mounted in HEB Series fuse holders. Size the fuse according to manufacturers recommendations.

PART 8 - REQUIRED SUBMITTALS

8.1 Submit manufacturer's data on all panelboards and disconnect switches.

END OF SECTION

Section-16425

Surge Suppression

SECTION 16425

SURGE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. These specifications describe the electrical and mechanical requirements for a hybrid high-energy suppression filter system that integrates transient voltage surge suppression (TVSS) with high-frequency electrical line noise filtering for high exposure applications.

B. The specified unit shall provide effective high energy transient voltage suppression, surge current diversion, high frequency attenuation and line control for all electrical modes of equipment connected downstream from the facility's meter or main overcurrent device in high exposure ANSI/IEEE C62.41-1991 environments. The unit shall be connected in parallel with the facility's wiring system.

C. The unit shall be designed and manufactured in the USA by a qualified manufacturer of suppression filter system equipment. The qualified manufacturer shall have been engaged in the commercial design and manufacture of such products for a minimum of five (5) years.

D. These specifications are based on Sine Control Technology Inc. "PowerClamp" TVSS Series. For consideration, other manufacturers shall provide detailed compliance or exception statements to all provisions of this specification fourteen (14) days prior to bid.

1.2 STANDARDS

A. The specified unit shall be designed, manufactured, tested, and installed in compliance with the following standards:

1. American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.41-1991 and C62. 45-1987);

2. Canadian Standards Association (CSA);

3. Federal Information Processing Standards Publication 94 (FIPS PUB 94);

4. National Electrical Manufacturers Association (NEMA);

5. National Fire Protection Association (NFPA 70 [NEC], 75, AND 78);

6. Underwriters Laboratories (UL 1449).

B. The unit shall be UL 1449 Listed and CSA Approved as a Transient Voltage Surge Suppressor and UL 1283 Listed as an Electromagnetic Interference Filter.

1.3 ENVIRONMENTAL REQUIREMENTS

A. Storage Temperature. Storage temperature range shall be -40 to +85 C (-40 to + 185F).

B. Operating Temperature. Operating temperature range shall be -40 to +60C (-40 to +140F).

C. Relative Humidity. Operation shall be reliable in an environment with 5% to 95% non-condensing relative humidity.

D. Operating Altitude. The unit shall be capable of operation in altitudes up to 13,000 feet above sea level.

E. Audible Noise. The unit shall not generate any audible noise.

F. Magnetic Fields. No appreciable magnetic fields shall be generated. Unit shall be capable of use directly in computer rooms in any location without danger to data storage systems or devices.

1.4 Electrical Requirements

A. Unit Operating Voltage. The nominal unit operating voltage at configuration shall be as indicated on the drawings.

MODEL NUMBER	VOLTAGE	POLES	CONFIGURATION
4827VF4-8	277/480	3	Grounded Wye; 4 Wire + ground
1208VF4-6	120/208	3	Grounded Wye; 4 Wire+ ground

B. Maximum Continuous Operating Voltage (MCOV). The maximum continuous operating voltage (MCOV) of all suppression components utilized in the unit shall not be less than 125% of the facility's nominal operating voltage for 120 volt nominal systems and not less than 115% of the facility's nominal operating voltage for 208 and 480 volt nominal systems.

C. Operating Frequency. The operating frequency range of the unit shall be 47 to 63 Hertz.

D. Protection Modes. In accordance with NEMA Standard LS 1-1992, the unit shall provide protection in all modes. For a wye-configured system the primary mode of protection shall be line-to-neutral, the secondary modes of protection shall be line-to-ground and neutral-to-ground. For a delta-configured system the primary mode of protection shall be line-to-line and the secondary mode shall be line-to-ground, if the system is grounded.

E. Tested Single-Pulse Surge Current Capacity. Based on ANSI/IEEE C62.41-1991's standard 8x20 microsecond current waveform, and in accordance with NEMA Publication No. LS 1-1992, the tested single-pulse surge current capacity, in amps, of the unit shall be no less than as follows:

MODE OF PROTECTION	L-L	L-N	L-G	N-G

Tested Single-Pulse Surge Current Capacity	150,000	150,000	150,000	150,000

F. Unit Performance Ratings. The unit's published performance ratings shall be the UL 1449 Listed suppression ratings. The UL 1449 suppression rating for all units shall be, for each mode of protection, as follows:

Category A waveform (6kV, 200 amps, 0.5us, 100kHz): TWO (2) VOLTS of the peak of the sine wave. Measured from the baseline at the 90° point of the power sine wave (@ WAVEFORM PEAK).

Category B ringwave (6kV, 500 amps, 0.5us, 100kHz): TEN (10) VOLTS of the peak of the sine wave. Measured from the baseline at the 90° point of the power sine wave (@ WAVEFORM PEAK).

Category B impulse (6kV, 1.2/50us, 3,000 amps): THIRTY (30) VOLTS of the peak of the sine wave. Measured from the baseline at the 90° point of the power sine wave (@ POSITIVE WAVEFORM PEAK).

Category C Impulse (20kV, 1.2/50us, 10,000 amps): TWO HUNDRED TWENTY (220) VOLTS of the peak of the sine wave. Measured from the baseline at the 90° point of the power sine wave (@ WAVEFORM PEAK).

PART 2 PRODUCTS

2.1 MAIN ENTRANCE AND SUBPANEL TVSS UNITS:

A. High-Performance Suppression System. The unit shall include an engineered solid-state high-performance suppression system, utilizing either selenium cells or metal oxide varistors with similar operating characteristics, or both.

1. The suppression systems' components shall optimally share surge currents in a seamless, low-stress manner assuring maximum performance. The suppression system shall not utilize gas tubes, spark gaps, silicon avalanche diodes or other components which might short or crowbar the line, thus leading to interruption of normal power to or system upset of connected loads. The suppression system shall not incorporate non-field replaceable fusing or any other components which may degrade performance or reliability of the suppression system.

B. High-Frequency Extended Range Tracking Filter. The unit shall include a high-frequency extended range tracking filter and shall be UL 1283 Listed as an Electromagnetic Interference Filter. The filter shall reduce fast rise-time, high frequency, error-producing transients and electrical line noise to harmless levels, thus eliminating disturbances which may lead to system upset. The filter shall provide minimum noise attenuation as follows:

Attenuation Frequency	100 kHz	1 MHz	10 MHz	100 MHz
Insertion Loss (ratio)	50-1	350-1	500-1	250-1
Insertion Loss (dB)	34	51	54	48

Note: Standardized insertion loss data obtained utilizing MIL-STD-E220A 50 ohm insertion loss methodology.

The TVSS device shall function in coordination with other suppression-filter devices within the facility-wide suppression-filter system to provide minimum noise attenuation as follows:

Attenuation Frequency	100 kHz	1 MHz	10 MHz	100 MHz
Insertion Loss (ratio)	355-1	50,000-1	500,000-1	1,000,000,-1
Insertion Loss (dB)	51	94	114	120

Note: Standardized insertion loss data obtained utilizing MIL-STD-E220A 50 ohm insertion loss methodology.

C. Internal Connections. All internal wiring associated with the suppression filter system and subject to surge currents shall utilize low-impedance circuitry. copper bus bar and/or #2 AWG copper conductor or larger

D. Field Connections. The unit shall include mechanical lugs for each phase, neutral and ground, if applicable. The lugs shall accommodate up to #4 AWG copper conductor.

E. Field Installation. The unit shall be installed as close as practical to the facility's wiring system in accordance with applicable national/local electrical codes and the manufacturer's recommended installation instructions. Connection shall be with #8 AWG copper conductor and not be any longer than necessary, avoiding unnecessary bends.

F. Unit Status Indicators. The unit shall include solid-state, long-life, externally mounted LED visual status indicators that monitor the fuse status of each phase of the unit.

G. Enclosure. Standard surface-mounted units shall be provided in a NEMA 1 type enclosure of 14 gauge steel, painted inside and out with Sherwin Williams Polane T or equal paint.

H. Circuit breaker. The unit shall be connected to the applicable circuit breaker panel via a standard circuit breaker rated at 15 amps or higher. The unit shall be UL 1449 Listed and the UL 1449 Suppression Rating for this configuration shall be provided. (1.4.6 Performance Ratings).

PART 3 - DOCUMENTATION AND TESTING

3.1 Equipment Manual. The manufacturer shall furnish an equipment manual with installation, operation, and maintenance instructions for the specified unit.

3.2 Drawings. Electrical and mechanical drawings shall be provided by the manufacturer which show unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.

3.3 UL 1449 Suppression Ratings. Documentation of unit's UL 1449 suppression rating shall be included as required product data submittal information. Manufacturer shall make available upon request certified documentation of applicable Location Category Testing in full compliance with ANSI/IEEE C62.41-1991 and ANSI/IEEE C62.45-1987 Guidelines.

3.4 Spare Parts. A list of customer-replaceable spare parts shall be included in the unit's installation, operation and maintenance instructions. All spare parts shall be quickly and easily field-replaceable.

3.5 Life Expectancy Testing. The unit shall be life-cycle tested to protect against and survive at least 2,500 ANSI/IEEE C62.41-1991 Category C3 surges without failing or degrading the UL 1449 Surge Suppression Rating by more than 10%. The EGP, when installed as part of a facility-wide suppression-filter system, shall be tested and capable of protecting against and surviving at least 6,000 ANSI/IEEE C62.41-1991 Category C3 surges without failing or degrading the UL 1449 Surge Suppression Rating by more than 5%.

3.6 MCOV Testing. The unit shall be factory-tested and burned-in at the applicable MCOV for a minimum of one (1) hour.

3.7 Warranty. The manufacturer shall provide a pro-rated five-year warranty from date of shipment against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's Installation, Operation and Maintenance Instructions.

3.8 Quality Assurance. The unit shall be thoroughly factory-tested before shipment. Testing of each unit shall include but shall not be limited to UL manufacturing and production-line tests, quality assurance checks, MCOV and clamping voltage verification tests.

PART 4 APPROVED VENDORS

4.1 Sine Control Technology, Inc., or approved equal capable of meeting or exceeding the Clamping Level performance (also called "Let-through Voltage") as listed in Part 1, paragraph 1.4, Sections E and F.

PART 5 REQUIRED SUBMITTALS

5.1 Submit manufacturer's data on surge suppression system and all its components.

END OF SECTION

Section-16482

Motor Control Centers

SECTION 16482

MOTOR-CONTROL CENTERS

GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes motor-control centers for use on ac circuits rated 600 V and less.

B. Related Sections include the following:

1. Division 16 Section "Basic Electrical Materials and Methods" for general materials and installation methods.
2. Division 16 Section "Electrical Identification" for labeling materials.

1.3 SUBMITTALS

A. Product Data: For products specified in this Section. Include dimensions, ratings, and data on features and components.

B. Shop Drawings: For each motor-control center specified in this Section. Include dimensioned plans, elevations, and component lists. Show ratings, including short-time and short-circuit ratings, and horizontal and vertical bus ampacities.

1. Schedule of features, characteristics, ratings, and factory settings of individual motor-control center units.
2. Wiring Diagrams: Interconnecting wiring diagrams pertinent to class and type specified for motor-control center. Schematic diagram of each type of controller unit indicated.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

D. Maintenance Data: For products to include in the maintenance manuals specified in Division 1.

E. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

F. Qualification Data for Field Testing Agency: Certificates, signed by Contractor, certifying that agency complies with requirements specified in "Quality Assurance" Article below.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain, within 100 miles (160 km) of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.

B. Field Testing Agency Qualifications: An independent testing agency with experience and capability to satisfactorily conduct testing indicated without delaying the Work. Evaluation criteria shall be according to ASTM E 699.

C. Source Limitations: Obtain similar motor-control devices through one source from a single manufacturer.

D. Comply with NFPA 70.

E. Listing and Labeling: Provide motor-control centers and components specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

F. Product Selection for Restricted Space: Drawings indicate maximum dimensions for motor-control centers, including clearances between motor-control centers and adjacent surfaces and items, and are based on types and models indicated. Other manufacturers' motor-control centers with equal performance characteristics and complying with indicated maximum dimensions may be considered. Refer to Division 1 Section "Substitutions."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver in shipping splits of lengths that can be moved past obstructions in delivery path as indicated.

B. Store so condensation will not occur on or in motor-control centers. Provide temporary heaters as required to prevent condensation.

C. Handle motor-control centers according to NEMA ICS 2.3, "Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers." Use factory-installed lifting provisions.

1.6 COORDINATION

A. Coordinate features of controllers and accessory devices with pilot devices and control circuits to which they connect.

B. Coordinate features, accessories, and functions of each motor controller with the ratings and characteristics of the supply circuit, the motor, the required control sequence, and the duty cycle of the motor and load.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Spare Indicating Lights: Furnish 6 of each type required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Allen-Bradley Co.; Industrial Control Group.
2. Danfoss Inc.; Danfoss Electronic Drives Div.
3. Eaton Corp.; Westinghouse & Cutler-Hammer Products.
4. General Electric Co.; Electrical Distribution & Control Div.
5. Siemens Energy & Automation, Inc.
6. Square D Co.

2.2 MOTOR-CONTROL CENTERS

A. Enclosures: Flush- or surface-mounted cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to meet environmental conditions at installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Compartments: Modular; individual doors have concealed hinges and quick-captive screw fasteners. Interlocks on combination controller units require disconnect means in off position before door can be opened or closed, except by consciously operating a permissive release device.
3. Interchangeability: Compartments are constructed to remove units without opening adjacent doors, disconnecting adjacent compartments, or disturbing the operation of other units in control center. Units requiring the same size compartment are interchangeable, and compartments are constructed to permit ready rearrangement of units, such as replacing 3 single units with a unit requiring 3 spaces, without cutting or welding.
4. Wiring Spaces: Each vertical section of structure with horizontal and vertical wiring has spaces for wiring to each unit compartment in each section, with supports holding wiring in place.

B. Short-Circuit Current Rating for Each Section: Equal to or greater than indicated available fault current in symmetrical amperes at motor-control center location.

2.3 BUSES

A. Material: Plated copper.

B. Ampacity Ratings: As indicated for horizontal and vertical main buses.

C. Neutral Buses: Full size.

D. Equipment Ground Bus: Noninsulated, horizontal copper bus 2 by 1/4 inch (50 by 6 mm), minimum.

E. Horizontal Bus Arrangement: Main phase, neutral and ground buses extended with same capacity the entire length of motor-control center, with provision for future extension at both ends by bolt holes and captive bus splice sections or approved equivalent.

F. Short-Circuit Withstand Rating: Same as short-circuit current rating of section.

2.4 FUNCTIONAL FEATURES

A. Description: Modular arrangement of motor controllers, control devices, overcurrent protective devices, transformers, panelboards, instruments, indicating panels, blank panels, and other items mounted in compartments of motor-control center as indicated.

B. Motor-Controller Units: Combination controller units of types and with features, ratings, and circuit assignments indicated.

1. Units with full-voltage, across-the-line, magnetic controllers up to and including Size 3 are installed on drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
2. Units have short-circuit current ratings equal to or greater than short-circuit current rating of motor-control center section.
3. Units in motor-control centers with Type B and C wiring are equipped with pull-apart terminal strips or drawout terminal boards for external control connections.

C. Overcurrent Protective Devices: Types of devices with features, ratings, and circuit assignments indicated. Individual feeder-tap units through 225-A rating shall be installed on drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.

D. Transient Voltage Surge Suppressors: Connected to motor-control center bus.

E. Spaces and Blank Units: Compartments fully bused and equipped with guide rails or equivalent, ready for insertion of drawout units.

F. Spare Units: Type, sizes, and ratings as indicated, and installed in compartments indicated "spare."

2.5 MAGNETIC MOTOR CONTROLLERS

A. Description: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated.

B. Control Circuit: 120 V; obtained from integral control power transformer, unless otherwise indicated. Include a control power transformer with adequate capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.

C. Combination Controller: Factory-assembled combination controller and disconnect switch with or without overcurrent protection as indicated.

1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses indicated. Select and size fuses to provide Type 2

protection according to IEC 947-4-1, as certified by a Nationally Recognized Testing Laboratory.

2. Nonfusible Disconnect: NEMA KS 1, heavy-duty, nonfusible switch.
3. Circuit-Breaker Disconnect: NEMA AB 1, motor-circuit protector with field-adjustable short-circuit trip coordinated with motor locked-rotor amperes.

D. Overload Relay: Ambient-compensated type with inverse-time-current characteristic. Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect, and with appropriate adjustment for duty cycle.

E. Multispeed-Motor Controller: Match controller to motor type, application, and number of speeds; include the following accessories:

1. Compelling relay ensures motor will start only at low speed.
2. Accelerating relay ensures properly timed acceleration through speeds lower than that selected.
3. Decelerating relay ensures automatically timed deceleration through each speed.

F. Star-Delta Controller: NEMA ICS 2, closed transition with adjustable time delay.

G. Part-Winding Controller: NEMA ICS 2, closed transition with separate overload relays for starting and running sequences.

H. Autotransformer Reduced-Voltage Controller: NEMA ICS 2, closed transition.

I. Solid-State, Reduced-Voltage Controller: NEMA ICS 2, suitable for use with NEMA MG 1, Design B, polyphase, medium induction motors.

1. Adjustable acceleration rate control uses voltage or current ramp, and adjustable starting torque control has up to 500 percent current limitation for 20 seconds.
2. Surge suppressor in solid-state power circuits provides 3-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
3. LED indicators show motor and control status, including the following conditions:

a. Control power available.
b. Controller on.
c. Overload trip.
d. Loss of phase.
e. Shorted silicon-controlled rectifier.

4. Automatic voltage-reduction controls to reduce voltage when motor is running at light load.
5. Motor running contactor operates automatically when full voltage is applied to motor.

2.6 VARIABLE-FREQUENCY CONTROLLERS

A. Description: NEMA ICS 2, variable-frequency controller, listed and labeled as a complete unit and arranged to provide variable speed of a standard NEMA MG 1, Design B, 3-phase, induction motor by adjusting output voltage and frequency.

B. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

C. Isolation Transformer: Match transformer voltage ratings and capacity to system and motor voltages; and controller, motor, drive, and load characteristics.

D. Output Rating: 3-phase, 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.

E. Starting Torque: 100 percent of rated torque or as indicated.

F. Speed Regulation: Plus or minus one percent.

G. Ambient Temperature: 0 to 40 deg C.

H. Efficiency: 95 percent minimum at full load and 60 Hz.

I. Isolated control interface allows controller to follow 1 of the following over an 11:1 speed range:

1. Electrical Signal: 4 to 20 mA at 24 V.
2. Pneumatic Signal: 3 to 15 psig (20 to 100 kPa).

J. Internal Adjustability: Include the following internal adjustment capabilities:

1. Minimum Speed: 5 to 25 percent of maximum rpm.
2. Maximum Speed: 80 to 100 percent of maximum rpm.
3. Acceleration: 2 to 22 seconds.
4. Deceleration: 2 to 22 seconds.
5. Current Limit: 50 to 110 percent of maximum rating.

K. Multiple-Motor Capability: Controller suitable for service to multiple motors and furnished with a separate overload relay and protection for each controlled motor. Shut off the controller and motors served by it when an overload relay is tripped.

L. Self-protection and reliability features include the following:

1. Input transient protection by means of surge suppressors.
2. Snubber networks to protect against malfunction due to system voltage transients.
3. Motor Overload Relay: Adjustable and capable of NEMA 250, Class 10 performance.
4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
5. Instantaneous overcurrent trip.
6. Loss of phase protection.
7. Reverse phase protection.
8. Under- and overvoltage trips.
9. Overtemperature trip.
10. Short-circuit protection.

M. Automatic Reset/Restart: Attempt 3 restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Restarting during deceleration will not damage controller, motor, or load.

N. Power-Interruption Protection: Prevents motor from reenergizing after a power interruption until motor has stopped.

O. Status Lights: Door-mounted LED indicators to indicate the following conditions:

1. Power on.
2. Run.
3. Overvoltage.
4. Line fault.
5. Overcurrent.
6. External fault.

P. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.

Q. Indicating Devices: Meters or digital readout devices and selector switch, mounted flush in controller door and connected to indicate controller output current, voltage, and frequency.

R. Manual Bypass: Magnetic contactor arranged to safely transfer motor between controller output and bypass controller circuit when motor is at zero speed. Controller-off-bypass selector switch indicator lights set and indicate mode selection.

S. Integral disconnect.

T. Bypass Controller: NEMA ICS 2, full-voltage, nonreversing motor controller, provides across-the-line starting capability in manual bypass mode. Provide motor overload protection under both modes of operation with control logic that allows common start-stop capability in either mode.

U. Isolating Switch: Non-load-break switch arranged to isolate variable-frequency controller and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode.

V. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.

2.7 FEEDER OVERCURRENT PROTECTION

A. Molded-Case Circuit Breaker: NEMA AB 1, handle lockable.

1. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting capacity rating to meet available fault current.
2. Application Listing: Appropriate for application, including Type HACR for heating, air-conditioning, and refrigeration equipment.
3. Circuit Breakers, 200 A and Larger: Trip units interchangeable within frame size.
4. Circuit Breakers, 400 A and Larger: Field-adjustable, short-time and continuous-current settings.
5. Current-Limiting Trips: Where indicated, let-through ratings less than NEMA FU 1, Class RK-5.
6. Current Limiters: Where indicated, integral fuse listed for circuit breaker.
7. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.
8. Shunt Trip: Where indicated.

B. Fusible Switch: NEMA KS 1, Type HD, clips to accommodate specified fuses, handle lockable.

2.8 ACCESSORIES

A. Devices are factory installed in controller enclosure, unless otherwise indicated.

B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.

C. Stop and Lockout Push-Button Station: Momentary-break push-button station with a factory-applied hasp arranged so a padlock can be used to lock push button in depressed position with control circuit open.

D. Control Relays: Auxiliary and adjustable time-delay relays.

E. Elapsed Time Meters: Heavy duty with digital readout in hours.

F. Meters: Panel type, 2-1/2-inch (60-mm) minimum size with 90- or 120-degree scale and plus or minus 2 percent accuracy. Where indicated, provide transfer device with an off position. Meters indicate the following:

1. Ammeter: To indicate output current, with current sensors rated to suit application.
2. Voltmeter: To indicate output voltage.
3. Frequency Meter: To indicate output frequency.

G. Phase-Failure and Undervoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable undervoltage setting.

H. Current-Sensing, Phase-Failure Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage. Provide adjustable response delay.

I. Transient Voltage Surge Suppressors: IEEE C62.41, selected to meet requirements for a high-exposure category.

J. Impulse sparkover voltage coordinated with system circuit voltage.

K. Factory mounted with a Nationally Recognized Testing Laboratory listed and labeled mounting device.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Select features of each motor controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.

B. Select horsepower rating of controllers to suit motor controlled.

C. Push-Button Stations: In covers of magnetic controllers for manually started motors where indicated, start contact connected in parallel with sealing auxiliary contact for low-voltage protection.

D. Hand-Off-Automatic Selector Switches: In covers of manual and magnetic controllers of motors started and stopped by automatic controls or interlocks with other equipment.

3.2 INSTALLATION

A. Install motor-control centers according to NEMA ICS 2.3 and manufacturer's written instructions.

B. Anchor each motor-control center assembly to steel-channel sills arranged and sized according to manufacturer's written instructions. Attach by tack welding or bolting. Level and grout sills flush with motor-control center mounting surface.

C. Install motor-control centers on concrete housekeeping bases conforming to Division 3 Section "Cast-in-Place Concrete."

D. Fuses: Install fuses in each fusible switch as indicated.

3.3 IDENTIFICATION

A. Identify field-installed wiring and components and provide warning signs according to Division 16 Section "Basic Electrical Materials and Methods."

B. Identify field-installed wiring and components and provide warning signs according to Division 16 Section "Electrical Identification."

C. Operating Instructions: Frame printed operating instructions for motor-control centers, including control sequences, and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of motor-control center.

3.4 CONTROL WIRING INSTALLATION

A. Install wiring between motor-control devices according to Division 16 Section "Wires and Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect hand-off-automatic switch and other automatic control devices according to an indicated wiring diagram or one that is manufacturer approved, where available.

1. Connect selector switches to bypass only the manual and automatic control devices that have no safety functions when switch is in the hand position.
2. Connect selector switches with motor-control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor-overload protectors.

3.5 CONNECTIONS

A. Tighten motor-control center bus joint, electrical connector, and terminal bolts according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Provide services of a qualified independent testing agency to perform specified testing.

B. Testing: After installing motor-control center and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Sections 7.5, 7.6, and 7.16. Certify compliance with test parameters.
2. Remove and replace malfunctioning units with new units, and retest.

3.7 CLEANING

A. Inspect interior and exterior of motor-control centers. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally, using methods and materials recommended by manufacturer.

3.8 DEMONSTRATION

A. Training: Engage a factory-authorized service representative to demonstrate solid-state and variable-speed controllers and motor-control centers, and train Owner's maintenance personnel.

1. Conduct a minimum of 4 hours of training in operation and maintenance as specified in Division 1 Section "Contract Closeout." Include training relating to equipment operation and maintenance procedures.
2. Schedule training with at least 7 days' advance notice.

END OF SECTION

Section-16500

Lighting

SECTION 16500

LIGHTING

PART 1 - GENERAL REQUIREMENTS

1.1 Lighting fixtures shall be of the types, sizes, etc. as specified in the light fixture schedule. The lighting fixtures specified are intended to indicate the general fixture type required. All fixtures shall be U.L. listed. All general requirements shall be required unless otherwise noted in detail specifications for each fixture.

1.2 The necessary precautions shall be exercised during the course of construction to protect the fixtures from dirt, dust, and debris. All fixtures shall be cleaned before the project is accepted.

1.3 The Contractor shall install lamps in all lighting fixtures and they shall be of one manufacturer such as Osram/Sylvania, General Electric, or Westinghouse.

1.4 Fixture housing, chassis and/or channel shall not be less than 20 gauge steel of rigid construction and shall be finished with a baked-on white enamel over a zinc phosphate undercoating. Wiring shall be secured by clips or similar means. All doors shall be extruded aluminum with a positive type latch.

1.5 Reflectors separate from housings for fluorescent fixtures shall not be less than 22 gauge steel furnished with baked-on white enamel with not less than 0.85 initial reflection factor unless otherwise specified.

1.6 Each ballast shall be designed to start and satisfactorily operate the type of lamp required in the particular fixtures. Ballasts shall be securely fastened in place with mounting surface of ballast making as complete contact with surface of ballast mounting area of fixture as practical. Ballast shall be high power factor, rapid start or 800 ma. ETL, CBM, "P" rated. Refer to individual fixture if special ballasts are required.

1.7 Refer to Section on "Fuses" for fixture fuses.

1.8 FLUORESCENT LAMPHOLDERS

A. Fluorescent lampholders shall be of such design that lamps will be held firmly in place, electrically and mechanically secure and shall permit easy insertion or removal of lamps.

B. Lampholders shall be rigidly (19 gauge) and securely fastened by bolts or screws to the mounting surface with necessary provisions to prevent lampholders from turning.

Snap-in type holders will not be allowed. The dimensions of lampholders shall be such as to position lamp tube not less than 1/8" from mounting surface of reflector. All lampholders in the industrial, open fixtures shall be spring loaded, turret type, heavy duty.

1.9 METAL HALIDE SOCKETS

A. All mercury and metal halide (250 watts and above) shall be split type to insure that lamps will not freeze in socket. The center contact shall be spring loaded.

1.10 LAMPS

A. FLUORESCENT

1. Rapid Start - T-8, 4100K.

B. H.I.D.

1. All mercury to be deluxe white, color corrected.

2. All metal halide to be phospor coated.

1.11 LENS

A. Refer to each fixture for type of lens used.

1.12 All recessed fixtures shall be securely fastened to ceiling framing member by mechanical means such as bolts, screws, nuts or clips manufactured for this purpose. (Wire lashing of each fixture to roof or floor structure above will be acceptable).

1.13 SUBSTITUTIONS

A. Fixture substitutions must be made through the equipment supplier's representative ten (10) days prior to the bid date. The equipment supplier's representative is to furnish the Engineer with original fixture brochures, photometrics and point by point computer printouts for consideration of written prior approval.

1.14 LIGHT FIXTURE SCHEDULE (See Electrical Plans)

A. Catalog numbers are for style and quality only. The Contractor shall be responsible to determine the type of ceiling that fixtures are to be installed and to so order fixtures even though catalog numbers may indicate other type of ceiling.

PART 2 - EMERGENCY LIGHTING SYSTEM

2.1 Exit and emergency light luminaires shall be connected to unswitched circuits with emergency power from emergency battery packs.

2.2 Provide self-contained battery powered emergency lighting units in areas indicated on Drawings with a permanent conduit connection to housing. Battery chargers shall be solid state.

2.3 Fluorescent emergency battery packs for fluorescent lamps shall power two lamps at 1100 lumens for 90 minutes. Emergency ballast shall consist of a field replaceable high temperature nickel cadmium battery charger, test switch and solid state charging indicator light, UL listed for mounting inside or outside of fixture. Unit shall have a full 3 year non-pro-rata warranty.

PART 3 - GENERAL INSTALLATION REQUIREMENTS

3.1 Deliver lighting fixtures individually wrapped in factory-fiberboard type containers.

3.2 Install lighting fixtures of types indicated, where indicated, and at indicated heights; in accordance with lighting fixture manufacturer's written instructions and recognized industry practices to ensure that fixtures comply with requirements and serve intended purposes. Comply with NEMA standards, and requirements of NEC pertaining to installation of lighting fixtures.

3.3 Set lighting fixtures and equipment plumb, square, and level and secure to structure support members of building. Provide all steel supports necessary for lighting fixtures in addition to those specified under general building construction. Recessed and semi-recessed fixtures shall be supported independent of suspended ceiling system. Secure fixtures in suspended ceilings to framing members in accordance with NEC by using standard clips made for the purpose. Sheet metal screws are not acceptable.

3.4 Mounting heights specified as indicated shall be to bottom of fixture. Coordinate exact mounting of lighting fixture with type, style and pattern of ceiling being installed.

3.5 Clean interior lighting fixtures of dirt and debris upon completion of installation. Protect installed fixtures from damage during remainder of construction period.

3.6 At date of substantial completion, replace lamps in lighting fixture which are observed to be inoperable or noticeably dimmed after Contractors use and testing, as judged by Architect/Engineer.

3.7 Set time switches for operation as directed by the Owner and/or Architect/Engineer.

PART 4 - REQUIRED SUBMITTALS

4.1 Submit light fixture shop drawings and manufacturer's data booklet form with a separate sheet for each fixture, assembled in luminaire type alphabetical order as shown in the light fixture schedule, with proposed fixture and accessories clearly indicated on each sheet.

END OF SECTION

Section-16000

Miscellaneous Systems

SECTION 16600

MISCELLANEOUS SYSTEMS

PART 1 - TELEPHONE SERVICE ENTRANCE

1.1 Furnish and install conduits and outlets, terminal board, etc. as shown on the drawings for a complete service entrance telephone conduit system. Install nylon pullstring in all empty conduit runs. The local telephone company will install service to building. Contractor to coordinate all work with local phone company and pay all fees required.

1.2 Furnish and install telephone terminal board as shown on the drawings.

PART 2 - PHOTO-CONTROL

2.1 Photo-control shall be an AMF Paragon, PJ201 Series with built-in weatherproof junction box for 120V. operation, swivel arm, 3 F/C "On"; 10 F/C "Off" and built-in 15 second time delay.

END OF SECTION

Section-16780

Control Systems

(SCADA)

SECTION 16780

CONTROL SYSTEMS (SCADA)

PART 1 - GENERAL

1.1 PROJECT DESCRIPTION

A. Description of Work

The work to be accomplished under this section shall consist of furnishing the equipment necessary for a complete automatic control and monitoring system to function as specified herein and as shown on the drawings. The system integrator's shall furnish a completely integrated all solid-state radio telemetry base Supervisory Control and Data Acquisition (SCADA) system. It shall be the system integrator's responsibility to supply a system that is compatible with existing equipment, new equipment supplied by others as part of this contract, and equipment supplied in other contracts. The complete system shall be designed, fabricated, programmed, tested, started up, and warranted by a single supplier to insure a single source of responsibility.

B. Scope of Work

This section covers a radio telemetry based SCADA and Instrumentation System to include:

(1) Sewage Lift Station Remote Units(s)
(1) Signal Repeater Station Units(s)
(1) Wastewater Treatment Plant Control System
(1) Central Terminal Unit with (1) Operator Display Console(s).
(1) Web Access/Control at the Pikeville WTP.

C. Contractor Shall Supply

1. All equipment required in other sections of the specifications.
2. All labor for installation and start-up of the system.

D. System Integrator Shall Supply:

1. Engineering submittal and shop drawings prior to installation.
2. All the paper work and fees necessary to obtain a FCC radio license in the name of the Owner.
3. All user licenses and fees for software supplied in this system with licenses in the name of the owner.
4. Spare parts and maintenance tools, as detailed in this section.
5. Operation and maintenance manuals, as detailed in this section.
6. All start-up labor and services, as required for equipment specified in this section.
7. Operator training as detailed in this section.

E. Owner Shall Supply:

1. Access and easements as needed for all sites.
2. 120VAC power at all sites.

3. Pressure sensing taps for all sensing points in the system.
4. Meter pits for sensing tank levels or line pressures in the system.
5. Desks and chairs for Operator Display Console computer.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications

The system specified herein shall be the product of a manufacturer who can demonstrate at least ten (10) years of satisfactory experience in furnishing and installing comparable radio based telemetry/control systems for water and wastewater installations.
The manufacturer of this system shall maintain a 24-hour available inventory of all replaceable modules to assure the Owner of prompt maintenance service and a single source of responsibility. The manufacture and shall certify this to the Engineer in writing at the time of bidder pre-qualification.

B. Pre-bid Approval

The Base Bid approved systems integrator for this project is:

Micro-Comm, Inc. Local Contact: Roger Schmitt
15895 S. Plfumm Rd Tel 859-250-8013
Olathe, KS 66066

Other integrators desiring to bid this project as "alternate" integrators must seek pre-bid approval by providing a submittal (14) days prior to the bid date. Submissions that fail to include a complete submittal as detailed shall be deemed unresponsive. The Consulting Engineer and the Owner shall be the sole judge as to whether the alternate equipment is considered an approved equal. Approval of an alternate system by the Engineer will not relieve the alternate system of strict adherence to these specifications. The pre-bid submittal shall include the following:

1. An installation list with the names and phone numbers of both the Owner and Consulting Engineer for at least ten projects of similar size and complexity.
2. A "statement of compliance" detailing paragraph by paragraph the bidders compliance to these specifications.
3. Block diagrams for the various sites in the proposed system showing the selected pieces of hardware equipment to be used.
4. Sample electrical drawings for typical sites proposed in this contract.
5. A product performance data sheet shall be included for each hardware component in the system (i.e. antennas, radios, coaxial cables & arrestors, programmable controllers, power supplies, time delays and relays, and the various sensors required) and each software component (programming & configuration software and operator display console software).
6. Radio path study for each radio path in the system. Bidders shall satisfy themselves that the necessary radio frequency(s) can be obtained. The radio path study provided by each bidder shall utilize either:
   a. Computer generated techniques utilizing a USGS 3 second terrain database to plot the path profiles for each radio path with elevation samples at not more that 200 foot increments.

b. Actual field measurements to showing the necessary antenna heights, transmitter power, and antenna gains required to insure a 20db fade margin as detailed in Section 2.02 of these specifications. The a physical path analysis shall be made using temporary equipment installations and a radio communications analyzer to measure actual path margins. The bidder shall include in his bid, all the calculations used to extrapolate the measured data. The bidder is expected to obtain the necessary temporary FCC license for the study.

7. Communications diagram for the entire system showing normal CTU-RTU communications paths and Peer-to-Peer back-up communications paths.

C. Approval Agencies

The control system and its components shall comply will all applicable requirements of the following:

1. Electrical Code Compliance (National & Local)
2. UL 508A
3. NEMA Compliance
4. IEEE Compliance
5. EIA Compliance
6. FCC Compliance

1.3 SUBMITTALS:

A. Complete submittal shall be provided to the engineer for approval prior to equipment fabrication. The submittal data shall include the following:

1. Product Data - Provide product data sheets for each instrument and component supplied in the system. The data sheets shall show the component name as used on reference drawings, manufacturer's model number or other product designator, input and output characteristics, scale or ranges selected, electrical or mechanical requirements, and materials compatibility.
2. Shop Drawings - Provide drawings for each panel showing the wiring diagrams for control circuits and interconnections of all components. The drawings shall include wiring diagrams for all remote devices connected to the panel.
3. Panel Layout Drawings - A front panel and sub-panel layout shall be included as part of each control panel drawing. Components shall be clearly labeled on the drawing.
4. Installation Drawings - Typical installation drawings applicable to each site in the system shall be included.
5. Operator Interface Software - The submittal shall include a generic but detailed technical description of the Operator's Interface Software as proposed for this system including:
   a. Sample text screens and menus
   b. Sample graphics screens
   c. Sample report logs and printed graphs

1.4 MAINTENANCE INFORMATION

A. Maintenance Data Manuals

Submit maintenance manuals and "as built" drawings on all items supplied with the system. The manuals and drawings are to be bound into one or more books as needed. In addition to "as built" engineering submittal data and drawings, the manual shall include trouble shooting guides and maintenance and calibration data for all adjustable items.

B. Maintenance Data Manuals

The Systems Integrator shall also provide 10% spare fuses and lamps for each type used in the system. Provide one each spare parts to include:

1. (1) of each type of Radio Transceiver.
2. (1) of each type of radio modem in the system.
3. (1) of each type of Power Supply used in the system.
4. (1) of each type of Programmable Logic Controller.
5. (1) of each type of Level Transmitter in the system.
6. (1) of each type of Pressure Transmitter in the system.

Systems that require the zero or span adjustments of level transducers be adjusted to specific site conditions shall require a spare adjusted transducer for each different site location.
No spare parts will be required for the Operator Display Console Computer, CRT display, printer, passive back-planes, or wiring harnesses.

1.5 JOB CONDITIONS

A. All instruments and equipment shall be designed to operate under the environmental conditions where they are to perform their service. The equipment shall be designed to handle lightning and transient voltages as normal environmental hazards. The environmental conditions are as follows:

1. Outdoor - The equipment will be exposed to direct sunlight, dust, rain, snow, ambient temperatures from -20 to +120 degrees F, relative humidity of 10 to 100 percent, and other natural outdoor conditions. The installations shall be hardened to with stand normal vandalism.
2. Indoor - The equipment will be capable of operating in ambient temperatures of +32 to +130 degrees F and relative humidity of 20 to 100 percent.

1.6 DELIVERY, STORAGE, & HANDLING

A. All items shall be stored in a dry sheltered place, not exposed to the outside elements, until ready for installation. All items shall be handled with appropriate care to avoid damage during transport and installation.

1.7 SEQUENCING & SCHEDULING

A. Coordination

The Systems Integrator shall coordinate with other electrical and mechanical work including wires/cables, raceways, electrical boxes and fittings, controls supplied by others, and existing controls, to properly interface installation and commissioning of the control system.

B. Sequence

Sequence installation and start-up work with other trades to minimize downtime and to minimize the possibility of damage and soiling during the remainder of the construction period.

1.8 DISTRIBUTED CONTROL OPERATION

A. General

The control system shall use "Programmable Logic Controllers" (PLCs) at all locations in the system as detailed later in these specifications. Each site in the system shall have a unique digital address. The Central Processing Units (CPUs) and Input/Output (I/O) cards used in each of the PLCs shall all be identical, fully interchangeable with out reprogramming by the operator. The PLCs shall be "self-initializing" and "self restoring" so that operator intervention is not required after power interruptions, transients from lightning storms, or component changes.

The system shall be composed of a Central Terminal Unit (CTU) that monitors and or controls the operation of multiple Remote Terminal Units (RTUs). The CTU shall be composed of a PLC (as described above) and one or more Operator Display Consoles (ODCs) with Human-Machine-Interface (HMI) software to display, alarm, record, all data received and for operator input for changes to the system.

The control system shall be capable of implementing multiple modes of communications in a single system to include: radio, leased phone-line, dial-up phone-line, high speed data highway, fiber optic, and Ethernet communications as details in these specifications. The individual sites in the system shall simultaneously support both Master-Slave and Peer-to-Peer communications as needed implement the distributed control features listed in these specifications.

B. Distributed Control Software Features

The system shall be a "distributed control" type system that simultaneously provides for the features of both "supervisory control" (ie centralize control of RTUs from the CTU) and "distributed control" (ie RTU self initiated control using local inputs and peer-to-peer communications with other RTUs) in to a single unified control system. The control system shall simultaneously support both Master-Slave (ie CTU to RTU) and Peer-to-Peer (i.e. RTU to RTU) communications to provide completely automatic control with no single point of system wide failure in either the PLC system or the communications system. The systems integrator shall implement redundant communications paths between RTUs to maintain automatic control in the event of CTU or system wide communications failure.

The control algorithms shall have the ability to integrate both hardware and software operator inputs (ie ODC setpoints and selector switch inputs) along with hardware inputs at the remote sites (ie remote Hand/Off/Auto selector switches, etc.) in to a unified cohesive automatic control system. As data is received, changes, or lost (i.e. a loss of signal from a RTU or CTU), the Central Unit control logic shall automatically adjust the controlling algorithm to the new situation.

In general the RTUs shall receive and store control parameter commands as inputted by the operator from both the CTU or the RTU. These inputs shall be displayed at both the CTU and RTU. Distributed control shall provide for fully automatic by the RTU based on the pre-programmed control algorithm, operator inputs received from the CTU, operator inputs received from the RTU front panel display, data received from other RTUs, and local inputs monitored at the RTU. For example, the RTU shall based on operator inputs automatically control the operation of pumps or valves based on level data received from other RTUs and local pressure, flow, and discrete inputs monitored at the RTU. Pump call/run/fail status shall be reported to the CTU for centralize display, alarming, and recording. The RTU distributed control algorithm shall handle the daily pump call/run/fail, automatic alternation, automatic transfer on fail, high discharge cut-off, low suction cut-off, low & high flow cut-ff and basic tank fill or demand supply operations at the pump station for RTUs as detailed for each RTU.

Supervisory control shall automatically or manually provide for the CTU to be able to override or modify the automatic operation of RTUs based on a pre-programmed control algorithm. For example, the CTU shall be able to automatically turn on or off pumps at RTUs or change RTU operational parameters as needed to satisfy "system" wide requirements such as peak load shedding for power or water distribution management during peak demand periods.
The control system shall provide for multiple levels of control such that a single point of failure shall not render the control system in-operative:

1. In the event of a ODC failure, the PLC at the shall continue to poll all of the RTUs to collect data and provide supervisory control.
2. In the event of PLC failure at the CTU, the individual RTUs shall continue to provide fully automatic control using last stored operator inputs and peer-to-peer communications with other RTUs for control data as needed.
3. In the event of peer-to-peer communications failure between RTUs, the controlling RTUs (ie sites with pumps, valves, etc) shall continue to provide automatic control based on locally sensed pressures and flows.
4. In the event of complete failure of local RTU at a booster station (or similar site), the failure shall cause a "system normal" lamp and relay to be de-energized to automatically re-engage any existing back-up control system (such as pressure switches, float switches, etc.) to maintain automatic control.

The system shall automatically revert to the next higher level of control as communications or equipment failures are repaired.

C. Standard Control Software Features

The supplied software shall not be a one-of-a-kind system, but rather a comprehensively designed software platform that provides a number of built in features that monitor local & remote inputs combined with standard software algorithms to provide an integrated system as follows:

1. Monitor local Hand/Off/Automatic (HOA) selector switch positions (ie on existing pump control panels) and integrate the switch position in to the control logic such that a HOA in HAND or OFF shall be considered by the control system as 'un-available".
2. Provide for High Discharge Cut-off and Low Suction Cut-off control of pumps from locally entered setpoints at RTUs equipped with suction and discharge pressure transmitters and/or from existing pressure switches.
3. Provide automatic Pressure/Flow pump staging operation of pumps of different sizes (including variable speed pumps) from local discharge pressure and discharge flow inputs in a closed-loop system. The pumps shall be up-staged on decreasing discharge pressure and down-staged on decreasing flow rate. The control shall include PID (Proportional Integral Derivative) loop control of variable speed pumps mixed with constant speed pumps for the various stages required.
4. Provide "Compound Loop" PID control of final devices (ie chemical feeders) from multiple inputs (ie flow rate and a chemical process analyzer, such as chlorine residual).

1.9 RADIO CHANNEL DATA OPERATION

A. General

The control system shall be specifically designed for radio channel data communications. The core of the system shall be over FCC licensed radio frequency spectrum intended for SCADA and remote control purposes. The systems integrator shall be responsible of obtaining the necessary FCC licenses for one or more frequencies as needed to establish both supervisory and distributed control.

All of the equipment required for operation of the system shall be directly owned by the Owner and included as part of this contract. Systems using third party repeaters, trunking masters, or leased equipment will not be allowed. The Systems Integrator shall select radio equipment as detailed below to insure reliable operation and be able to implement all software features listed in this specification whether currently required or described as a "shall be capable" feature.

The overall system design and operation shall provide a 20db pad over the minimum required for operation on all primary data paths (primary paths may include data relays) to insure a 98% reliability of communications. Remote site communications for distributed peer-to-peer communications shall provide 30db of pad to insure operation under all weather conditions and provide a 99.9% communications reliability. The 20db and 30db pad requirements and FCC rule compliance shall be demonstrated (at no additional cost) to the Engineer at his request. The testing shall be accomplished using an IFR AM/FM 1000S communications analyzer or equal equipment.

B. Communications

The CTU-RTU supervisory communications and RTU-RTU distributed control communications system shall operate in a half-duplex mode over a single "licensed" radio frequency using "point-to-point" communication techniques. The RTUs shall monitor for the channel to avoid data collisions with other RTUs during peer-to-peer communications. The system shall be capable of sharing the radio channel with other radio telemetry system.

To facilitate system layout and future expansion all RTUs shall under the direction of the CTU be able to implement store-and-forward communications to relay data and commands to and from other RTUs as required to establish the desired path. Should the assigned relay site for a distant remote be inoperative, the Central Unit shall automatically choose another remote site to access the distant remote. Any RTU shall be able to provide automatic antenna switching as part of their relaying operations.

All data transmitted shall be in digital word form using FSK (frequency shift keying) transmission. All transmissions shall include the address of the sender and the receiver, and be subject to check sum, parity, and framing error checks, to insure a minimum data reliability of 1 error in 1,000,000,000 bits. Any transmissions that fail the data checking will be retried until correct. No data correction methods will be allowed. A plug-in RS232C data port shall be provided at all locations in the system to allow the use of a standard data terminal to view data exchanges between the sites and to provide a means of extensive de-bugging.

The system shall provide a complete data update at least once every (2) minutes with some functions updating faster as required by local system conditions.

C. Radio Channel Operation

The system shall be capable of operation on the narrow band splinter frequencies of the Private Land Mobile Radio Services within the Federal Communications Commissions (FCC) rules and regulations regarding these telemetry channels. The manufacture shall guarantee operation under co-channel conditions with other radio systems without interference to this system. FSK tones, data baud rates, transmitter output power, transmitter deviation, antenna gain, and antenna height shall be chosen to comply with the FCC requirements Part 90 - Subpart 90.35 and 90.238 for the Industrial/Business frequency pools. The radio system shall specifically meet the operating requirement that the sum of the highest FSK frequency and the amount of deviation shall not exceed 1.7 kHz for 3F2 emission (or 2.8 kHz for 6F2 emission) as detailed by the FCC for the specific frequency assigned.

CTUs and RTUs shall be capable of automatically switching antennas and/or radios (including radios on different frequencies) during CTU-RTU, RTU-RTU, and store & forward communications. The antenna/radio switching at remote units shall automatically default back to RTU-CTU paths if communications are lost with the CTU.

D. FCC Licensing

The system manufacturer/supplier shall be responsible for collecting all information, generating all paper work, and paying all fees required obtaining a license on behalf of the Owner.

PART 2 - PRODUCTS

2.1 PROGRAMMABLE LOGIC CONTROLLERS & LOCAL I/O EQUIPMENT

A. General

Industrial Programmable Logic Controllers (PLCs) shall be used at all locations. The PLCs shall have an operational range of 0-60degC and 5-95% relative humidity. The PLCs shall all be from the same family of controllers, scalable from very small to very large applications, and programmed from identical programming software used for all processors. The PLCs shall be readily available on and directly purchasable online from the manufacture's WEB page. The PLCs shall be Allen-Bradley CompactLogix or Micro-Comm M1500 Series controllers.

The software at all locations shall be stored in a user removable non-volatile CompactFlash or similar type ROM memory that can be exchanged under power, used to upgrade sites in the field, and store historical data (local trends, accumulators, etc) for retrieval locally or by the central unit. The memory modules shall store all site specific logic and configurations including communication parameters, control algorithms, analog input/output scaling, PID control parameters. The module shall be programmed via the CPU and without the use of external adapters. The PLCs shall include "watch-dog" circuitry and be "self-initializing" without operator intervention. In the event that the program or configuration data is corrupted, the CPU shall reload the program and configuration data from the EEPROM memory module.

The PLCs shall be fully online programmable while the PLC continues to communicate with the rest of the system and performs its assigned control tasks. The PLCs shall support "fill-in-the-blank" type configuration for basic operation and to set-up common features such as COM port set-up, peer-to-peer data collections, local back-up control set points, input and output setup, output on/off time delay settings, front panel display setup, etc. The PLC shall also support a process script language or ladder logic type programming for site-specific customizations including special input and output manipulations, local sequential control, math functions, and PID control as follows:

1. Relay (Bit) Type - Examine if ON, Examine if OFF
2. Timer & Counter - Timer ON, Timer OFF, Timer DONE
3. Compare Functions - Equal, Not Equal, Greater Than, Less Than, etc
4. Math Functions - Add, Subtract, Multiply, Divide, Square Root
5. Scaling Functions - Scale & Scale with Parameters
6. Logical Functions - AND, OR, & NOT
7. Program Control - Jump & Skip Next functions
8. PID - PID with compound loop input

The PLC programming software shall be written for the 32 bit interface of Windows XP. The supplier shall provide a licensed copy of the PLC configuration and programming software along with the necessary communications cables to the owner. Training on the use of the software shall be provided as part of the system training.

B. Construction

The PLC shall use modular construction. The base unit shall be composed of the power supply, CPU, communications modules, and basic inputs and outputs (I/O). The unit shall have expandable inputs and outputs using a "rack-less" DIN rail mount design and capable of supporting local I/O (via an integrated high-performance serial I/O bus) and remote I/O via a industrial serial bus. All terminations shall use removable, NEMA-style "finger-safe" terminal blocks so that individual modules may be removed with out disturbing adjacent modules.

The PLC shall be capable of being powered from AC, DC, or solar sources. DC and solar powered PLCs shall have an integral battery charging circuit that protects the external battery from over and under voltage conditions and provides automatic charging of the battery after power failures. The back-up power supply shall be either 12VDC with 24VDC DC/DC converter or 24VDC with a 12VDC DC/DC converter to run the 12VDC radio and 24VDC to power external sensors from a single battery source. Series tapped 24VDC batteries for 12VDC will not be allowed. Back-up batteries shall be rechargeable sealed lead-acid type batteries as manufactured by PowerSonic or equal. The back-up battery shall provide for 24 hours of back-up operation at water tower remote units and 3 hours at all other sites.

The PLC shall have a minimum of two (2) communications ports. The first shall be used primarily for CTU-RTU and RTU-RTU communications. It shall support baud rates of 110-19,200 baud and have a plug-in standard 25pin or 9pin sub-D connector that provides a full RS232 interface and radio modem interface. The second communications port shall provide programming, operator front panel interface, multiple PLC interconnect and other local communications. It shall support baud rates of 110-19,200 baud and have a 9-pin sub-D interface. The communications ports shall include LED's to show the status of all control lines. The PLC shall also optionally support Ethernet communications as detailed in the specifications.

The PLC shall utilize a rack-less design and provide for sufficient installed and configured spare inputs and outputs (I/O) to meet the site requirements as detailed and provide for 25% spares of each type. The unit shall have a minimum of (4) discrete (relay) outputs, (8) discrete inputs (DI), (4) analog inputs (AI), and (2) analog outputs (AO). The analog inputs shall provide for sensor excitation with separate fuses for each input. The fuses may be the self-resetting type. All input and output connections to the PLC shall be via Nema "finger-safe" plug-in terminal blocks.

The PLC shall support both local and remote I/O. Input/Output cards shall be mounted on a DIN rail channel. The PLC inputs, outputs, and operator interface shall be as follows: .

1. DISCRETE OUTPUTS - The discrete outputs shall be isolated relay outputs rated at 5.0A continuous @ 240VAC. LEDs on the front of the PLC base unit or expansion module shall indicate the status of each output point. Interposing relays shall be provided if the voltage or current of the external load on a contact exceed the 5.0A 240VAC ratings. Each output shall be provided with operator settable software ON and OFF time delays.
2. DISCRETE INPUTS - The discrete inputs shall be optically isolated and provide for 24VDC excitation to remote sensors and switches. Each input shall be separately fused or current limited such that accidental grounding shall not render the other inputs non-functional. LEDs on the front of the input module shall indicate the status of each input point.

3. ANALOG INPUTS - The analog inputs shall provide filtered and scalable analog to digital conversion of input signals. The analog inputs shall be switch selectable from 0-5VDC to 0-20mADC and provide a minimum of 0.3% resolution and 0.5% accuracy over the temperature range of 0-70degrees C. The PLC shall provide separately fused 24VDC excitations to the remote sensors.
4. ANALOG OUTPUTS - The analog outputs shall provide a 4-20mA isolated signal to other panels and devices as specified.
5. PULSE INPUTS - The high-speed counter/pulse inputs shall provide for pulse rates up to 1KHz direct from flow meter transmitter heads without interposing equipment. The pulse input shall include fused 12VDC excitation to the meter transmitter.
6. POWER SUPPLY - Each PLC assembly shall include an integral power supply. Power supplies shall be designed for 12VDC or 24VDC input power and suitable for use in battery back-up operations. DC/DC converters shall be required to insure that both the 12VDC and 24VDC are regulated separately from the common source.
7. KEYPAD & DISPLAY UNIT - The optional keypad & display unit shall have a 4x20 back-lighted LCD display to display the status of all local inputs and the tank level of the associated control water tower level. The 5x5 keypad shall provide for operator input of set points and timer settings. The operator interface shall be menu driven and provide for dedicated keys for cursor position and input functions. The operator interface shall provide for up to 50 screens of data display. The keypad & display unit shall be supplied and mounted on the front of the PLC enclosure if detailed in the specific PLC I/O requirement list. The keypad & display unit shall maintain the Nema 4 rating of the PLC enclosure.
8. GRAPHICAL TOUCH-SCREEN DISPLAY UNIT - The optional Graphical Touch-Screen display unit shall have an 6" diagonal (3.5" x 4.5") back-lighted 256-color TFT LCD display with resolution of at least VGA (640x480 pixels) resolution. The display shall have a resistive touch-screen with a touch accuracy of 2mm. The operator interface shall be graphical and provide for display of all data monitored and operator input of setpoints and operating commands. The Graphical Touch-screen unit shall be supplied and mounted on the front of the PLC enclosure if detailed in the specific PLC I/O requirement list. The unit shall maintain the Nema 4 rating of the PLC enclosure.
9. GRAPHICAL TOUCH-SCREEN FRONT PANEL PC – The optional Front Panel PC shall be a featured-pack industrial panel computer designed for various industrial applications. The processor shall be a low power 667MHz Eden powers all member of the ARP-2600 product family. The onboard CPU incorporates the VIA VT8606 chipset and the VT82C686B with built-in AGP-4x VGA controller; three or four RS-232, two USB 1.1 ports meet most of industrial interface requirements; the PC/104 bus is available for further expansions. The display shall be a minimum of 15" diagonal. The Front Panel PC shall be an Arista Model 2615 or approved equal.

C. Enclosures

The remote unit enclosures for indoor mounting shall meet all the requirements for NEMA Type 12 enclosures. The enclosures body shall be made of a minimum 14 gauge steel with continuously welded seems and be furnished with external mounting feet. The enclosure door shall be made of a minimum 16 gauge steel with have a 14 gauge steel hinge. Enclosures larger than 16x14 shall have a rolled lip on 3 sides of the door for added strength. The door opening shall have a rolled edge on 4 sides to protect the door gasket. The door gasket shall be heavy neoprene and attached to the door with oil resistant adhesive. Sub-panels shall be 14-gauge steel for 16x14 enclosures and 12 gauge for larger enclosures. The enclosure finish shall be gray polyester powder coating inside and out over phosphatized surfaces. The subpanels shall be finished in white. Nema 12 enclosures shall be Hoffman "CH" or "CONCEPT" wall mount enclosures.

Remote site installations requiring equipment to be mounted outside shall have a double box enclosure with the remote unit enclosure mounted inside a lockable NEMA 3R enclosure. The double enclosure shall be required to control vandalism, provide complete weather protection, reduce the heating effects of the sun, and prolong the life of the equipment. The NEMA 3R enclosure shall be constructed of 14 gauge galvanized steel, with a drip shield top and seems free sides front and back, and a stainless steel hinge pin. The enclosure finish shall be gray polyester powder coating inside and out over phosphatized surfaces. The NEMA 3R enclosure shall be Hoffman Bulletin A-3.

The remote unit enclosures mounted in damp corrosive areas (such as concrete meter vaults) shall be NEMA Type 4X rated enclosures. The enclosures shall be made of molded fiberglass polyester and be furnished with external mounting feet. The door shall have a seamless foam-in-place gasket and corrosion-resistant hinge pin and bails. Sub-panels shall be 14-gauge steel for 16x14 enclosures and 12 gauge for larger enclosures. The enclosure finish shall be a light gray inside and out. The subpanels shall be finished in white. Nema 4X enclosures shall be Hoffman "Fiberglass Hinged Cover".

Refer to Appendix for specific enclosure requirements.

D. Front Panel Hardware Displays

As detailed in the appendix, the PLC units may include front panel displays of the specified inputs and outputs. The indicator lamps, pushbuttons, and selector switches used in the system shall be IP65 oiltight/waterproof/corrosion resistant rated. The indicators use slide or bayonet based colored LED light sources. The lenses shall be acrylic and color matched to the LED color. The lamps shall have translucent marking plates for legends and be constructed such that the acrylic lens covers the legends for dust and water protection. The pushbutton and selector switch operators shall be Nema 600V rated with contacts rated for 6A @ 120VAC inductive. The contact blocks shall be stackable and snap-fit with screw terminals for termination.

Refer to Appendix for specific front panel display requirements.

E. Local Control Functions

In general the PLC shall be programmed to provide generic control functions as detailed earlier and to work in concert with the CTU. The integrator shall be responsible to meet with the owner and the engineer to develop the automatic control strategy required for the system.

Refer to Appendix for special input and output control requirements.

2.2 RADIO TRANSCEIVERS & ACCESSORIES

A. General

The radio transceivers shall be standard "un-modified" radios that can be tuned, aligned, and repaired at any two-way radio shop. Interface to external data modems shall be through the front panel microphone jack. The radios shall be synthesized and fully field programmable and include a built-in time-out timer to disable the transmitter after 0-60seconds. The units shall be tuned to FCC specifications for the specific frequency assigned. The radio equipment shall be FCC type approved and the system capable of operation on the 3KHz ot 6KHz narrow band splinter frequencies (154 or 173MHz) in the Industrial/Business radio service.

B. VHF Radio Transceiver (154Mhz or 173Mhz)

The system manufacturer shall supply a 5-watt VHF radio transceiver to insure a high level of quality and reliability. The radios shall be adjustable to 4 watts output power as may be required by the FCC for ERP (Effective Radiated Power) restrictions. All connections to the radio shall be plug-in. The VHF radio transceiver shall have the following specifications:

Transmitter:

RF output power	25 watts minimum (adjustable to 4)
Spurs & Harmonics	16 dBm (25uW) (or -50dBc)
Frequency stability	±0.00025% (-30 to +60 degrees C)
Emission	6F2 (2.5kHz DEV max) or 3F2 (1.2kHz DEV max)
FM hum and noise	-40 dB

Receiver:

Sensitivity	0.35uV @ 12 dB SINAD (.5uV @ 20db quieting)
Selectivity	-65 dB
Spurious image rejection	-50 dB
Inter-modulation	-65 dB
Frequency stability	±0.00025% (-30 to +60 degrees C)
Receive bandwidth	*6kHz (or 3kHz) as required to match the transmitter

* The receiver bandwidth shall be reduced to match the transmit bandwidth of the transmitter and provide a minimum adjacent channel rejection of -50db.

The radio transceivers shall be a Motorola Radius CM200 or a Microwave Data Systems 1710.

C. UHF Radio Transceiver (450Mhz)

If the system supplier can demonstrate to the satisfaction of the Engineer that no VHF (154-173 MHz) frequency can be obtained, an UHF (450-470 MHz) frequency may be used. The UHF shall operate under Part 90.35 and 90.238 for secondary fixed operations. The system will still be required to operate with point-to-point operation within the FCC rules and regulations and provide the same RF path margins as detailed in these specifications.

The UHF radios must meet or exceed the requirements set forth in these specifications for VHF radios, except that the radio output power must be adjustable to 2 watts as needed to meet FCC requirements. The radios shall be tuned to operate in 6KHz of bandwith to meet the proposed FCC standards for 2005. Antennas shall provide a minimum 10db of gain.

The radio transceivers shall be Motorola Radius CM200 or Microwave Data Systems 4710. No changes to the contract amount will be made for a change to UHF operation.

D. Antenna & Coaxial Cable

The radio antennas at all locations shall be a five element Yagi, constructed with 3/8" diameter solid aluminum rod elements and 1-1/16" diameter aluminum pipe element support with a type N coaxial connector. The antenna shall have a minimum 8.0db forward gain with a 20.0db front-to-back ratio. The antenna shall be wind rated for a 100-MPH wind speed. The VHF antennas shall be MC-Yagi, Decibel Products DB292, or Celwave PD390S. The UHF antennas shall be MC-Yagi or Celwave PD688S.

Antennas shall be cabled to the transmitter enclosure connection by a RG/8U type low loss (less than 1.8db per 100ft @ 100MHz) coaxial cable with cellular polyethylene (foam) dielectric. The coaxial cable shall have a braided copper shield coverage of 97% and a long life weather resistant polyvinyl chloride jacket. The antenna coaxial cable connection shall be a constant impedance weatherproof Type N connector, taped with a weather resistant electrical tape to insure a lifetime watertight assembly. The coaxial cable shall be Belden 8214 or 9913 cable.

E. Antenna Lightning Protection

Coaxial connection to remote and central unit enclosures shall be by means of a coaxial type bulkhead lightning arrestor. The units shall be rated at 1 kilowatt with a minimum 500V and maximum 2000V-breakdown voltage. Coaxial lightning arrestors shall be a PD-593 or PolyPhaser IS-B50LN-C1.

F. Antenna Mounting Systems

Antennas shall be mounted at a height above ground that is consistent with FCC rules and regulations and provides adequate signal fade margin as described earlier. Antennas must be a minimum of 15 feet above ground and mounted as follows:

1. Water Towers: The antenna shall be mounted on the ladder or the water tower catwalk railing at a height consistent with FCC requirements. The coaxial cable shall be secured to the ladder or obstruction lighting conduit. A 3/4" rigid conduit with a weather-head shall be provided from the transmitter to the ladder on the tower.
2. Above Ground Structures: The antenna shall be mounted on a 10' long X 1-1/2" diameter galvanized mast with top mounted weather-head. The mast assembly shall be secured to the side of the structure with Uni-strut clamps. The coaxial cable shall feed through the mast assembly to the interior of the building.
3. Below Ground Structures: The antenna shall be mounted on a 20' high Class II power pole with a 10' long X 1-1/2" galvanized mast secured to the side of the pole and extending 5' above the pole or a 20' high free-standing antenna tower. A 3/4" rigid conduit with a weather-head shall be provided from the below ground vault to a location 10 feet up the power pole for the coaxial cable.

4. Antenna Towers (>20feet): A bracketed antenna tower shall be supplied where specifically noted on the plans or in the RTU & CTU site descriptions. The tower shall be assembled from 10 sections built on a 12-1/2" (or 18" for ROHN 45G) equilateral triangle design. Tower sections shall be constructed of 1-1/4" steel tubing with continuous solid steel rod "zigzag" cross bracing electrically welded to the tubing. The entire 10' sections shall be Hot-Dip Galvanized after fabrication for long life. The antenna towers shall be ROHN Model 25G (for unsupported heights of up to 33 feet) or ROHN Model 45G (for unsupported heights less that 45 feet).

2.3 INSTRUMENTATION & ACCESSORIES

A. General

All items in the control system (electronic cards, power supplies, radios, time delays, relays, etc.) shall be of plug- in construction, make use of a plug-in wiring harness, use plug-in terminal blocks, and be interchangeable without recalibration. To insure field repair-ability by non-technical personnel, equipment that must be un-wired for replacement will not be accepted.

The following instrumentation devices and techniques shall be used as specifically called for in the RTU and CTU input/output sections of this specification.

B. Power Supplies

The DC power supplies shall provide ±0.1% line and load regulation with ±10% input variations. They shall have a temperature coefficient of ±0.02% per degree C. The input/output isolation shall be 100 Mohms DC (900Volts AC) with output transient response of 50 microseconds maximum. The power supplies shall be sized to operate the remote unit equipment with or without the back-up battery in place. Power Supplies shall be a Power One Series MAP130, Sola SLS, or approved equal.

C. Battery Back-up Operation

The remote units indicated shall be supplied with battery back-up operation. The rechargeable batteries shall be the sealed solid gelled electrolyte types, designed for float or standby service. Unless noted otherwise in the RTU descriptions, batteries shall be sized to maintain 24-hour service at water tower remotes and 8 hour service at pump stations and other remotes. The remote shall include a charging module to recharge the battery when power is resumed, maintain the charge between outages, and provide a low voltage cut-off to protect the battery from excessive discharge during prolonged outages. All discrete, analog, and pulse inputs (i.e. switch closures, pressure, level, flows, etc.) shall continue to function on battery back up. Batteries shall be Globe Gel/Cell or approved equal.

D. Single Phase 120VAC Power Line Lightning Protection

Every site in the system shall be equipped with AC line filtering and lightning protection. The equipment shall provide 2-stage lighting/transient protection including inductive and capacitive filtering and MOV over-voltage protection.

E. Level & Pressure Transducers

Level & pressure transducers shall be of the all solid-state two-wire transmitter type with a 4-20mA output from a 10.5-24VDC excitation. The units shall be powered from the RTU power supply. The transducers shall have a combined error (linearity and hysteresis) of ±0.25% full scale and be temperature compensated to ±2.5% per 100 degrees Fahrenheit. Zero and span adjustments shall be standardized so that transducers are interchangeable without recalibration. All exposed or wetted parts shall be series 316 stainless steel, PVC, or Buna-N. The units shall be capable of a three times full scale over pressure with out damage or change of calibration.

The transducers shall be mounted at the sensing point and wired to the enclosure. The transducers shall have a 1/4" or 1/2" NPT process pressure connection. Transducers for above ground mounting shall have a 1/2" conduit connection for cable entry. Transducers at water towers (and other outside locations) shall be mounted below grade and below frost line to prevent freezing. Below grade mounted units shall have factory signal cabling and be suitable for a minimum of 100' submerged duty.

Level transducers for clear-wells and wetwells shall be suspended in the clearwell or wetwell and supplied with sufficient factory installed cable to access a "clean/dry area" junction box. The suspension cable shall have a polyethylene jacket and internal venting to provide for atmospheric sensing of the non-process side of the diaphragm. The sensors shall have a multi-ported pressure-sensing end that protects the diaphragm while sensing the level of viscous liquids or slurries. The cable connection in wet-well applications shall have a non-fouling guard to prevent build up of foreign materials.

Pressure/Level transducers shall be Micro-Comm L5N series, Consolidated A300 Model 221GEE, or Ametek Model 57S.

F. Station Flooding Float Switches

The station flooding sensors shall be a wall bracket mounted float switch capable of sensing less that 1-1/2" of water on the floor. The units shall be constructed with a Buna N float, 304 stainless steel float guide, a clear plastic protective shield, and a sealed neoprene cable connection. The float switch shall be Omega LV-70 or approved equal.

G. Entry Alarm

Unauthorized entry alarms at remote sites shall be accomplished through a perimeter alarm system powered from the common 12VDC-power supply. The system shall include the necessary structure entrance magnetic door switches. Should an intruder enter the structure without acknowledging his presence, an entry alarm will be sent to the Central Unit. The entry alarm shall have an adjustable time delay (0-60 seconds) to allow authorized personnel time to acknowledge their presence when entering the structure and provide a re-arming delay when leaving the structure. The RTU door mounted key switch shall be constructed so that the key can only be removed in the "armed" position. The alarm system can be implemented as part of the RTU logic system or be a Digital Control Systems (DCS) or approved equal.

H. High/Low Wetwell Floats

The high/low wetwell alarm floats shall be direct acting float switches. The floats shall have a polypropylene case containing a hermetically sealed mercury switch and be supplied with 40' of PVC type STO cable. The float switches shall be Anchor Scientific Roto-Float or approved equal.

2.4 CENTRAL UNIT EQUIPMENT

A. General

The "Central Unit" shall be composed of two or more separate CPUs communicating over a high-speed serial data links. The first computer (called the Central Terminal Unit or CTU) shall be a PLC as specified earlier and provide all communications with remote units, local inputs and outputs, and local hardware display devices. The second computer (called the Operator Display Console or ODC) shall be responsible for the operator interface to the system and provide display, alarm, and logging of all data.

B. Construction

The CTU shall be as specified for the PLCs used on the project. The CTU control panel shall be equipped with a battery back up. The CTU shall operate for a minimum of 8 hours controlling all radio/RTU operations. The rechargeable 12 amp hour batteries shall be sealed solid gelled electrolyte type batteries. The CTU shall recharge, maintain, and contain a low voltage cut-off protecting the battery from excessive discharge.

C. Enclosures

All of the CTU and PLC equipment (including CPU card cage, radio, power supplies, automatic antenna switching, and local inputs & outputs) at the master shall be housed in a free standing or wall mount NEMA 12 enclosure.

Refer to Appendix for specific enclosure requirements.

D. Front Panel Hardware Displays

As detailed in the appendix, the Central Unit may include front panel displays of the specified remote unit data for each remote unit. In such case, each remote unit shall have its own display. Single unit display devices that provide scanning displays of information or that require operator intervention to display the desired data will not be allowed. HOA switches CRF lamps, alternator selector switches, and associated alarm/status lamps shall be grouped in a logical manner.

The indicator lamps, pushbuttons, and selector switches used in the system shall be IP65 oiltight/waterproof/corrosion resistant rated. The indicators use slide or bayonet based colored LED light sources. The lenses shall be acrylic and color matched to the LED color. The lamps shall have translucent marking plates for legends and be constructed such that the acrylic lens covers the legends for dust and water protection. The pushbutton and selector switch operators shall be Nema 600V rated with contacts rated for 6A @ 120VAC inductive. The contact blocks shall be stackable and snap-fit with screw terminals for termination.

1. Levels & Pressures - Front panel displays of levels and pressures shall be .5" high 3.5 digit LCD displays.
2. HOA Selector Switches - Front panel HAND/OFF/AUTO selector switches shall be oiltight rated 3 position selector switches with engraved nameplates.
3. Indicator Lamps - Front panel indicator lamps shall be oiltight rated LED lamps with engraved lenses.

Refer to Appendix for specific front panel display requirements.

E. Local Control Functions

In general the CTU shall be programmed to provide generic control functions as detailed earlier. The integrator shall be responsible to meet with the owner and the engineer to develop the automatic control strategy required for the system.

Refer to Appendix for special input and output control requirements.

2.5 OPERATOR DISPLAY CONSOLE (ODC)

A. General

As described previously the Central Unit shall have two microprocessors tied together with separate operating responsibilities. The first processor (Central Terminal Unit or CTU-PLC) shall handle all the telemetry, set-point comparison and command duties. The second processor (Operator Display Console or ODC) shall handle the LCD displays, operator keyboard, alarm/log printer, and data storage duties. The system shall be capable of supporting multiple OCDs connected to a single CTU-PLC.

B. System Unit

The Operator Display Console (ODC) computer shall be an Intel/Windows base processor with the following features:

1. Intel Core 2 Duo Processor operating at 3GHz (minimum)
2. Windows XP Service Pack 2 operating system
3. 2GB RAM (minimum)
4. 160GB SATA Hard Drive (minimum)
5. 16x DVD+/-RW optical storage drive
6. Dual monitor DVI video card
7. USB 104-Key QWERTY Keyboard with integral numeric keypad & 6ft cable
8. USB 2-button Mouse with Scroll Wheel
9. Integral Gigabit wired Network Adapter
10. Internal 56K V.92 Data/Fax modem
11. (8) USB 2.0 ports, (1) parallel printer port, & (1) RS-232 serial port

The system unit shall be housed in a desktop or mini-tower case as required by the owner. The CTU shall store all command inputs and set points as downloaded from the ODC. The hard drive in the ODC shall be used for program and data storage. The R/W CD-ROM shall be used for archive data storage and back-up protection of the operating program.

The separately mounted keyboard shall have a standard typewriter format with tactile feedback, twelve special function keys, and a separate numeric keypad for entering set point data and cursor control. The 256-character symbol set shall include 96 ASCII characters and the IBM (International Business Machine) graphic symbols. The system shall include a 2-button Windows compatible mouse with mouse pad. The ODC shall be a minimum Dell Optiplex Model 760 or latest current model.

C. LCD Video Displays

The system unit shall be equipped with two (2) LCD Flat Panel displays. Each LCD display shall be a 19" high-resolution (1600 x 1200) color display terminal with minimum .264mm dot pitch, 600:1 contrast ratio, and IBM SXGA compatibility. The LCDs shall be utilized for display of station and system graphics and real-time data display. The first LCD shall provide for operator input and output data, report generation, and access to system utilities. The second LCD shall provide for multiple graphic overviews of the process system and/or sub-systems. The LCD display shall be a minimum Dell 19inch UltraSharp 1908FP Flat Panel Monitor or latest available model.

D. Printer

The system shall include a color "graphic" Laserjet printer with a 600dpi X 600dpi resolution, color resolution, 21ppm color output speed, and 1000 page/month duty cycle. The printer shall provide for printing of alarms summaries, data logs, trend graphs, and reports. The printer shall be a HP DeskJet CP2020 printer or equal.

E. Internal Modem

The internal modem shall be reserved for phone-line debug & remote access.

The ODC shall include Symantec's current version of PCAnywhere for remote access by the Owner's or Systems Integrator's remote computers.

F. Enclosures

The Operator Display Console unit (including CRT display, Keyboard, and System Unit) and the graphic printer shall be located on top of a desk supplied by the Owner. All interconnecting cabling shall be plug-in and supplied by the contractor.

G. Battery Back-up Operation

The ODC shall include 20 minutes of back up. The ODC back-up unit shall be a Stand-by Uninterruptible Power Supply (UPS) system that provides power line filtering and transient protection. The unit shall automatically take over (within 4mS) when the power line fails without interrupting or restarting the system and automatically recharge the battery within 10hours after the power returns to normal. The UPS shall be located at the desk location of the ODC and shall power the System Unit and display. The UPS shall be a APC Back-UPS 650, 1000, or 1400 as required.

2.6 MAIN OPERATOR DISPLAY CONSOLE SOFTWARE

A. General

The software shall be 32bit compatible and capable of operating in the ODC hardware described above as well as in customer supplied Windows XP Professional compatible hardware similar to the unit specified above. The contractor shall supply a fully functional "developmental" version of the SCADA software (including any required software protection keys) for the first ODC as well as a separate configured "runtime" version for installation and use in a customer supplied back-up computer. The software may be modular, however the operator interface shall provide an integrated interface to all areas of the program. Demo program copies will not be allowed.

The software shall operate in the 32-bit Windows XP Professional/Vista Business environment. The software shall be the latest "full developmental" version of SCADAview 32 (Optional SC), Wonderware InTouch, GE-Fanuc iFIX, or Allen-Bradley RSView 32 (Optional SE). The software shall be licensed to the owner.

B. System Back-up & Installation

The contractor shall provide a back-up copy of the installed software on a USB-Thumb drive. Back-up copies of any setup or graphic files shall be on a USB-Thumb drive. In the event of a catastrophic failure, the Owner shall utilize the USB-Thumb drive for emergency reloading the software. The contractor shall provide an easy to use installation (or re-installation) program that will automatically setup the hard drive operating system and automatically load (or reload) the software.

C. System Capacity

At a minimum, the operating software shall be capable of accommodating 32,000 tag points as follows:

1. Discrete status & alarm points
2. Measured variables
3. Accumulated variables
4. Calculated status & alarm points
5. Calculated control points

D. Communications

The HMI shall have several methods for exchanging data from programmable controllers and other software programs.

1. Direct
2. DDE Client/Server
3. OPC Client
4. ODBC
5. SQL Database (MySQL, MS-SQL, PostgreSQL)

E. HMI Operational Characteristics:

In general, the HMI software shall display all received data in engineering units with appropriate generated labels, generate and print alarms, print logs, store manually entered data, update displays, and perform operator commands as required by the database. The system shall automatically generate the following system displays:

1. Main Menu page (with direct access to all screens and other program modules)
2. System Summary page listing key data points for all RTUs in the system
3. RTU specific display pages showing all data for each RTU in the system

Beyond the basic operating software required for SCADA operations, the software package shall accommodate the following:

Status Point Operations:
Display ODC, CTU, and RTU status functions
Input/Display control database

Analog Data:
Display value directly in engineering units
Accept operator High & Low alarm limits and generate alarms
Accept operator rate of change alarm limit and generate alarm
Store data for trending displays

Flow Rate Data:
Display value directly in engineering units
Accept operator High & Low rate alarm limits and generate alarms
Totalize flow total and display in engineering units
Accept operator High/Low 24 hour total limits and alarms
Store data for trending displays

Pump Control Operations:
Display ODC, CTU, and RTU HAND/OFF/AUTO functions
Display Pump CALL/RUN/FAIL status for each pump
Input/Display control database

Alarm Point Operations:
Display ODC, CTU, and RTU alarm functions
Enter new alarm in data log archive and send alarm to printer
Sound alarm horn until alarm is acknowledge by the operator
Log alarm acknowledgment to data log and printer
Log alarm clearing and send alarm clear to printer
Input/Display control database

Event Point Operations:
Display ODC, CTU, and RTU alarm functions
Display ODC, CTU, and RTU event functions
Enter new event in data log archive and send alarm to printer
Log event clearing and send alarm clear to printer
Input/Display control database

Historical Trending Operations:
Real-time and historical trending functions
Create a multi-pen trend.

a. Ability to be shaded to compare two or more different trends
b. Create a trend that is part of a graphic display
c. The trends shall have a marker displaying the pen's date, time, and value

F. Graphical Screen Display Editor

The HMI shall provide a graphics display editor for creating displays using graphic objects. The graphics display editor shall have the ability to drag and drop objects from a pre-configured graphics library, paste objects that are copied to the clipboard from another Windows application, and insert objects created by another Windows application using OLE. True OLE support is required in that it shall be possible to call up the native application that created the object being inserted and use the naïve object editing tools from within the HMI. The graphics display editor shall have tear-away toolbars and color palettes. It shall be possible to customize the color pallet. Graphics drawn with a customized color pallet shall not require the customized color pallet to be present on all runtime computers. Colors must be stored internal to the graphic files as Red, Green, Blue numbers, not pallet indexes. The graphics display editor shall have:

1. Context sensitive "right-mouse" support on all objects.
2. As a minimum the following drawing tools:
   Rectangle, line, ellipse, wedge, and text
3. As a minimum the following editing tools:
   Tag substitute, flip, rotate, resize, reshape, align, cut, paste, copy, duplicate, bring to front, send to back, space, fill, undo, redo, line, and color.
4. As a minimum the following viewing tools:
   Zoom in, zoom out, pan, and view entire graphic.
5. The ability to use tag placeholders to provide a way to use one graphic display to represent a number of similar operations.
6. Provide tools for each of the following as a minimum:
   Numeric input, numeric display, string input, string display, label, arrow, recipe, alarm summary, tag monitor, input command line, trend, button, OLE object, and ActiveX object.
7. The ability to create a screen background by converting objects to wallpaper. These wallpaper objects cannot be selected or edited.
8. Allow the user to create libraries of graphic objects.
9. Allow the user to assign control to any object or grouping of objects. It shall also allow the user to drill down in a group to modify any object or object attribute without losing any object control property.
10. Allow control to be copied from any object to another object.
11. Permit the user to specify screen placement anywhere on the display.

2.7 HMI CLIENT SERVER (OPTIONAL HMI SOFTWARE PACKAGE)

A. General

The HMI option shall permit Client/Server operation whereby graphics functionality (full operations) shall be provided at a client station. The HMI sever shall permit up to 10 remote clients at any one time. HMI Client server communications shall be based upon STANDARD TCP/IP communications and permit remote operation across a WAN or a high speed radio based network.

B. The HMI Server shall:

1. Support redundant HMI servers and Data Servers.
2. Support data server redundancy.

3. Support seamless fail over from a primary server to a secondary server.
4. Support seamless fail back from a secondary server to a primary server.
5. Support notification of a service disruption including computer name of failed server.
6. Support notification service recovery including the computer name of active server.
7. Support redundancy without the need to write application logic.
8. Automatically synchronize the alarm state information on the primary and secondary so there is no disruption or loss of alarm state information on a failover.
9. Permit client/server operation whereby graphics functionality (full operations) shall be provided at a client station.
10. Client stations are desired to be thin clients. Performance shall not degrade at the thin client in terms of display refresh or display call-up. (For example, displays on the client refresh at a rate equal to or better than the rate possible on the server).
11. The client computers must cache copies of the HMI project graphics locally and be able to automatically copy the latest graphic from the server(s) as required.

2.8 WEB SERVER

A. General

The ODC shall include an integral WEB Server allowing the operator to remotely access the system using standard WEB Browser software (MS Explorer). The operator shall have the ability to monitor the main display screen, view current alarms, view RTU sub-screens, draw trend graphs, and make changes to the HOA and operator setpoints.

The integral WEB Server will use the same ODC HMI software security to control un-authorized access.

2.9 VOICE ALARM PHONE-DIALER

A. General

The ODC shall be equipped with software based automatic alarm dialer software. The software shall be tied to the MMI software database to provide automatic dialing of operator selected alarms. The software shall be 32bit compatible and capable of operating in the ODC hardware described above. The contractor shall supply a fully functional "developmental" version of the Alarm Dialer Software (including any required software protection keys) for the first ODC as well as a separate configured "runtime" version for installation and use in a customer supplied back-up computer. The software may be modular, however the operator interface shall provide an integrated interface to all areas of the program.

The software shall dial a pre-programmed list of phone numbers to provide a natural voice describing generated the specific alarm and time of occurrence. The dialer software shall have provisions to accept an operator acknowledgement of the alarm that will cancel further calls. If a proper acknowledgement is not received, the software will continue to dial phone numbers from the list until an acknowledgement is received.

The alarm dialer software shall allow operators to dial into the system to retrieve current alarm status and via a voice driven menu system access current operational data for each remote station.

B. Phone Dialer Modem

The phone dialer software shall include a voice modem that will allow the ODC computer to interface with standard dial-up phone-lines. The modem shall be FCC type approved. The Alarm Dialer Software shall be SCADAdial, Win911, or SCADAlarm.

PART 3 - EXECUTION

3.1 EQUIPMENT EXAMINATION

The control system shall be completely tested prior to shipment. The entire control system shall be "Burned In" at the factory for a period of at least 20 days. The component equipment shall be computer tested and temperature cycled at zero degrees and at fifty degrees centigrade.

3.2 SYSTEM START-UP

The manufacturer shall supply "Factory" personnel for start-up service as needed to insure satisfactory operation. Subsequent trips to the job site to correct defects shall be made at no charge to the Owner during the warranty period.

3.3 TRAINING

The system manufacturer shall supply "factory" personnel to conduct two separate on-site training sessions, totaling a minimum of three days of training.

The initial training session shall be conducted during start-up as needed until the Owner and Engineer are satisfied that the operators are comfortable with the operation and maintenance of the system. Training shall be done on site with the owner's personnel.

Three to six months after the Owner commencing system operation, the system manufacturer shall supply "factory" personnel to conduct follow-up training of the Owner's personnel. The follow-up training shall be conducted on-site and consist of reviewing the operation and maintenance of the system. The Owner shall be contacted a minimum of two weeks in advance, prior to scheduling the training session to allow proper coordination.

3.4 SUBSTANTIAL COMPLETION

The Engineer will grant substantial completion only after completion of the start-up and initial training phase of the project. The Engineer shall make an inspection of the system to determine the status of completion. Substantial completion will be awarded only when the system is providing usable service to the Owner. If the system is commissioned in phases, the Contractor may request substantial completion for the completed phases.

3.5 ACCEPTANCE TEST

After start-up and debugging of the entire system has been completed, the system manufacturer shall notify the Engineer that he is ready to begin the 60-day acceptance test. The system must run continuously for 60 consecutive calendar days. During this period, all system functions shall be exercised in automatic control, including all levels of back-up control. During the initial phase of the acceptance test, the multiple levels of control and radio path pad shall be demonstrated to the Owner as follows:

1. Primary level control shall be demonstrated by allowing the operators to manually initiate remote device operation and observing the automatic operation by comparing trend charts to operator entered stop/start values.
2. Secondary level control shall be demonstrated by turning off the ODC and verifying that each automatic control loop continues to function by monitoring operation with a passive monitor.
3. Third level control shall be demonstrated by turning off the CTU radio and verifying that the RTUs continue automatic operation and communications between RTUs by monitoring one full cycle of automatic operation using a passive monitor.
4. The fourth level of control shall be demonstrated by placing selected RTUs in back-up pressure mode and monitoring tower levels to observe one full pumping cycle.

Any level test or system interruption and accompanying component, subsystem, or program failure shall be logged for cause of failure, as well as the time of occurrence and the duration of each failure.

The Owner's representative shall classify failures as either major or minor. A minor failure would be a small, non-critical component failure that is corrected by the operators. This occurrence shall be logged but shall not be grounds for non-acceptance unless the same or similar failure occurs repeatedly (more than two such failures of similar components). A major failure shall be considered to have occurred when a component, subsystem, or program fault causes a halt in the operation of the any portion of the system and/or when a "factory" technician's work is required to make a repair or to reinitiate operation of the system.

A major failure shall cause termination of the 60-day acceptance test. When the causes of a major failure have been corrected, a new 60-day acceptance test shall be started. Final Acceptance of the control system shall not occur until satisfactory completion of this 60-day test.

The manufacturer shall provide "factory" personnel who shall be on site and conduct the initial system exercise portion of the testing. The manufacturer shall be responsible for maintaining a checklist type test report wherein each function is checked-off and initialed by the Owner's representative as it is demonstrated. During the remainder of the 60-day acceptance test, the manufacturer shall provide 24-hour response to calls from the owner in order to correct any failure.

3.6 WARRANTY/SUPPORT PROGRAM

The control system manufacturer shall supply a two (2) year parts and labor warranty and comprehensive support program for all items and software supplied under this section (except as noted below). Power surges and lightning damage shall be included as part of the warranty.

The warranty shall begin from the time of "substantial completion" as issued by the engineer. The manufacturer shall provide a 24-hour response to calls from the Owner. The manufacturer, at his discretion, may dispatch replacement parts to the Owner by next-day delivery service for field replacement by the Owner. Any damage to the control system caused by the actions of the Owner in attempting these field replacements shall be the sole responsibility of the manufacturer. If, during the warranty period, satisfactory field repair can not be attained by field replacement of parts by the Owner, the manufacturer shall dispatch "factory" personnel to the job site to complete repairs at no cost to the Owner.

The support program shall begin from the time of "substantial completion" as issued by the engineer. The support program shall include free updating of all software as needed and providing free phone support from the integrator throughout the warranty period.

The ODC Computer System Unit, keyboard, CRT display, printer, and associated UPS (and Portable Operator Display Console if specified in this contract) shall be covered by a one (1) year warranty beginning with "substantial completion". Lightning damage shall be included as part of the warranty on these components.

PART 4 - APPENDIX: DETAILED EQUIPMENT DESCRIPTION

4.1 SEWAGE PUMP STATION REQUIREMENTS:

A. Installation Requirements:

Sites: Proposed Sewage Lift Station Site
Telemetry Control and Pump Command outputs to other panels shall be dry isolated contacts on relays. Local pressure inputs shall be by two-wire transducers as specified.

The Pump Station equipment shall be housed in a NEMA 12 wall mount enclosure for indoor locations or a NEMA 3R enclosure as specified. The pump station equipment shall include an internal power switch, bulkhead coaxial cable lightning arrestor, and a power line lightning arrestor as specified earlier.

The antenna shall be mounted on a 10' long X 1-1/2" diameter mast secured to the side of the structure for pump stations buildings or on a 20' power pole with 3/4" rigid conduit and a weather-head run to the RTU enclosure as previously specified.

B. Front Panel Display Requirements:

1. Keypad & Display assembly to display all inputs and output status

C. Discrete Outputs:

1. Pump #1 CALL
2. Pump #2 CALL
3. spare
4. spare

D. Discrete Inputs:

1. Power Failure
2. Pump #1 RUNNING
3. Pump #2 RUNNING
4. Pump #1 FAIL
5. Pump #2 FAIL
6. High Float Alarm (Wetwell Overflow)
7. spare
8. spare

E. Analog Inputs:

1. Wetwell Water Level (New Submersible Transducer)
2. FUTURE Well Drawdown (Reserved for future input)
3. spare
4. spare

F. Pulse Inputs:

1. FUTURE Flow Rate & Total (Reserved for future flow meter interface)
2. spare

4.2 REPEATER STATION REQUIREMENTS:

A. Installation Requirements:

Sites: Repeater Site

The Repeater RTU shall be housed in a NEMA 3R enclosure as specified. The repeater equipment shall include an internal power switch, bulkhead coaxial cable lightning arrestor, and a power line lightning arrestor as specified earlier.

The antenna shall be mounted on a 20' Rohn Tower or on a 20' power pole with 3/4" rigid conduit and a weather-head run to the RTU enclosure as previously specified.

B. Front Panel Display Requirements:

1. Keypad & Display assembly to display all inputs and output status

C. Discrete Outputs:

1. spare
2. spare
3. spare
4. spare

D. Discrete Inputs:

1. Power Failure
2. spare
3. spare
4. spare
5. spare
6. spare
7. spare
8. spare

E. Analog Inputs:

1. spare
2. spare
3. spare
4. spare

F. Pulse Inputs:

1. spare
2. spare

4.3 WWTP CENTRAL UNIT RTU REQUIREMENTS:

A. Installation Requirements:

Sites: WWTP Site
Telemetry Control and Pump Command outputs to other panels shall be dry isolated contacts on relays. Local pressure inputs shall be by two-wire transducers as specified.

The Central PLC equipment shall be housed in a NEMA 12 wall mount enclosure as specified. The equipment shall include an internal power switch, bulkhead coaxial cable lightning arrestor, and a power line lightning arrestor as specified earlier.

The CTU antenna(s) shall be mounted on a 10' long X 1-1/2" diameter mast secured to the side of the structure or on a 40' antenna tower with rigid conduit and a weather-head run to the CTU-PLC enclosure. The antennas should be mounted as close as possible to the CTU-PLC enclosure.

B. Front Panel Display Requirements:

1. Keypad & Display assembly to display all inputs and output status

C. Discrete Outputs:

1. – 16. Please Refer to I/O Table in Section 4.4

D. Discrete Inputs:

1. – 16. Please Refer to I/O Table in Section 4.4

E. Analog Inputs:

1. – 4. Please Refer to I/O Table in Section 4.4

F. RS-485 / Ethernet IP Network Communication:

1. The SBR PLC I/O shall be networked to the Central PLC-RTU. Please Refer to the SBR I/O Table in Section 4.4

4.4 WWTP PLC-RTU INPUTS/OUTPUTS REQUIREMENTS:

Location	Equipment	Function	Type	Notes
Inf EQ	Mixing Pump	Call to run	DO	Remote
Inf EQ	Mixing Pump	Run status	DI	Remote
Inf EQ	Mixing Pump	Common alarm	DO	Remote
Inf EQ	Mixing Pump	Seal fail	DI	
Inf EQ	Mixing Pump	Seal fail alarm light	DO	
Inf EQ	Transfer Pump 1	Call to run	DO	Remote
Inf EQ	Transfer Pump 1	Run status	DI	Remote
Inf EQ	Transfer Pump 1	Common alarm	DO	Remote
Inf EQ	Transfer Pump 1	Seal fail	DI	
Inf EQ	Transfer Pump 1	Seal fail alarm light	DO	
Inf EQ	Transfer Pump 1	in Auto'	DI	Remote
Inf EQ	Transfer Pump 2	Call to run	DO	Remote
Inf EQ	Transfer Pump 2	Run status	DI	Remote
Inf EQ	Transfer Pump 2	Common alarm	DO	Remote
Inf EQ	Transfer Pump 2	Seal fail	DI	
Inf EQ	Transfer Pump 2	Seal fail alarm light	DO	
Inf EQ	Transfer Pump 2	in Auto'	DI	Remote
Inf EQ	Influent EQ float	Emergency high level	DI	Remote
Inf EQ	Influent EQ float	Pump cutout/low level	DI	Remote
Inf EQ	Influent EQ	Level	AI	Remote
SBR	SBR 1 Motive Pump	Call to run	DO	Remote
SBR	SBR 1 Motive Pump	Run status	DI	Remote
SBR	SBR 1 Motive Pump	Common alarm	DO	Remote
SBR	SBR 1 Motive Pump	Seal fail	DI	
SBR	SBR 1 Motive Pump	Seal fail alarm light	DO	
SBR	SBR 2 Motive Pump	Call to run	DO	Remote
SBR	SBR 2 Motive Pump	Run status	DI	Remote
SBR	SBR 2 Motive Pump	Common alarm	DO	Remote
SBR	SBR 2 Motive Pump	Seal fail	DI	
SBR	SBR 2 Motive Pump	Seal fail alarm light	DO	
SBR	SBR 1 Sludge Pump	Call to run	DO	Remote
SBR	SBR 1 Sludge Pump	Run status	DI	Remote
SBR	SBR 1 Sludge Pump	Common alarm	DO	Remote
SBR	SBR 1 Sludge Pump	Seal fail	DI	
SBR	SBR 1 Sludge Pump	Seal fail alarm light	DO	
SBR	SBR 2 Sludge Pump	Call to run	DO	Remote
SBR	SBR 2 Sludge Pump	Run status	DI	Remote
SBR	SBR 2 Sludge Pump	Common alarm	DO	Remote
SBR	SBR 2 Sludge Pump	Seal fail	DI	
SBR	SBR 2 Sludge Pump	Seal fail alarm light	DO	
SBR	SBR Blower 1	Call to run	DO	Remote
SBR	SBR Blower 1	Run status	DI	Remote
SBR	SBR Blower 1	Common alarm	DO	Remote
SBR	SBR Blower 1	in Auto'	DI	Remote
SBR	SBR Blower 2	Call to run	DO	Remote
SBR	SBR Blower 2	Run status	DI	Remote
SBR	SBR Blower 2	Common alarm	DO	Remote
SBR	SBR Blower 2	in Auto'	DI	Remote
SBR	SBR 1 Influent Valve	Call to open/close	DO	Remote
SBR	SBR 1 Influent Valve	Open status	DI	Remote
SBR	SBR 1 Influent Valve	Close status	DI	Remote
SBR	SBR 1 Influent Valve	Common alarm	DO	Remote
SBR	SBR 2 Influent Valve	Call to open/close	DO	Remote
SBR	SBR 2 Influent Valve	Open status	DI	Remote
SBR	SBR 2 Influent Valve	Close status	DI	Remote
SBR	SBR 2 Influent Valve	Common alarm	DO	Remote
SBR	SBR 1 Effluent Valve	Call to open/close	DO	Remote
SBR	SBR 1 Effluent Valve	Open status	DI	Remote
SBR	SBR 1 Effluent Valve	Close status	DI	Remote
SBR	SBR 1 Effluent Valve	Common alarm	DO	Remote
SBR	SBR 2 Effluent Valve	Call to open/close	DO	Remote
SBR	SBR 2 Effluent Valve	Open status	DI	Remote
SBR	SBR 2 Effluent Valve	Close status	DI	Remote
SBR	SBR 2 Effluent Valve	Common alarm	DO	Remote
SBR	SBR 1 Air Valve	Call to open/close	DO	Remote
SBR	SBR 1 Air Valve	Open status	DI	Remote
SBR	SBR 1 Air Valve	Close status	DI	Remote
SBR	SBR 1 Air Valve	Common alarm	DO	Remote
SBR	SBR 2 Air Valve	Call to open/close	DO	Remote
SBR	SBR 2 Air Valve	Open status	DI	Remote
SBR	SBR 2 Air Valve	Close status	DI	Remote
SBR	SBR 2 Air Valve	Common alarm	DO	Remote
SBR	SBR 1 float	Emergency high level	DI	Remote
SBR	SBR 1	Level	AI	Remote
SBR	SBR 1	D.O	AI	Remote
SBR	SBR 2 float	Emergency high level	DI	Remote
SBR	SBR 2	Level	AI	Remote
SBR	SBR 2	D.O	AI	Remote
Digester	Digester Blower 1	Call to run	DO	Remote
Digester	Digester Blower 1	Run status	DI	Remote
Digester	Digester Blower 1	Common alarm	DO	Remote
Digester	Digester Blower 1	in Auto'	DI	Remote
Digester	Digester Blower 2	Call to run	DO	Remote
Digester	Digester Blower 2	Run status	DI	Remote
Digester	Digester Blower 2	Common alarm	DO	Remote
Digester	Digester Blower 2	in Auto'	DI	Remote
Digester	Digester float	Emergency high level	DI	Remote
Digester	Digester	Level	AI	Remote

4.5 WWTP CENTRAL UNIT SOFTWARE REQUIREMENTS:

A. Installation Requirements:

The CTU shall communicate with the remote PLC/RTUs via VHF/UHF radio frequency data network. The Systems Integrator shall provide the communications cable to link the PLCs into a wired local area network.

B. Operator Workstation Requirements:

The WWTP workstation will include the desktop computer system and SCADA HMI software (as detailed earlier). This workstation will be the primary control/monitoring/alarm station for the SCADA system. This workstation will include all standard day-to-day operation duties, Web Access – primarily for remote control at Pikeville Water District, and alarm dialer duties. This workstation shall meet the specification as detailed previously.

Section-16800

Emergency Generator

SECTION 16800

EMERGENCY GENERATOR

Part 1. **GENERAL**

1.01 Scope

A. Provide complete factory assembled generator set equipment with digital (microprocessor-based) electronic controls.

B. Provide factory test, startup by a supplier authorized by the manufacturer, and on-site testing of the system.

C. The generator set manufacturer shall warrant all equipment provided under this section, whether or not is manufactured by the generator set manufacturer, so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator sets.

1.02 Codes and Standards

A. The generator set installation and on-site testing shall conform to the requirements of the following codes and standards, as applicable. The generator set shall include necessary features to meet the requirements of these standards.

1. CSA 282, 1989 Emergency Electrical Power Supply for Buildings
2. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
3. NFPA37 –
4. NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
5. NFPA99 – Essential Electrical Systems for Health Care Facilities
6. NFPA110 – Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.

B. The generator set and supplied accessories shall meet the requirements of the following standards:

1. NEMA MG1-1998 part 32. Alternator shall comply with the requirements of this standard.
2. UL142 – Sub-base Tanks
3. UL1236 – Battery Chargers
4. UL2200. The generator set shall be listed to UL2200 or submit to an independent third party certification process to verify compliance as installed.

C. The control system for the generator set shall comply with the following requirements.

1. CSA C22.2, No. 14 – M91 Industrial Control Equipment.
2. EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.
3. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
4. FCC Part 15, Subpart B.
5. IEC8528 part 4. Control Systems for Generator Sets
6. IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.
7. UL508. The entire control system of the generator set shall be UL508 listed and labeled.

8. UL1236 –Battery Chargers.

D. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.03 **Acceptable Manufacturers**

Only approved bidders shall supply equipment provided under this contract. Equipment specifications for this project are based on microprocessor-based generator sets manufactured by Cummins Power Generation. Equipment by other suppliers that meets the requirement of this specification are acceptable, if approved not less than 2 weeks before scheduled bid date. Proposals must include a line by line compliance statement based on this specification.

Part 2. **PRODUCTS**

2.01 Generator set

A. Ratings

1. The generator set shall operate at 1800 rpm and at a voltage of: 120/208 Volts AC, Three phase, 4-wire, 60 hertz.
2. The generator set shall be rated at 150 kW.
3. The generator set rating shall be based on emergency/standby service.

B. Performance

1. Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load for both parallel and non-parallel applications. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.
2. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.
3. The engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.
4. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic. Telephone influence factor shall be less than 40.

C. Construction

1. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails
2. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight, and the enclosure door shall be gasketed. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.

D. Connections

1. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept mechanical or compression terminations of the number and type as shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.

2. Power connections to auxiliary devices shall be made at the devices, with required protection located at a wall-mounted common distribution panel.

3. Generator set control interfaces to other system components shall be made on a common, permanently labeled terminal block assembly.

2.02 Engine and Engine Equipment

A. The engine shall be natural gas fueled, radiator and fan cooled. Complete engine fuel system, including all pressure regulators, strainers, and control valves. The fuel system shall be plumbed to the generator set skid for ease of site connections to the generator set.

B. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous or parallel states.

C. Skid-mounted radiator and cooling system rated for full load operation in 104 degrees F (40 degrees C) ambient as measured at the generator air inlet, based on 0.5 in H_2O external static head. Radiator shall be sized based on a core temperature that is 20F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The equipment manufacturer shall fill the cooling system with a 50/50-ethylene glycol/water mixture. Rotating parts shall be guarded against accidental contact.

D. Electric starter(s) capable of three complete cranking cycles without overheating.

E. Positive displacement, mechanical, full pressure, lubrication oil pump.

F. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.

G. Replaceable dry element air cleaner with restriction indicator.

H. Flexible fuel lines.

I. Engine mounted battery charging alternator, 40-ampere minimum, and solid-state voltage regulator.

J. Coolant heater

1. Engine mounted, thermostatically controlled, coolant heater(s) for each engine. Heater voltage shall be as shown on the project drawings. The coolant heater shall be UL499 listed and labeled.

2. The coolant heater shall be installed on the engine with high temperature silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall be installed using quick disconnect couplers to isolate the heater for replacement of the heater element. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.

3. The coolant heater shall be provided with a 24VDC thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the coolant heater system.

4. The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 100F (40C) in a 40F ambient, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this specification.

K. Provide vibration isolators, spring/pad type or as recommended by the manufacturer, quantity as recommended by the generator set manufacturer. Isolators shall include seismic restraints if required by site location.

L. Starting and Control Batteries shall be calcium/lead antimony type, 24 volt DC, sized as recommended by the engine manufacturer, complete with battery cables and connectors.

M. Provide exhaust silencer(s) for each engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. The mufflers shall be critical grade. Exhaust system shall be installed according to the engine manufacturer's recommendations and applicable codes and standards.

N. Provide a minimum 12 amp battery charger for each generator set battery bank. Generator sets incorporating two battery banks shall be provided with two chargers connected together and operating in parallel, with alarm output(s) connected in parallel. The charger(s) shall include the following capabilities:

1. Chargers shall be UL 1236-BBHH listed and CSA or CUL certified for use in emergency applications.
2. The charger shall be compliant with UL991 requirements for vibration resistance.
3. The charger shall comply with the requirements of EN61000-4-5 for voltage surge resistance; EN50082-2 for immunity; EN61000-4-2 for ESD; EN61000-4-3 for radiated immunity; ANSI/IEEE C62.41 category B and IN61000-4-4 for electrically fast transient; EN61000-4-6 for conducted emissions; and FCC Part 15 Class A for radiated emissions.
4. The charger shall be capable of charging a fully discharged battery without damage to the charger. It shall be capable of returning a fully discharged battery to fully charged condition within 24 hours. The charger shall be UL-labeled with the maximum battery amp-hour rating that can be recharged within 24 hours.
5. The charger shall incorporate a 4-state charging algorithm, to provide trickle charge rate to restore fully discharged batteries, a bulk charge rate to provide fastest possible recharge after normal discharge, an absorption state to return the battery to 100 percent of charge, and a float stage to maintain a fully charge battery and supply battery loads when the generator set is not operating. In addition; the charger shall include an equalization timer. Charge rates shall be temperature compensated based on the temperature directly sensed at the battery.
6. The DC output voltage regulation shall be within plus or minus 1%. The DC output ripple current shall not exceed 1 amp at rated output current level.
7. The charger shall include the following features:
   a) two line alphanumeric display with programming keys to allow display of DC output ammeter and voltmeters (5% accuracy or better), display alarm messages, and perform programming;
   b) LED indicating lamp(s) to indicating normal charging condition (green), equalize charge state (amber), and fault condition (red);
   c) AC input overcurrent, over voltage, and undervoltage protection;
   d) DC output overcurrent protection;
   e) Alarm output relay
   f) Corrosion resistant aluminum enclosure

2.03 **AC Generator**

A. The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 105 degrees Centigrade.

B. The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.

C. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.

D. The subtransient reactance of the alternator shall not exceed 15 percent, based on the standby rating of the generator set.

E. The alternator shall be capable of operation with reverse kVAR of 0.15 per unit.

2.04 **Generator set Control**. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.

The control shall be mounted on the generator set, or may be mounted in a free-standing panel next to the generator set if adequate space and accessibility is available. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

The generator set mounted control shall include the following features and functions:

A. Control Switches

1. Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or MANUAL position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. A separate push-button to initiate starting is acceptable. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
2. EMERGENCY STOP switch. Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
3. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
4. PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

B. Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:

1. Digital metering set, 1% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.
2. Analog voltmeter, ammeter, frequency meter, power factor meter, and kilowatt (KW) meter. Voltmeter and ammeter shall display all three phases. Meter scales shall be color coded in the following fashion: green shall indicate normal operating condition, amber shall indicate operation in ranges that indicate potential failure, and red shall indicate failure impending. Metering accuracy shall be within 1% at rated output. Both analog and digital metering are required.
3. The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.
4. The control system shall log total number of operating hours, total kWH, and total control on hours, as well as total values since reset.

C. Generator Set Alarm and Status Display.

1. The generator set control shall include LED alarm and status indication lamps. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. Functions indicated by the lamps shall include:

   - The control shall include five configurable alarm-indicating lamps. The lamps shall be field adjustable for any status, warning, or shutdown function monitored by the genset. They shall also be configurable for color, and control action (status, warning, or shutdown).
   - The control shall include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at the generator set. The running signal shall be based on actual sensed voltage and frequency on the output terminals of the generator set.
   - The control shall include a flashing red lamp to indicate that the control is not in automatic state, and red common shutdown lamp.
   - The control shall include an amber common warning indication lamp.

2. The generator set control shall indicate the existence of the warning and shutdown conditions on the control panel. All conditions indicated below for warning shall be field-configurable for shutdown. Conditions required to be annunciated shall include:

   low oil pressure (warning)
   low oil pressure (shutdown)
   oil pressure sender failure (warning)
   low coolant temperature (warning)
   high coolant temperature (warning)
   high coolant temperature (shutdown)
   high oil temperature (warning)
   engine temperature sender failure (warning)
   low coolant level (warning)
   fail to crank (shutdown)
   fail to start/overcrank (shutdown)
   overspeed (shutdown)
   low DC voltage (warning)
   high DC voltage (warning)
   weak battery (warning)
   low fuel-daytank (warning)
   high AC voltage (shutdown)
   low AC voltage (shutdown)
   under frequency (shutdown)
   over current (warning)
   over current (shutdown)
   short circuit (shutdown)
   over load (warning)
   emergency stop (shutdown)
   (4) configurable conditions

3. Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

D. Engine Status Monitoring.

1. The following information shall be available from a digital status panel on the generator set control :

   engine oil pressure (psi or kPA)
   engine coolant temperature (degrees F or C)
   engine oil temperature (degrees F or C)

engine speed (rpm)
number of hours of operation (hours)
number of start attempts
battery voltage (DC volts)

2. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

E. Engine Control Functions.

1. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.
2. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.
3. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.
4. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
5. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

F. Alternator Control Functions:

1. The generator set shall include a full wave rectified automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase line to neutral RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.
2. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445. The protection for this function shall be 3rd party certified to very performance.
3. Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445. The protection for this function shall be 3rd party certified to very performance.
4. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5

seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

5. An line to neutral sensing AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

G. Other Control Functions

1. The generator set shall be provided with a network communication module to allow LonMark compliant communication with the generator set control by remote devices. The control shall communicate all engine and alternator data, and allow starting and stopping of the generator set via the network in both test and emergency modes.

2. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC. During engine cranking (starter engaged), the low voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

H. Control Interfaces for Remote Monitoring:

1. The control system shall provide four programmable output relays. These relay outputs shall be configurable for any alarm, shutdown, or status condition monitored by the control. The relays shall be configured to indicate: (1) generator set operating at rated voltage and frequency, (2) common warning, (3) common shutdown, (4) load shed command.

2. A fused 10 amp switched 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.

3. A fused 10 amp 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.

4. The control shall be provided with a direct serial communication link for the LonWorks communication network interface as described elsewhere in this specification and shown on the drawings.

2.05 **Other equipment to be provided with the generator set**

A. Provide and install a 20-light LED type remote alarm annunciator with horn, located as shown on the drawings or in a location that can be conveniently monitored by facility personnel. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems for the local generator control panel. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA110 3-5.6.2. The interconnecting wiring between the annunciator and other system components shall be monitored and failure of the interconnection between components shall be displayed on the annunciator panel.

B. The annunciator shall include the following alarm labels, audible annunciation features, and lamp colors:

Condition	Lamp Color	Audible Alarm
Normal Power (to Loads)	Green	No
Genset Supplying Load	Amber	No
Genset Running	Green	No
Not in Auto	Red (Flashing)	Yes
High Battery Voltage	Red	Yes
Low Battery Voltage	Red	Yes

Charger AC Failure	Red	Yes
Fail to Start	Red	Yes
Low Engine Temperature	Amber	Yes
Pre-High Engine Temperature	Amber	Yes
High Engine Temperature	Red	Yes
Pre-Low Oil Pressure	Amber	Yes
Low Oil Pressure	Red	Yes
Overspeed	Red	Yes
Low Coolant Level	Amber	Yes
Low Fuel Pressure	Amber	Yes
Network OK	Green	Yes
(4) Spares	Configurable	Configurable

Low battery voltage lamp shall also be lighted for low cranking voltage or weak battery alarm.

C. The generator set shall be provided with a mounted main line circuit breaker, sized to carry the rated output current of the generator set. The circuit breaker shall incorporate an electronic trip unit that operates to protect the alternator under all overcurrent conditions, or a thermal-magnetic trip with other overcurrent protection devices that positively protect the alternator under overcurrent conditions. The supplier shall submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided.

D. Outdoor Weather-Protective Enclosure

1. The generator set shall be provided with an outdoor enclosure, with the entire package listed under UL2200. The package shall comply with the requirements of the National Electrical Code for all wiring materials and component spacing. The total assembly of generator set, enclosure, and sub-base fuel tank (when used) shall be designed to be lifted into place using spreader bars. Housing shall provide ample airflow for generator set operation at rated load in an ambient temperature of 100F. The housing shall have hinged access doors as required to maintain easy access for all operating and service functions. All doors shall be lockable, and include retainers to hold the door open during service. Enclosure roof shall be cambered to prevent rainwater accumulation. Openings shall be screened to limit access of rodents into the enclosure. All electrical power and control interconnections shall be made within the perimeter of the enclosure.

2. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturers standard color using a two step electrocoating paint process, or equal meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating that meets the following requirements:

   Primer thickness, 0.5-2.0 mils. Top coat thickness, 0.8-1.2 mils.

   Gloss, per ASTM D523-89, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.

   Crosshatch adhesion, per ASTM D3359-93, 4B-5B.

   Impact resistance, per ASTM D2794-93, 120-160 inch-pounds.

   Salt Spray, per ASTM B117-90, 1000+ hours.

   Humidity, per ASTM D2247-92, 1000+ hours.

   Water Soak, per ASTM D2247-92, 1000+ hours.

3. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.
4. Enclosure shall be constructed of minimum 12 gauge steel for framework and 14 gauge steel for panels. All hardware and hinges shall be stainless steel.
5. A factory-mounted exhaust silencer shall be installed inside the enclosure. The exhaust shall exit the enclosure through a rain collar and terminate with a rain cap. Exhaust connections to the generator set shall be through seamless flexible connections.
6. The enclosure shall include the following maintenance provisions:
   - Flexible coolant and lubricating oil drain lines, that extend to the exterior of the enclosure, with internal drain valves
   - External radiator fill provision.
7. The generator set shall be provided with a sound-attenuated housing which allows the generator set to operate at full rated load in an ambient temperature of up to 100F. The enclosure shall reduce the sound level of the generator set while operating at full rated load to a maximum of 72 dBA at any location 7 meters from the generator set in a free field environment.
8. The enclosure shall be insulated with non-hydroscopic materials.

Part 3. OPERATION

3.01 Sequence of Operation

A. Generator set shall start on receipt of a start signal from remote equipment. The start signal shall be via hardwired connection to the generator set control and a redundant signal over the required network connection.

B. The generator set shall complete a time delay start period as programmed into the control.

C. The generator set control shall initiate the starting sequence for the generator set. The starting sequence shall include the following functions:

1. The control system shall verify that the engine is rotating when the starter is signaled to operate. If the engine does not rotate after two attempts, the control system shall shut down and lock out the generator set, and indicate "fail to crank" shutdown.
2. The engine shall fire and accelerate as quickly as practical to start disconnect speed. If the engine does not start, it shall complete a cycle cranking process as described elsewhere in this specification. If the engine has not started by the completion of the cycle cranking sequence, it shall be shut down and locked out, and the control system shall indicate "fail to start".
3. The engine shall accelerate to rated speed and the alternator to rated voltage. Excitation shall be disabled until the engine has exceeded programmed idle speed, and regulated to prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.

D. On reaching rated speed and voltage, the generator set shall operate as dictated by the control system in isochronous, synchronize, load share, load demand, or load govern state.

E. When all start signals have been removed from the generator set, it shall complete a time delay stop sequence. The duration of the time delay stop period shall be adjustable by the operator.

F. On completion of the time delay stop period, the generator set control shall switch off the excitation system and shall shut down.

1. Any start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.

Part 4. OTHER REQUIREMENTS

4.01 Submittals. Within 10 days after award of contract, provide six sets of the following information for review:

- Manufacturer's product literature and performance data, sufficient to verify compliance to specification requirements.
- A paragraph by paragraph specification compliance statement, describing the differences between the specified and the proposed equipment.
- Manufacturer's certification of prototype testing.
- Manufacturer's published warranty documents.
- Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.
- Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.
- Manufacturer's installation instructions.

4.02 **Factory Testing.**

A. The generator set supplier shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided. Equipment supplied shall be fully tested at the factory for function and performance.

B. Factory testing may be witnessed by the owner and consulting engineer. Costs for travel expenses will be the responsibility of the owner and consulting engineer. Supplier is responsible to provide two weeks notice for testing.

C. Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns.

4.03 **Installation**

A. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

B. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

C. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.

D. Equipment shall be initially started and operated by representatives of the manufacturer.

E. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to final testing of the system.

4.04 **On-Site Acceptance Test**:

A. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.

B. Installation acceptance tests to be conducted on-site shall include a "cold start" test, a two hour full load test, and a one step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.

C. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

4.05 **Training**

A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

4.06 **Service and support**

A. The manufacturer of the generator set shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.

B. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.

C. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

4.07 **Warranty**

A. The generator set and associated equipment shall be warranted for a period of not less than 5 years from the date of commissioning against defects in materials and workmanship.

B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

Section-16825

Automatic Transfer Switch

SECTION 16825

AUTOMATIC TRANSFER SWITCH

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes transfer switches rated 250 V and less, including the following:

1. Service Entrance Rated Automatic transfer switches

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

1. Technical data on all major components of all transfer switches and other products described in this section. Data is required for the transfer switch mechanism, control system, cabinet, and protective devices specifically listed for use with each transfer switch. Include steady state and fault current ratings, weights, operating characteristics, and furnished specialties and accessories.

2. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Dimensioned outline drawings of assembly, including elevations, sections, and details including minimal clearances, conductor entry provisions, gutter space, installed features and devices and material lists for each switch specified.
2. Internal electrical wiring and control drawings.
3. Interconnection wiring diagrams, showing recommended conduit runs and point-to-point terminal connections to generator set.
4. Installation and mounting instructions, including information for proper installation of equipment to meet seismic requirements.

C. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Seismic certification, as required for site conditions. Seismic certifications shall be third-party certified, and based on testing. Certification based on calculations does not meet this requirement.

    a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational *both during and after* the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Manufacturer and Supplier Qualification Data

1. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.
2. The manufacturer of this equipment shall have produced similar equipment for a minimum period of 10 years. When requested, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

E. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays, timers and protective devices; provide setting and calibration instructions where applicable.

F. Warranty documents demonstrating compliance with the project's contract requirements.

1.4 QUALITY ASSURANCE

A. Only approved bidders shall supply equipment provided under this contract.

B. Manufacturer Qualifications: The equipment supplier shall maintain a service center capable of providing training, parts, maintenance and emergency repairs to equipment, including transfer switch generator sets and remote monitoring equipment (if applicable) at the site within a response period of less than eight hours from time of notification.

1. The transfer switch shall be serviced by technicians employed by, and specially trained and certified by, the generator set supplier and the supplier shall have a service organization that is factory-certified in both generator set and transfer switch service. The supplier shall maintain an inventory of critical replacement parts at the local service

organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.

2. Submit names, experience level, training certifications, and locations for technicians that will be responsible for servicing equipment at this site.
3. The manufacturer shall maintain model and serial number records of each transfer switch provided for at least 20 years.

C. Source Limitations: All transfer switches are to be obtained through one source from a single manufacturer. The generator set manufacturer shall warrant transfer switches to provide a single source of responsibility for products provided.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked as suitable for use in emergency, legally required or optional standby use as appropriate for the connected load.

E. The automatic transfer switch installation and application shall conform to the requirements of the following codes and standards:

1. Transfer switches and enclosures shall be UL 1008 listed and labeled as suitable for use in emergency, legally required, and optional standby applications.
2. CSA 282, Emergency Electrical Power Supply for Buildings, and CSA C22.2, No. 14-M91 Industrial Control Equipment
3. NFPA 70, National Electrical Code. Equipment shall be suitable for use in systems in compliance with Articles 700, 701 and 702.
4. Comply with NEMA ICS 10-1993 AC Automatic Transfer Switches
5. IBC 2006 – The transfer switch(es) shall be prototype-tested and third-party certified to comply with the requirements of IBC group III or IV, Category D/F. The equipment shall be shipped with the installation instructions necessary to attain installation compliance
6. IEEE 446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
7. EN55011, Class B Radiated Emissions and Class B Conducted Emissions
8. IEC 1000-4-5 (EN 61000-4-5); AC Surge Immunity
9. IEC 1000-4-4 (EN 61000-4-4) Fast Transients Immunity
10. IEC 1000-4-2 (EN 61000-4-2) Electrostatic Discharge Immunity
11. IEC 1000-4-3 (EN 61000-4-3) Radiated Field Immunity
12. IEC 1000-4-6 Conducted Field Immunity
13. IEC 1000-4-11 Voltage Dip Immunity
14. IEEE 62.41, AC Voltage Surge Immunity
15. IEEE 62.45, AC Voltage Surge Testing

F. Comply with NFPA 99 – Essential Electrical Systems for Healthcare Facilities

G. Comply with NFPA 110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems, regardless of the actual circuit level.

H. The manufacturer shall warrant the material and workmanship of the transfer switch equipment for a minimum of one (1) year from registered commissioning and start-up, or eighteen (18) months from date of shipment.

I. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, and etc. during the minimum noted warranty period described above.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:

1. Notify (Architect/Construction Manager/Owner) no fewer than (insert appropriate number) days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without (Architect/Construction Manager/Owner's) written permission.
3. Do not energize any new service or distribution equipment without notification and permission of the (Architect/Construction Manager/Owner).

1.6 COORDINATION

A. Size and location of concrete bases and anchor bolt inserts shall be coordinated. Concrete, reinforcement and formwork must meet the requirements specified in Division 03. See section 3.1 for additional information on installation

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cummins Power Generation
2. Russelectric
3. ASCO
4. Generac

B. Equipment specifications for this Project are based on automatic transfer switches manufactured by Cummins Power Generation. Switches manufactured by Russelectric or ASCO that meet the requirement of this specification are acceptable, if approved not less than two weeks before scheduled bid date. Proposals must include a line-by-line compliance statement based on this specification.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Provide transfer switches in the number and ratings that are shown on the drawings. 800A (80% rated) or 600A (100% rated), 120/208V three phase NEMA 3R SERVICE ENTRANCE RATED. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer.

B. Fault-Current Closing and Withstand Ratings: UL 1008 WCR ratings must be specifically listed as meeting the requirements for use with protective devices at installation locations, under specified fault conditions. Withstand and closing ratings shall be based on use of the same set of contacts for the withstand test and the closing test.

C. Solid-State Controls: All settings should be accurate to +/- 2% or better over an operating temperature range of - 40 to + 60 degrees C (- 40 to + 140 degrees F).

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplished by a non-fused, momentarily energized solenoid or electric motor operator mechanism, mechanically and electrically interlocked in both directions (except that mechanical interlock is not required for closed transition switches).

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
   1. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the Source 1 and Source 2 positions.
   2. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.
   3. Contacts shall be operated by a high-speed electrical mechanism that causes contacts to open or close within three electrical cycles from signal.
   4. The transfer switch operation shall include the ability to switch to an open position (both sources disconnected) for the purpose of load shedding from the generator set.
   5. The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical, but must be coordinated with control function.
   6. Transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with components that could be operating at line voltage levels.
   7. The transfer switch shall include the mechanical and control provisions necessary to allow the device to be field-configured for operating speed. Transfer switch operation with motor loads shall be as is recommended in NEMA MG1.
      a. Phase angle monitoring/timing equipment is not an acceptable substitute for this functionality
   8. Transfer switches designated on the drawings as "service entrance" switches shall meet the requirements of section 2.7 of this specification.

G. Control: Transfer switch control shall be capable of communicating with the genset control, other switches and remote programming devices over a high-speed network interface.

H. Factory wiring: Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism

I. Terminals: Terminals shall be pressure type and appropriate for all field wiring. Terminal arrangement and cabinet space must be such that feeder conductors can enter from the top, side or bottom of the switch, at the installer's discretion. Control wiring shall be equipped with suitable lugs, for connection to terminal strips.

J. Enclosures: All enclosures shall be third-party certified for compliance to NEMA ICS 6 and UL 508, unless otherwise indicated:

1. The enclosure shall provide wire bend space in compliance to the latest version of NFPA70, regardless of the direction from which the conduit enters the enclosure.
2. Exterior cabinet doors shall provide complete protection for the system's internal components. Doors must have permanently mounted key-type latches. Bolted covers or doors are not acceptable.
3. Transfer switches shall be provided in enclosures that are third party certified for their intended environment per NEMA requirements.
   a. Transfer switches located outdoors shall be supplied in NEMA Type 3R (IEC IP34) when dust-proof and/or rain-proof enclosures are required.

2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with requirements for Level 1 equipment according to NFPA 110.

B. Indicated current ratings:

1. Refer to the Project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosure type, and accessories.
2. Main contacts shall be rated for 600 VAC minimum.
3. Transfer switches shall be rated to carry 100% of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C (-40 to +140 degrees F), relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000 meters).

C. Manual Switch Operation: The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical, but must be coordinated with control function

D. Relay Signal: Control shall include provisions for addition of a pre-transfer relay signal, adjustable from 0 to 60 seconds, to be provided if necessary for elevator operation, based on equipment provided for the project..

E. Control: Transfer switch control shall be provided with necessary equipment and software to communicate with the genset control, other transfer switches, remote annunciation equipment, and other devices over a high speed control network.

F. Neutral Switching: Transfer switches designated on the drawings as 4-pole shall be provided with a switched neutral pole. The neutral pole shall be of the same construction and have the same ratings as the phase poles. All poles shall be switched simultaneously using a common crossbar. Substitute equipment using overlapping neutral contacts is not acceptable.

G. Transfer switches that are designated on the drawings as 3-pole shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.

H. The transfer switch physically located closest to the generator and not more than 50 ft (15 meters) away, except those served by generator paralleling equipment, shall be provided with a battery charger suitable for the requirements of the application and in compliance with NFPA 110 requirements for Level 1 systems. If no transfer switch is located within this distance, a battery charger shall be installed on the generator set.

I. Automatic Transfer Switch Control Features

1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600 VAC. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.
2. All transfer switch sensing shall be configurable from an operator panel or from a Windows XP or later PC-based service tool. Designs utilizing DIP switches or other electromechanical devices are not acceptable.
3. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device for load shedding purposes. On receipt of this signal, the transfer switch shall switch to a neutral position when connected to Source 2. If Source 1 is available when the load-shed signal is received, the transfer switch shall connect to Source 1.
4. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device to prevent transfer to the generator service.
5. The transfer switch shall provide a relay contact signal prior to transfer or re-transfer. The time period before and after transfer shall be adjustable in a range of 0 to 50 seconds.
6. The control system shall be designed and prototype tested for operation in ambient temperatures from - 40 degrees C to + 60 degrees C (- 40 to +140 degrees F). It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.
7. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.
8. The transfer switch network monitoring equipment, when supplied, shall be provided with a battery-based auxiliary power supply to allow monitoring of the transfer switch when both AC power sources are non-operational. The battery power supply shall be monitored for proper condition, and the transfer switch shall include an alarm condition to indicate low battery condition.

J. Transfer Switch Control Panel: The transfer switch shall have a microprocessor-based control with a sealed membrane panel incorporating pushbuttons for operator-controlled functions, and LED lamps for system status indicators. The panel shall also include an alphanumeric display for detailed system information. Panel display and indicating lamps shall include permanent labels.

1. The indicator panel LEDs shall display:

   a. Which source the load is connected to (Source 1 or Source 2)
   b. Which source or sources are available

c. When switch is not set for automatic operation, because the control is disabled or the bypass switch is in use
d. When the switch is in test/exercise mode

2. The indicator shall have pushbuttons that allow the operator to activate the following functions:

a. Activate pre-programmed test sequence
b. Override programmed delays, and immediately go to the next operation
c. Reset the control by clearing any faults
d. Test all of the LEDs by lighting them simultaneously

3. The alphanumeric digital display shall be vacuum fluorescent-type, clearly visible in both bright sunlight and no-light conditions over an angle of 120 degrees, and shall display the following:

a. AC voltage for all phases, normal and emergency
b. Source status: connected or not connected.
c. Load data, including voltage, AC current, frequency, KW, KVA, and power factor.

4. The display panel shall be password-protected, and allow the operator to view and make adjustments:

a. Set nominal voltage and frequency for the transfer switch
b. Adjust voltage and frequency sensor operation set points
c. Set up time clock functions
d. Set up load sequence functions
e. Enable or disable control functions including program transition
f. View real-time clock data, operation log (hours connected, times transferred, failures) and service history

K. Control Functions: Functions managed by the control shall include:

1. Software adjustable time delays:

a. Engine start (prevents nuisance genset starts in the event of momentary power fluctuation): 0 to 120 seconds (default 3 sec)
b. Transfer normal to emergency (allows genset to stabilize before load is transferred): 0 to 120 seconds (default 3 sec)
c. Re-transfer emergency to normal (allows utility to stabilize before load is transferred from genset): 0 to 30 minutes (default 3 sec)
d. Engine cooldown: 0 to 30 minutes (default 10 min)
e. Programmed transition: 0 to 60 seconds (default 3 sec)

2. Undervoltage sensing: three-phase normal, three-phase emergency source.

a. Pickup: 85 to 98% of nominal voltage (default 90%)
b. Dropout: 75 to 98% of nominal voltage (default 90%)
c. Dropout time delay: 0.1 to 1.0 seconds (default 0.5 sec)
d. Accurate to within +/- 1% of nominal voltage

3. Over-voltage sensing: three-phase normal, three-phase emergency source.

    a. Pickup: 95 to 99% of dropout setting (default 95%)
    b. Dropout: 105 to 135% of nominal voltage (default 110%)
    c. Dropout time delay: 0.5 to 120 seconds (default 3 sec)
    d. Accurate to within +/- 1% of nominal voltage

4. Over/under frequency sensing:

    a. Pickup: +/- 5 to +/-20% of nominal frequency (default 10%)
    b. Dropout: +/-1% beyond pickup (default 1%)
    c. Dropout time delay: 0.1 to 15.0 seconds (default 5 sec)
    d. Accurate to within +/- 0.2%

5. Voltage imbalance sensing:

    a. Dropout: 2 to 10% (default 4%)
    b. Pickup: 90% of dropout
    c. Time delay: 2.0 to 20 seconds (default 5 sec)

6. Phase rotation sensing:

    a. Time delay: 100 msec

7. Loss of single-phase detection:

    a. Time delay: 100 msec

L. Control features shall include:

1. Programmable genset exerciser: A field-programmable control shall periodically start the generator, transfer the load to generator for a preset time, then re-transfer and shut down the generator after a preset cool-down period.

    a. Push-button programming control shall have a selection of eight different schedules for exercising generator, with or without load.

2. In event of a loss of power to the control, all control settings, real-time clock setting and the engine start-time delay setting will be retained.
3. The system continuously logs information including the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. An event recorder stores information, including time and date-stamp, for up to 50 events.
4. Transfer Override Switch: Overrides automatic re-transfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light to indicate override status.

M. Control Interface

1. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.

2. The transfer switch shall be provided with a network communication card, and configured to allow network-based communication with the transfer switch and other network system components, including the generator set(s) provided for the Project.
3. Unassigned Auxiliary Contacts: Two normally open, 1-pole, double-throw contacts for each switch position, rated 10A at 240 VAC.

N. Engine Starting Contacts

1. One isolated and normally closed, and one isolated and normally open; rated 10A at 32 VDC minimum.

2.4 SERVICE ENTRANCE TRANSFER SWITCHES

A. Transfer switches must be specifically intended for service entrance applications, and labeled "Suitable for service entrance use only"

B. Transfer switch shall meet NEC requirements for emergency, legally required and standby applications as specified in UL 1008.

C. Entire transfer switch including enclosure must be listed and labeled to UL 1008; switches with only the mechanism listed are not acceptable.

D. Molded case circuit breaker must be UL 489 listed.

2.5 REMOTE ANNUNCIATOR SYSTEM

A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:

1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
2. Switch position.
3. Switch in test mode.
4. Failure of communication link.

B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.

1. Indicating Lights: Grouped for each transfer switch monitored.
2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
3. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
4. Lamp Test: Push-to-test or lamp-test switch on front panel.

C. Malfunction of annunciator, annunciation and control panel, or communication link shall not affect functions of automatic transfer switch. In the event of failure of communication link, automatic transfer switch automatically reverts to stand-alone, self-contained operation.

D. Automatic transfer-switch sensing, controlling, or operating function shall not depend on remote panel for proper operation. The remote annunciation system shall not prevent transfer to

the alternate source when the primary power source fails, nor prevent return to the primary source if the alternate source fails

2.6 REMOTE ANNUNCIATOR AND CONTROL SYSTEM

A. Functional Description: Include the following functions for indicated transfer switches:

1. Indication of sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
2. Indication of switch position.
3. Indication of switch in test mode.
4. Indication of failure of digital communication link.

B. Malfunction of annunciator, annunciation and control panel, or communication link shall not affect functions of automatic transfer switch. In the event of failure of communication link, automatic transfer switch automatically reverts to stand-alone, self-contained operation. Automatic transfer-switch sensing, controlling, or operating function shall not depend on remote panel for proper operation.

C. Remote Annunciation and Control Panel: Solid-state components. Include the following features:

1. Controls and indicating lights grouped together for each transfer switch.
2. Label each indicating light control group. Indicate transfer switch it controls, location of switch, and load it serves.
3. Digital Communication Capability: Matched to that of transfer switches supervised.
4. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Floor-Mounting Switch: Anchor to floor by bolting.

1. Floor-mounted transfer switches (except drawout switches supported by wheeled carriages, which must be rolled out at floor level) shall be mounted on concrete bases complying with the following requirements:

a. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Division 26 Section "Hangers and Supports for Electrical Systems."

C. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

D. Identify components according to Division 26 Section "Identification for Electrical Systems."

E. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.

C. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the switch. Lugs shall be suitable for the number and size of conductors shown on the drawings.

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 SOURCE QUALITY CONTROL

A. Prior to shipping, factory shall test and inspect components, assembled switches, and associated equipment to ensure proper operation.

B. Factory shall check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements.

C. Factory shall perform dielectric strength test complying with NEMA ICS 1.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: The supplier of the transfer switch(es) and associated equipment shall inspect, test, and adjust components, assemblies, and equipment installations, including connections, and report results in writing.

B. Manufacturer's representative shall perform tests and inspections and prepare test reports.

C. After installing equipment and after electrical circuitry has been energized, installer shall test for compliance with requirements.

1. Perform recommended installation tests as recommended in manufacturer's installation and service manuals.

2. After energizing circuits, demonstrate interlocking sequence and operational function for each switch.

    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Verify time-delay settings.
    c. Verify that the transfer switch is accurately metering AC voltage and current (when provided).
    d. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
    e. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

3. Ground-Fault Tests (if integral to transfer switch): Coordinate with testing of ground-fault protective devices for power delivery from both sources.

    a. Verify grounding connections and locations and ratings of sensors.

D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 DEMONSTRATION

A. After generator set installation, the generator and transfer switch supplier shall conduct a complete operation, basic maintenance, and emergency service seminar covering generator set and transfer switch equipment, for up to 10 people employed by the Owner.

1. The seminar shall include instruction on operation of the transfer equipment, normal testing and exercise, adjustments to the control system, use of the PC based service and maintenance tools provided under this contract, and emergency operation procedures.
2. The class duration shall be at least 8 hours in length, and include practical operation with the installed equipment.

END OF SECTION

Section-16900

Camera Security System

SECTION 16900

CAMERA SECURITY SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work covered by this section of the Specifications includes the furnishing of all labor, equipment, materials, and performance of all operations associated with the installation of the camera security system as shown on the Drawings and as herein specified.

B. The requirements of the conditions of the Contract, Supplementary Conditions, and General Requirements apply to the work specified in this section.

C. All new systems furnished under this Contract shall be the same brand

E. Provide a complete IP microprocessor-controlled mega pixel camera system with all required wire, outlets and equipment, as shown on the drawings, and as herein specified to provide a complete and operational Camera security system.

1.02 SUBMITTALS

A. Data sheets shall be provided on all equipment being provided.

B. Wiring diagrams showing typical field wiring connections shall be provided.

C. Equipment list, itemizing major system components:

1. Central Equipment with equipment racks
2. Monitors
3. Cameras
4. Power Supplies
5. UPS

D. Shop Drawings shall be clearly marked and or highlighted as to which product, type, option, etc. is being submitted. Product literature with one or more styles / configurations for a single product shall have a written description of use for each of the styles / configurations represented on the literature. For example: Device boxes – Styles shall be listed as: For masonry walls, for electrical devices, for ceiling mounted light fixtures, etc

1.03 QUALITY ASSURANCE

A. The Contractor shall currently maintain a locally run business and shall be an authorized distributor of the supplied equipment with full warranty privileges.

B. The Contractor shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the equipment manufacturer to maintain and service the equipment being supplied. This facility shall be available for inspection by the engineer.

C. The supplying Contractor shallhave attended the manufacturer's installation and service school.

D. The Contractor shall furnish manufacturer's manuals of the completed system including individual specification sheets, schematics, inter-panel and intra-panel wiring diagrams. In addition, all information necessary for the proper maintenance and operation of the system must be included. Any bidder using equipment other than that specified shall provide this information to the Engineer ten (10) days prior to bidding.

E. Record Drawings that include any changes to wiring, wiring designations, junction box labeling and any other pertinent information shall be supplied upon completion of project.

F. The entire system shall be listed by Underwriters' Laboratories (UL). Proof of such a listing shall be furnished at time of submittal. All equipment shall be installed and connected in strict accordance with the manufacturer's recommended instructions. Systems having only UL listed power supplies and amplifiers shall be deemed unacceptable.

G. Demonstrate proof of after hours service arrangements and provide the telephone number being used for such service. Contractor shall provide warranty service during normal business hours, but shall also demonstrate full capability of providing 24hour local service for emergency calls, after hours. After hours emergency service shall be charged at the Contractors standard published service rates.

H. In-Service Training:

1. The Contractor shall furnish four hours of in-service training with the system. This session shall facilitate the training of individuals in the operating of the audio equipment.Operating manuals and users guides shall be provided at the time of the training.

I. Wiring Practices: System wiring shall be in accordance with good engineering practices as established by the EIA and NEC. Wiring shall meet all established state and local electrical codes and other portions of these specifications. All wiring shall test free from grounds and shorts.

J. Systems manufactured by OnSSI, and Genetec are acceptable as long as all specified features are provided. IP cameras must meet the requirements in these specifications.

PART 2 - PRODUCTS

2.01 HIGH DEFINITION DAY/NIGHT IP CAMERA SYSTEM

The control center, cameras and software shall be Avigilon with UPS backup. The system will provide the number of ports adequate to meet the specifications. The system will be an 8 Channel NVR with 2.5.0 TB storage and two viewing clients at the main office and the Center. The system will include a 7 year license agreement for each camera. All cameras will be new megapixel cameras as indicated on drawings. The Camera System shall provide at least the following functions and features:

A. The Network Video Management Software (NVMS) shall be Avigilon Control Center (ACC) version 3.4 or later. The NVMS software shall be pre-loaded on a turn-key NVR workstations and

servers with configurable storage.

B. The Network Video Management Software (NVMS) shall be a scalable enterprise level software solution that will be scalable from one client, server, and camera to hundreds of clients, servers, and cameras.

C. The Network Video Management Software (NVMS) shall consist of server software applications and client software applications.

D. The Network Video Management Software (NVMS) shall include the following applications:
   a. Server Software Applications
      - Control Center Server
      - Control Center Admin Tool
   b. Client Software Applications
      - Control Center Client
      - Control Center Player
      - Control Center Camera Installation Tool

E. The Network Video Management Software (NVMS) shall permit client software applications to be installed and run on both the same computer or on separate computers.

F. The Network Video Management Software (NVMS) shall support edge based storage and processing of video inputs.

G. The Network Video Management Software (NVMS) shall support High Definition Stream Management (HDSM) architecture which includes:
   a. Support for industry standard JPEG2000 progressive compression format
   b. Support for reducing the required client bandwidth and processing power by only transmitting what is necessary to view the video stream at full quality (e.g. if a user is viewing a 16MP camera in a 1MP window then a 1MP representation of the 16MP image will be transmitted).

H. The Network Video Management Software (NVMS) shall support recording and management of video sources including:
   a. Avigilon HD IP Cameras (1 – 5 Mega pixels)

I. The Network Video Management Software (NVMS) shall support recording and monitoring video streams from sources with bandwidth up to 90 Mbit/sec, frame rate up to 60fps, and resolution up to 16MP (4872x3248).

J. The Network Video Management Software (NVMS) shall require no proprietary recording hardware, no hardware multiplexer or timedivision technology for video recording or monitoring.

K. The Network Video Management Software (NVMS) shall not limit the storage capacity and shall allow for gradual upgrades of recording capacity.

L. The Network Video Management Software (NVMS) shall digitally sign recorded video using 256

bit encryption so video can be authenticated for evidentiary purposes.

M. The Network Video Management Software (NVMS) shall securely transmit all command and control data via TCP/IP using cryptographic keys based on SSL to prevent eavesdropping or tampering.

N. The Network Video Management Software (NVMS) shall be on a turn-key NVR platform utilizing enterprise-grade servers and workstations preloaded with NVMS software and tested to manufacturer specifications for deployment in enterprise applications.

O. The Network Video Management Software (NVMS) shall be upgraded from one version to another without the user having to uninstall the previous version.

P. The Network Video Management Software (NVMS) shall automatically detect if video source firmware is out of date and upgrade it.

Q. The Network Video Management Software (NVMS) shall automatically detect if client application software is out of date and upgrade it.

R. The Network Video Management Software (NVMS) shall run as a service configured to automatically startwhen the NVR is powered on and automatically recover from failure or attempted tampering.

S. The Network Video Management Software (NVMS) shall allow system administration, and live and recorded video monitoring all from a single client application that can be located anywhere on the network.

T. The Network Video Management Software (NVMS) shall automatically discover video sources that are connected to the same network.

U. The Network Video Management Software (NVMS) shall provide a search functionality to discover video sources that are connected on a different network segment.

V. The Network Video Management Software (NVMS) shall provide administration of all system connections from a single window.

W. The Network Video Management Software (NVMS) shall detect if the camera signal is lost and alert the system administrator.

X. The Network Video Management Software (NVMS) shall provide the capability to rename all video sources and NVRs.

Y. The Network Video Management Software (NVMS) shall record video streams based on a recording schedule that can be defined individually for each video source. The schedule shall be created with the following parameters:

a. Recording Mode
   - Continuous
   - Motion
   - Alarm
   - Motion or Alarm
   - Disabled

b. Time and Date Settings
   - Daily
   - Weekly

Z. The Network Video Management Software (NVMS) shall provide a prealarm and post-alarm recording option.

AA. The Network Video Management Software (NVMS) shall provide a reference frame recording option in the absence of motion or alarm events.

BB. The Network Video Management Software (NVMS) shall perform motion detection on each individual video source with adjustable sensitivity, threshold and detection zones.

CC. The Network Video Management Software (NVMS) shall provide the ability to change image quality and image rate parameters on each individual video source.

DD. The Network Video Management Software (NVMS) shall provide the ability to reduce the image rate of the recorded video over time as a means of increasing record time. The image rate can be reduced to one half or one quarter of the original image rate.

EE. The Network Video Management Software (NVMS) shall perform dynamic bandwidth management to ensure that the total bandwidth does not overload the system.

FF. The Network Video Management Software (NVMS) shall authenticate users before granting access to the system. Access rights for each user can be defined and include:
   a. Viewing live images
   b. Viewing recorded images
   c. Exporting images
   d. Setting up cameras and NVRs
   e. Creating and modifying users and groups

GG. The Network Video Management Software (NVMS) shall provide the ability to import Windows users and use Windows credentials to authenticate users.

HH. The Network Video Management Software (NVMS) shall provide the ability to email system administrators when an event or system health error occurs.

II. The Network Video Management Software (NVMS) shall provide a maintenance log and audit trail of all system errors and events.

JJ. The Network Video Management Software (NVMS) shall provide the ability to change the security level on a video source to prevent lower level users from viewing the video stream.

KK. The Network Video Management Software (NVMS) shall provide the ability to change the network settings for a video source.

LL. The Network Video Management Software (NVMS) shall provide the ability to change the exposure, iris, focus, and white balance settings for a video source.

MM. The Network Video Management Software (NVMS) shall provide the ability to change the image dimensions for a video source.

NN. The Network Video ManagementSoftware (NVMS) shall support live or recorded video monitoring of 1 to 36 video streams simultaneously on a single monitor.

OO. The Network Video Management Software (NVMS) shall support an unlimited number of monitors for monitoring video streams.

PP. The Network Video Management Software (NVMS) shall support monitoring live and recorded video streams simultaneously on the same monitor.

QQ. The Network Video Management Software (NVMS) shall support viewing the same live or recorded video stream at different zoom levels.

RR. The Network Video Management Software (NVMS) shall support the creation of unlimited views with unique layouts of video streams.

SS. The Network Video Management Software (NVMS) shall support the ability to fullscreen a view.

TT. The Network Video Management Software (NVMS) shall support the ability to save views.

UU. The Network Video Management Software (NVMS) shall support the ability to cycle through views (guard tour) based on a specified interval.

VV. The Network Video Management Software (NVMS) shall display all video sources connected to the system.

WW. The Network Video Management Software (NVMS) shall support the ability to drag and drop a video source from a tree of video sources into a window for live or recorded video monitoring.

XX. The Network Video Management Software (NVMS) shall support the ability to drag and drop a view from a tree of views into a window for live or recorded video monitoring.

YY. The Network Video Management Software (NVMS) shall support forward and reverse playback of recorded video at variable speeds.

ZZ. The Network Video Management Software (NVMS) shall synchronously playback recorded video from selected video sources.

AAA. The Network Video Management Software (NVMS) shall support navigation of recorded video via calendar, timeline, orevents.

BBB. The Network Video Management Software (NVMS) shall support a timeline that displays all connected video sources and the corresponding motion, alarm and recording events.

CCC. The Network Video Management Software (NVMS) shall support a timeline thatan display the entire time range down to one second of recorded video.

DDD. The Network Video Management Software (NVMS) shall support creating bookmarks for recorded video and displaying the bookmarks on the timeline.

EEE. The Network Video Management Software (NVMS) shall support searching through recorded video based on various search criteria including time, date, video source, and events.

FFF. The Network Video Management Software (NVMS) shall support searching through recorded video based on motion in user defined areas (pixel search).

GGG. The Network Video Management Software (NVMS) shall support the ability to export recorded video in the following formats:

a. Native
b. JPEG
c. PNG
d. TIFF
e. AVI

HHH. The Network Video Management Software (NVMS) shall support the ability to snapshot a live or recorded image and export it from the system.

III. The Network Video Management Software (NVMS) shall support viewing video that was exported in the Native format.

JJJ. The Network Video Management Software (NVMS) shall support authenticting video that was exported in the Native format to validate that it was not tampered with.

KKK. The Network Video Management Software (NVMS) shall support converting video that was exported in the Native format to an industry standard format.

2.02 CAMERAS - 5.0 Megapixel–HD-DN

A. The High Definition IP Camera Series shall support 100BASETX and PoE 802.3af network interfaces for streaming video and control data over standards compliant networks.

B. The High Definition IP Camera Series shall operate in the Avigilon Control Center (ACC) environment with support for automatic detection of cameras, encoders and NVRs in the same broadcast domain.

C. The High Definition IP Camera Series shall support user selectable image dimensions, or windowing, to enable lower bandwidth and/or higher refresh rates for the image or portion of the image being monitored.

D. The High Definition IP Camera Series shall support user configuration of network parameters including: Static IP address; Subnet Mask; Gateway; and Control Port for control communications.

E. The High Definition IP Camera Series shall support user configuration of camera parameters including: Camera Name; Location; and Security Level.

F. The High Definition IP Camera Series shall support user configuration of image acquisition parameters including: Automatic Exposure Control; Manual Exposure Control; Flicker Control; Auto-iris Control; Backlight Compensation; Day/Night Control.

G. The High Definition IP Camera Series shall incorporate a removable IR filter mechanism for improved performance in low light, night time conditions or in applications requiring near IR illumination.

H. The High Definition IP Camera Series shall support a mode that automatically removes the IR filter and enters a monochrome mode when the available light drops below a set threshold.

I. The High Definition IP Camera Series shall support user configuration of an unlimited number of independent motion detection zones within the camera field of view.

J. The High Definition IP Camera Series shall support user configuration of up to 4 privacy zones within the camera field of view.

K. The High Definition IP Camera Series shall support user configuration of compression quality and image rate per individual camera.

L. The High Definition IP Camera Series shall have I/O terminals for connecting alarm inputs and alarm outputs.

M. The High Definition IP Camera Series shall support UDP transport.

N. The High Definition IP Camera Series shall be remotely upgradeable over an IP network for feature enhancements and investment protection.

O. The High Definition IP Camera Series shall meet or exceed the following design and performance specifications.

P. All outside cameras will be day night cameras with clear domes, appropriate lens, factory installed heater, IR illuminator and mountinghardware. Provide 5.0 Megapixel camera as shown on the drawings.

2.03 OFFICE MONITOR

A. Provide a 36" monitor for viewing all cameras. Ъ be located and mounted inthe office.

PART 3 - EXECUTION

3.01 INSTALLATION/APPLICATION/ERECTION

GENERAL

A. All Camera cables shall be labeled at theNVR system head end.

CAMERA SYSTEM

A. Provide all equipment, mounting brackets, wiring, conduit and outlet boxes required for the installation of a complete and operating system in accordance with applicable local, state and national codes, the manufacturer's recommendations, these plans and specifications. All circuits not in conduit must be wired with power limited ornon-power limited cable as listed under NEC 725 Class II wiring. Color coded wires shall be used throughout. Wiring shall conform to the practices in the National Electrical Code.

B. Cameras will be mounted on light poles as shown on drawings.

C. The manufacturers' authorized representative shall provide supervision of final system connections, perform a complete functional test of the system, and submit a written report to the Contractor attesting to satisfactory operation of the system. In addition on-site instruction shall be provided to the Owner's designated personnel.

D. Size and quantity of conductors shall be in accordance with manufacturer's requirement for cabling. Cables may be run in conduit or in return air plenums provided the cable is UL listed for plenum use.

E. The electrical contractor shall install appropriate voltage regulation equipment on the system AC voltage supply, installing such equipment as necessary to arrest damaging electrical transients and spikes which can cause damage to the microprocessor components of the system.

3.02 OWNER TRAINING

A. The system manufacturer shall train the Owner's representative (operator) on the system operation. The training session shall last a minimum of4 hours and consist of, but not limited to:

1. Programming functions

2. General operations
3. Review of recorded video
4. Exterior door monitoring and control functions

B. No question from the Owner shall be left unanswered following the training session(s).

3.03 WARRANTY

A. The Contractor shall warrant the completed system, wiring, and equipment to be free from inherent mechanical and electrical defects for a period of 1 year from the date of the completed and certified test.

END OF SECTION

CONTRACT 2

ELECTRICAL SPECIFICATIONS

Section-16000

General Provisions

And Requirements

SECTION 16000

GENERAL PROVISIONS AND REQUIREMENTS

PART 1 - PERMITS, CODES, INSPECTIONS, APPROVALS, ETC.

1.1 The Contractor shall obtain all permits necessary and shall bear all costs involved.

1.2 All electrical work shall be performed in accordance with the requirements of the latest revision of the National Electrical Code (NFPA 70), National Electrical Safety Code, and Ky. Building Code. Similarly, all electrical equipment, where applicable, shall conform to all other NFPA Pamphlets, NEMA, ANSI, IPCBA and U.L. requirements. Whenever and wherever the design or State and local regulations require higher standards than the current National Electrical Code, then these shall be followed. Division 1 of the Architectural specifications shall apply to all electrical work.

1.3 The Architect/Engineer shall be notified twenty-four (24) hours in advance when any tests are to be made and before any work is concealed. The Contractor shall notify the Architect/Engineer when he is ready for final inspection.

1.4 The fronts of all electrical panels shall be removed for final punch list inspection.

1.5 All electrical items on this project shall bear the Underwriters Laboratories (UL) label and/or FM (Factory Mutual).

1.6 Provide electrical inspection by a licensed and recognized Electrical Inspector. Notify Electrical Inspector in writing, immediately upon start of work with a copy of notice to Architect. Schedule inspection for rough as well as finished work. Approval from Electrical Inspector will not be allowed as reason for deviation from Contract Documents. All costs incidental to Electrical Inspection shall be borne by Contractor. Prior to final acceptance of work and release of final payment, deliver to Architect the certificate of final inspection.

PART 2 - CLEANING AND PAINTING

2.1 The Contractor shall remove all temporary stickers, tags, etc. from all items installed under this Contract and shall thoroughly clean all equipment or materials installed under this Contract. Scratched and damaged paint and/or other finishes shall be touched up and/or repainted as required. All equipment shall be cleaned and made ready for painting by others.

2.2 Upon completion of the work, the Contractor shall thoroughly clean and lubricate all equipment.

2.3 Surplus material, rubbish and equipment resulting from the electrical work shall be removed from the building and premises by the Contractor upon completion of the work in accordance with the Architectural specifications.

2.4 All permanent nameplates on equipment shall be kept clean and exposed for easy reading. If field conditions warrant (in the opinion of the Architect) the Contractor shall vacuum clean all equipment and installed materials.

PART 3 - IDENTIFICATION OF ELECTRICAL EQUIPMENT

3.1 The equipment services, feeder and branch circuits shall be marked in accordance with the National Electrical Code. Mark with moisture and fungus resistant wire markers and nameplates. All conductors that are not color coded shall be marked with colored tapes to denote phases.

3.2 Identification of Motor Control Center (MCC) and Main Electric Panelboard (MEP) and branch circuit panelboards shall be labeled with a machine cut lamacoid plate with 1/4" high letters, indicating the panel designation, voltage and phase (i.e.: Panelboard "A" - 120/208V., 3-Phase, 4W). Branch panelboards in finished areas shall have plate installed inside of door.

3.3 All switches or breakers in main switchboard shall be labeled to indicate equipment served with ½" wide machine cut lamacoid plate with 1/8" high letters.

3.4 All remote disconnects, safety switches, motor starters, etc. shall have the name of the motor/equipment which it is controlling engraved on lamacoid plate, ½" wide with 1/8" high letters. Exact name of system or motor shall be coordinated with Architect/Engineer prior to manufacture.

3.5 Identify circuits contained in each box on exterior cover w/permanent marker.

3.6 Mark all conduit housing currents with greater than 300 volts phase to phase every 20'. ½" high letters to be used.

3.7 All lighting and power panels shall have each breaker (including spares and spaces) identified with typed directory cards covered in plastic.

PART 4 - SLEEVES, ESCUTCHEONS AND INSERTS

4.1 Sleeves shall be installed through masonry and concrete walls and floors for the passage of electrical raceways, cables, etc. Sleeves shall be placed and sized to permit installation and removal of the assembly. All electrical raceways larger than 1" shall be sleeved. Sleeves are not required where raceway bends into wall.

4.2 Cast iron sleeves shall be installed through all walls where conduit enters the building below grade. All other sleeves shall be standard weight steel. Sleeves shall be flush with each face of the wall. Sleeves for conduit through outside walls shall be packed with oakum for weatherproofing.

4.3 All sleeves through floors shall extend ¾" above finished floors. All sleeves shall be ½" larger than the outside diameter of the duct or conduit. All sleeves shall be equal to Schedule 20 pipe or heavier.

4.4 Escutcheon shall be installed around all openings in exposed finished area. This includes all raceways whether they are sleeved or not. Escutcheon shall be equal to Benton & Caldwell, No. 40.

4.5 Inserts shall be installed as required, with location coordinated with other Contractors.

PART 5 - CIRCUIT NUMBERS AND CIRCUITRY

5.1 Circuit numbers, and breaker numbers shall be coordinated on panel identification card as shown on the Drawings.

5.2 The exact routing of circuits as shown on the drawings from receptacle to receptacle, light to light, etc. is schematic only. If the Contractor desires to change the routing of any circuits, he may do so within the scope of good engineering practice, and with the permission of the Architect/Engineer. All outlets shall be on the same circuit number as shown on the Drawings. Any change in routing shall be shown on the "Record" Drawings. Contractor shall not run more than (3) circuits (one circuit per phase) in any conduit even if conductors are derated (1 neutral per run of conduit).

PART 6 - SPARE CIRCUITS

6.1 All spare breakers or switches shown in the Panelboard Schedule shall have conduits stubbed above ceiling and/or down below slab as described hereinafter.

A. Recessed Panels - All spare conduit shall be stubbed above ceiling. If area has no ceiling, spare conduit shall ell out 2" below slab above.

B. Surface Panels - Spare circuits shall have knockouts only in top of tub available for spare circuits.

6.2 Number of conduit required for spare circuits shall be figured at three (3) 115 volt circuits per ¾" conduit. Cap all spare conduits.

PART 7 - PROTECTION

7.1 All work, equipment and material shall be protected at all times. All conduit openings shall be closed with caps or plugs during construction. All equipment and accessories shall be tightly covered and protected against dirt, water or other injury during period of construction.

7.2 The Contractor shall cover all installed receptacles, switches, etc. with a plastic or equal cover prior to the painting of the areas. No device plate shall be installed prior to the finish painting. Any receptacle, switch, device plate, etc. with paint on it shall be removed and replaced by this Contractor. It shall be the Contractor's responsibility to coordinate with the Painting Contractor with regard to the scheduling of the installation of switches, outlets, device plates, etc.

PART 8 - TESTING AND ADJUSTING

8.1 When the work included is complete, the Contractor shall start up and adjust all parts of his system. All equipment items of the various systems shall be adjusted for proper operation within the framework of design intent, and the operating characteristics as published by the equipment manufacturer.

8.2 No equipment shall be operated for any purpose until properly lubricated and brought into service condition.

8.3 The Contractor shall provide all equipment, materials and labor required to make the necessary tests.

8.4 The Architect/Engineer reserves the right to require the services of an authorized representative of the manufacturer in the event the Contractor is unable to so adjust any piece of equipment. The Contractor shall arrange for such services and bear all incurred costs thereof. After completion of adjustments, the Contractor shall advise the Architect/Engineer that the work is ready for the final acceptance test.

8.5 Upon completion of the installation, the Contractor, at his expense, shall conduct complete performance tests in the presence of the Architect/Engineer and Owner to fully demonstrate the capacity and all other characteristics of the systems. The test shall be run for a length of time sufficient to demonstrate the ability of each system to perform as required by design drawings and specifications.

8.6 The Electrical Contractor shall perform the following tests:

A. All branch circuits of No. 8 wire and larger and main feeders shall be megged for ground and insulation resistance before connecting to equipment. (Megger to be 500 volts).

B. All motors larger than ½ HP shall be megged before conductors are connected thereto and again after they have gained running temperature.

C. A record of all megging shall be delivered to the Engineer before final acceptance. Architect/Engineer shall be notified in advance so that he may witness the test.

8.7 Refer to respective equipment sections for special tests such as Sound Systems, Fire Alarm, Television, etc.

PART 9 - CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS

9.1 The Architectural, Structural, Electrical, Plumbing, Heating, Ventilating and Air Conditioning Drawings and Specifications are complementary to one another.

A. The Contractor shall rough-in for and furnish all labor and materials necessary to make final connections to all equipment furnished by the Owner or any other Contractor or Sub-Contractor which requires electrical connections, including heating controls and all control and interlock wiring.

9.2 The Contractor making the required connections shall be responsible for any damages caused by erroneously connected equipment.

PART 10 - MOTORS AND APPARATUS BY OTHER TRADES

10.1 The Contractor shall obtain from the other trades all necessary information regarding motors, and wiring connections of apparatus furnished by these trades.

10.2 Furnish and install all necessary wiring and raceways required for satisfactory testing and operation of all controllers, starters, motors, control boards, alarm boards and related equipment, etc. The other trades supplying apparatus on which there are motors will supply and deliver to the Contractor at the sidewalk or building receiving quarters all control equipment specified under their section of the specifications for erection and connection of all such equipment in their designated places under this section of the specifications. (The equipment furnished by others is shown on the Motor Schedule).

10.3 The Contractor shall carefully examine the Architectural, Structural, Plumbing, Heating, Ventilating and Air Conditioning Drawings and Specifications to determine the extent, type and locations of all wiring required and shall obtain from the respective Contractors the wiring diagrams and other necessary information to properly install his part of the work.

10.4 Motor sizes shown on the Drawings are nominal sizes with some variation anticipated in the final installations. Under this section of the specifications, the Contractor is to coordinate the work with all other trades by obtaining all final data from each supplier and install wiring, circuit and motor protection and equipment in accordance with the actual equipment nameplate data regardless of sizes, etc. shown on the drawings. Undersized wiring, conduit, disconnects, etc. connected to equipment shall be the responsibility of the Contractor. Coordinate with the Engineer on any differences found between drawings and actual load data.

PART 11 - ELIMINATION OF NOISE AND VIBRATION

11.1 During the construction of this project, if any system or piece of equipment produces noise or vibration which, in the opinion of the Architect is objectionable to the Owner, the Contractor shall, at his own expense, make changes in equipment and do all work necessary to eliminate the objectionable noise or vibration.

PART 12 - GROUNDING OF SYSTEM

12.1 All metallic conduit, supports, cabinets and equipment shall be grounded in accordance with the latest issue of the National Electrical Code and as shown on the Drawings.

12.2 The size of the grounding conductor for service equipment shall not be less than that given in Article 250-94 and 250-95 of the National Electrical Code or as shown on the Drawings.

12.3 Ground bus and non-current carrying metallic parts of all equipment and conduit shall be securely grounded by connection to common ground bus insofar as possible or as shown. Jumper all noise or vibration isolators to insure ground potential.

12.4 The above ground bus shall not be less than #350 MCM copper or as per code with all connections made with pressure connectors.

12.5 No ground wires smaller than No. 12 solid copper shall be used; all wires larger than No. 8 shall be bare copper, stranded cable. All flexible conduit shall have a green insulated jumper bonded at each end.

12.6 The main ground electrode shall be a bare #350 MCM (or as shown on the drawings) copper conductor laid in bottom of footer trench. This electrode shall be as shown, but no less than

100' long and shall be thermal welded to building steel at each column it passes with both ends tied back to ground terminal in main gear. Ground resistance shall not exceed 5 ohm. (If ground electrode cannot be installed in bottom of footer trench, then the Contractor shall provide ground rods necessary, (minimum of six (6)), no less than 15' (center to center) to meet the ohmic value mentioned above).

12.7 The main water pipe shall be bonded to the service equipment enclosure, the grounded conductor at the service and the grounding electrode conductor in footer trench.

12.8 All connections to main ground conductors shall be thermal welded.

12.9 All raceways with ground lug bushings shall be grounded to their respective boxes with an approved jumper wire.

12.10 All EMT runs to receptacles, light fixtures, power outlets or any equipment shall have a code size insulated green ground wire connected to respective receptacle, light fixture outlet or equipment. All PVC (if allowed) shall have code sized ground wire.

PART 13 - SAMPLES

13.1 There will be no samples required by the Architect under this section of the specifications, unless a substitution is questioned. Any samples submitted may be subsequently installed on the project providing it is approved.

PART 14 - SHOP DRAWINGS

14.1 Submit Shop Drawings in bound sets on all items furnished under this Contract in sufficient number to satisfy the Architect's requirements. Shop Drawings should be submitted within 30 days after the work order to proceed. All shop drawings submitted for review shall bear an "approved stamp" and signed by the Contractor. All shop drawings not bearing the Contractor's "approved" stamp will be returned without comment.

PART 15 - CUTTING AND PATCHING

15.1 Any cutting and patching in the building required to install the equipment, etc. shown on Drawings shall be accomplished by the Contractor. He shall meet all requirements of the Architectural Section and at his expense.

15.2 The Contractor shall be responsible for all openings and chases he may require in floors, walls or ceilings of any type construction (whether under construction or existing). All work necessary as a result of failure on the part of the Contractor to provide the required openings and chases and to set sleeves and inserts shall be performed at his own expense. When shown, these openings and/or chases will be formed or provided for in the work of the General Contractor. However, the Contractor shall be responsible for cooperation with the General Contractor in locating and sizing such openings. Openings required and not shown on Drawings shall be brought to the attention of the General Contractor promptly and the Architect/Engineer for approval.

PART 16 - ACCESS DOOR

16.1 The Contractor shall refer to the Architectural Drawings to ascertain which rooms have removable ceilings. Where removable ceilings are specified, access to equipment may be obtained by removing the ceiling pieces. Where non-removable ceilings are specified, the Contractor shall furnish all required access doors for servicing disconnect switches, etc.

16.2 Access doors shall be equal to L.M. Walsh Company "Way-Loctor". No. 3 shall be used for concrete block or tile walls having no plaster finish and No. 2 shall be used for plastered walls and ceilings for acoustical tile ceilings. All doors shall be prime coated and key operated and keys shall be the same for plumbing and heating work. Doors by Miami or Milcor will be acceptable.

16.3 Installation of doors will be done by the General Contractor. However, the Contractor shall be responsible for the correct location of them for servicing equipment. These access doors shall be sized large enough to service the equipment with a minimum size of 20" X 20".

PART 17 - COORDINATION OF WALL OUTLETS

17.1 The Contractor shall plan his work in such a manner that wall outlets that are adjacent to each other or within a given area, shall be installed at the same height, and with a symmetrical appearance.

PART 18 - FOUNDATIONS AND ANCHOR BOLTS

18.1 The Contractor shall be responsible for the location of all concrete pads required for all equipment installed under this Contract. All pads required will be poured at the expense of the Contractor.

18.2 The Contractor shall furnish anchor bolts for all equipment installed on concrete slabs and/or bases. Bolts shall be placed in exact positions prior to pouring concrete. Sizes of bolts shall be determined by the manufacturer's recommendations for the equipment served.

PART 19 - OPERATING AND MAINTENANCE INSTRUCTIONS

19.1 Deliver to the Architect three (3) copies of shop drawings and all Operating and Maintenance Instructions for all equipment furnished and installed under this Contract, including parts lists for all new major equipment items. Each set shall be provided in a hard back binder with table of contents and divider for each section.

PART 20 - FIRESTOPPING

20.1 All openings required for conduit in walls, floors, ceilings, partitions, etc., where such construction is required for fire protection, shall be firestopped to preserve the fire rating of the construction. Firestopping shall be mineral wool or other non-combustible insulating material tightly placed and filling the space around such conduit. All materials used shall be approved for use as fire stop equal to 3M Fire Barrier. (Caulk CP-25, putty 303 and 7904 Barriers), or equal by Hilti (Caulk CS240, putty CB 120 Foam, CS2420 barrier material.

PART 21 - SUSPENDED CEILINGS

21.1 The Contractor shall insure that framing members of suspended ceiling systems used to support fixtures shall be securely fastened to each other and shall be securely attached to the building structure at necessary intervals (NEC).

21.2 If the above items are not covered, the Contractor shall immediately alert the Architect. Fixtures shall not be installed until all questions concerning the above are answered.

21.3 All recessed light fixtures shall be clipped to ceiling structure.

PART 22 - ELECTRICAL DRAWINGS AND SPECIFICATIONS

22.1 The drawings and specifications are intended to cover all work enumerated under the respective headings. The drawings are diagrammatic only as far as final location of raceways, equipment, etc. is concerned. Any item of work not clearly included, specified and/or shown, any errors or conflict between plans (Mechanical, Electrical, Architectural or Structural) specifications, codes and field conditions, shall be clarified by a written request to the Architect by the Bidder before bidding; otherwise, the bidder shall, at his own expense, supply the proper labor and materials to make good any damages or defects in his work caused by such error, omission or conflict.

22.2 Schematics, risers and details shown on the drawings are for the equipment specified. All revisions, modifications or changes in circuitry, accessories, etc. due to using equipment of a different manufacturer than specified hereinafter, shall be the responsibility of the Bidder and shall be made at no additional cost to the Owner. All modifications or changes shall be submitted to the Architect in writing and meet his approval before the equipment is released for shipment.

22.3 The Contractor shall be responsible for all revisions, modifications or changes necessary in the Structural, Architectural or Mechanical/Electrical systems to accommodate the equipment to be furnished under this section of the specifications. This shall be made at no additional cost to the Owner.

PART 23 - APPLICATION FOR PAYMENT

23.1 Line items and description of electrical work shall be as follows:

Item No.	Description of Work
1	Bond & Permits
2	Mobilization
3	Distribution Equipment
4	Lighting
5	Wiring Devices
6	Fire Alarm
7	Conduit & Boxes
8	Wiring
9	Excavation & B.F.
10	Electrical Inspection
11	Modular Wiring System (if used)

Section-16025

Scope of Work

SECTION 16025

SCOPE OF WORK

PART 1 - GENERAL

1.1 Except as otherwise hereinafter specified, the work under this Contract consists of furnishing all labor, materials, tools, elevating apparatus, transportation permits, certificates and equipment and performing all operations relevant to the installation of the Electrical Systems complete and working (unless otherwise noted) in strict accordance with this Specification and the applicable drawings, and all applicable codes, and subject to the terms and conditions of the Contracts. All systems shall be turned over to the Owner in a workable and usable condition.

PART 2 - WORK INCLUDED

2.1 Without restricting the generality of the foregoing, the work to be performed under this Contract shall consist of furnishing, installing and connecting the following items:

A. Power and Lighting Distribution.
B. Conduit, Fittings, Pull Boxes, Junction Boxes, Terminal Boxes.
C. Safety Switches as required by Code.
D. Wire and Cable installations and terminations.
E. Installation of Wiring of Starters, Switches and other electrical equipment furnished under other sections of these Specifications or Owner.
F. Lighting Fixtures and Lamps.
G. Motor Controls and Motor Control Center.
H. Grounding.
I. Connection to equipment furnished by others.
K. Voice/data system is rough-in only.
L. SCADA system.
M. Emergency Generator
N. Connection to WWTP equipment.
O. CCTV System.

END OF SECTION

Section-16050

Basic Materials

And Methods

SECTION 16050

BASIC MATERIALS AND METHODS

PART 1 - RACEWAYS (CONDUIT, ETC.)

1.1 RIGID

A. Rigid, threaded steel conduit shall be used in concrete, underground in hazardous locations or where called for on the Drawings. All main feeders to panelboards to be rigid. All underslab branch circuits shall be rigid, (unless otherwise noted.) All wiring above 600V. shall be rigid, unless otherwise noted. In addition PVC coated rigid shall be used as shown on the drawings.

1.2 INTERMEDIATE

A. Intermediate grade conduit may be used in lieu of rigid.

1.3 ELECTRIC METALLIC TUBING (EMT)

A. Metallic tubing may be used where permitted by code, except for panel feeders or unless otherwise noted as rigid. No raceway smaller than ¾" will be permitted except for vertical drops to switch legs, or receptacles which may be ½".

1.4 PVC CONDUIT

A. Nonmetallic schedule 40 PVC rigid conduit conforming to ANSI, NEMA specifications with each length U.L. labeled may be installed under concrete floor slabs buried deep enough to allow for vertical code bends for branch circuits when the following conditions are adhered to:

1. Provide rigid steel conduit or IMC conduit where under-floor conduits penetrate the slab and above floor.

2. Install equipment grounding conductors as required by N.E.C. and size conduits for number of conductors installed.

3. P.V.C. conduit may also be used for telephone and television service entrance. (Encased in 3" concrete under roadways). Use long radius steel ells.

4. P.V.C. conduit may also be used for primary service (from service pole to transformer) (Encased in 3" concrete under roadways). Use long radius steel ells.

5. P.V.C. conduit shall not otherwise be allowed unless shown or noted on drawings.

1.5 All metallic conduit shall be electro-galvanized, sheradized, hot-dipped galvanized or metallized galvanized. Conduit shall be concealed, where possible, depending upon the structure of the building. All (exposed and concealed) runs of conduit shall have supports spaced not more than 8' apart and shall be installed with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings, with right angle turns

consisting of cast metal fittings or symmetrical bends as shown on the Drawings. Expansion fittings or other approved devices shall be used to provide for expansion and contraction where conduit crosses expansion joints. Jumper for ground continuity in all cases. Conduit shall be installed so as to insure against trouble from collection of trapped condensation.

1.6 Flexible conduit for motors shall be liquid tight single strip, neoprene covered, and shall be used from motor terminal boxes to outlet or conduit for vibration purposes. Lengths of this flexible conduit shall not exceed 24" and shall be installed in such a manner so as to isolate vibration from the conduit. Connectors, as manufactured by Efcor, Thomas and Betts or Appleton will be acceptable.

1.7 All conduit systems, except those otherwise specifically shown to the contrary, shall be concealed in the building construction or run above suspended ceiling.

1.8 Runs of conduit shall not have more than the equivalent of three (3) 90 degree bends. Junction boxes shall be installed in conduit runs exceeding 100', whether shown on Drawings or not. Length requirement does not apply to underground circuits to outside lights.

PART 2 - CABINETS, OUTLETS AND JUNCTION BOXES

2.1 CABINETS, JUNCTION AND PULL BOXES

A. Cabinets for lighting and power, telephone, clocks or any other purposes specified or shown on the Drawings shall be constructed of panelboard code gauge, galvanized steel with sides formed and corner seams riveted or welded before galvanizing. Boxes constructed with sheet metal screws or bolts will not be accepted.

B. Pull boxes shall include all boxes used to reduce the run of conduit to the required number of feet or bends for cables, supports, taps, troughs and other similar applications and shall also be constructed as specified above.

C. All cabinets and boxes shall be provided with knockouts as required by the manufacturer, or shall be cut in the field by approved cutting tools which will provide a clean symmetrically cut opening. Such boxes shall be provided with code gauge fronts which shall have hinged doors with ¼ turn fasteners.

2.2 OUTLET BOXES

A. Lighting fixture outlet boxes shall be galvanized steel, 4" octagonal, not less than 2-1/8" deep, with lugs or ears to secure covers and those for use with ceiling lighting fixtures shall be fitted with 3/8" fixture studs fastened to the back of the boxes, where applicable.

B. Outlet boxes for switches, receptacles, telephone, etc., installed in walls of glazed tile, brick or other masonry which will not be covered by wood wainscot or paneling shall be sized as per code in U.L. listed box and they shall be completely covered with plates or lighting fixtures. All exposed boxes shall be FS type. No box will be allowed with the ears on the outside. The Contractor shall cooperate with the brick layers and carpenters to insure that the outlet boxes are installed straight and flush in the walls. Jumbo plates will not be allowed.

C. Boxes for more than two devices shall be for number of devices required and shall be one piece. No ganging of single switch boxes will be allowed.

D. Outlets for use on this project shall have only the holes necessary to accommodate the conduits at the point of installation and shall be rigidly secured in position.

E. The location of fixtures, outlets and/or equipment, as shown on the drawings, shall be considered as approximate only. It shall be incumbent upon the Contractor to study the general building drawings, with relation to spaces surrounding each outlet, in order to coordinate this work with the work of others and in order that when the fixtures, outlets and/or equipment are installed, they will be symmetrically located and will not interfere with any other work or equipment. Any change in fixture layout shall be coordinated with the Architect before the change is made.

F. Refer to separate articles for any special outlet boxes, etc. required for individual equipment.

PART 3 - CONDUCTORS

3.1 All conductors on this project shall be copper. All circuits shall be sized as the load requires or as shown on the drawings. No conductor shall be less than #12 AWG. All conductors shall have THHN/THWN insulation. All conductors within fixture or equipment housing shall have temperature rating not less than recommended by fixture or equipment manufacturer. All wiring shall be installed in conduit unless otherwise noted.

3.2 Conductors No. 10 and smaller sizes of wire shall be solid. Conductors No. 8 and larger sizes of wire shall be stranded. The pulling of all wires and cable on this project shall be performed in strict compliance with Section 300 of the National Electrical Code. No conductor entering or leaving a cabinet or box shall be deflected in such a manner as to cause excess pressure on the conductor insulation. (See NEC).

3.3 All wire on this project shall be new, in good condition, and shall be delivered in standard coils. The color of the wire shall be selected to conform with the latest edition of the National Electrical Code with conductors phase color coded at each termination (red, blue and black). Neutral to be white and ground wire to be green. #12 and #10 wiring shall be supplied with colored insulation.

PART 4 - SUPPORTS AND HANGERS FOR CONDUIT AND FIXTURES

4.1 The Contractor shall be responsible for the support of all fixtures specified hereinafter. He shall not relocate them from the locations shown on the Drawings for the purpose of supporting them from existing angles, tee bars, bulb tees, etc.

4.2 Recessed fixtures supported from suspended ceiling framing members shall be securely fastened to the ceiling framing member as per N.E.C.

4.3 Raceways shall be run at least 6" from parallel flues, steam pipes, or hot water and refrigeration pipes. Raceways shall be supported each 8' unless special conditions require closer spacing. Individual horizontal runs of raceways shall be supported by Kindorf's C-144, C-147, C-149, C-247, C-248, C-249, HS-100, HS-400, HS-900, or equivalent as approved. Exposed runs shall be installed with runs parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings, and have all right angle turns

consisting of constant radius bend or threaded fittings. Where two or more conduits run parallel or where specified, they shall be supported by a rack, trapeze or framework constructed of B-900 series channel. Wherever hanger rods are used in conjunction with channel to form a trapeze, B-900 series channel with holes such as B-903, B-905-2A, B-905, B-907 and B-995 shall be used and, in all cases, rigid conduit shall be fastened to the channel with C-105 straps, E.M.T. and C-106 straps, and O.D. tubing with C-107 straps.

4.4 Copper or steel wire hangers will not be acceptable to support any item under this Contract.

4.5 Strap iron, properly installed, may be used for 1¼" conduit and smaller.

4.6 Where pipe supports and inserts have been specified by a particular manufacturer, pipe supports and inserts of equal quality and size, as manufactured by Elcen Metal Products or the Auto-Grip Division of Automatic Sprinkler Corporation will be acceptable.

PART 5 - SPECIALTIES

5.1 All EMT terminations at junction boxes, panels, etc. shall be made with locknuts, case hardened, and appropriate fittings as manufactured by Thomas and Betts, Efcor, or ETP. All rigid conduit shall have double locknuts.

5.2 All conduit, except main and branch feeders, shall have insulated metallic bushings equal to OZ Type B. All branch and main feeders #6 and larger and all raceways entering a box thru concentric knockouts shall have insulated bushings with grounding lugs equal to Type BL as manufactured by OZ. Jumper ground lugs to box. All rigid conduit fittings shall be threaded metal type, not set screw type.

5.3 All EMT terminations shall have insulated throat fittings equal to Thomas and Betts "Insulined" fittings.

5.4 All conduit stubbed through floor during construction shall have openings protected with plastic caps approved for this purpose. Connections on both ends of all flexible conduit shall be equal to Efcor.

5.5 All EMT fittings up to 2" shall be compression type, steel, malleable iron or equal. Pressure cast or die cast fittings will not be acceptable. 2½" and larger shall be set screw type, malleable or equal.

5.6 Dead spring type pressure connectors will not be acceptable on this project. All connections shall be made with insulated pressure type connectors (live spring) as manufactured by Thomas and Betts, (connectors with rigid body will not be acceptable). All connections on conductors No. 8 and larger shall be made with Burndy Type KS.

5.7 Items as manufactured by OZ, Gedney, Thomas and Betts, Midwest, Efcor or ETP will be considered equal.

END OF SECTION

Section-16140

Wiring Devices

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.1 The work under this section consists of furnishing and installing all materials, equipment and services necessary for the installation of all wiring devices shown on the drawings and herein specified.

1.2 All receptacles and switches, insofar as possible, shall be of one (1) manufacturer.

1.3 All receptacles and switch coverplates shall be stainless steel.

1.4 All receptacles shall be grounded type.

1.5 All outlets behind water coolers shall be concealed by water cooler when viewed from the front of the cooler. Refer to Shop Drawings furnished by Mechanical Contractor.

PART 2 - DUPLEX RECEPTACLES

2.1 Duplex receptacles shall be 20 amp, 120 volts, 2-pole, 3-wire, NEMA 5-20R configuration, unless otherwise shown. Receptacles shall have the following characteristics:

A. "T" Type contacts for phase and neutral female connection.

B. Female ground connection shall be riveted to the bridge.

C. The bridge shall be of hot dipped steel.

D. The receptacle body shall be of heat resistant thermoset material.

E. Rivet connecting the face plate to bridge shall be spun brass.

2.2 Duplex receptacles shall be 5352 Series equal to Hubbell, Arrow Hart, Bryant, P&S, or Leviton.

2.3 Weatherproof receptacles shall be the same as "B" above with Hubbell, #HBL5206-WO lift cover plate.

PART 3 - GROUND FAULT INTERRUPTER RECEPTACLES

3.1 Ground fault interrupter receptacle shall be duplex type suitable for mounting in a standard outlet box, rated 20 amps., 125 volts, 2-pole, 3-wire grounding type.

3.2 Device shall have a nominal sensitivity to ground leakage current of five milli-amperes and shall function to interrupt the current supply for any value of ground leakage current above five milli-amperes on the load side of the device. Device shall have a minimum nominal

tripping time of 1/30th. of a second. All receptacles within 6 foot of a sink shall be GFI type, as well as other locations shown on the drawings.

3.3 Device shall be equal to Hubbell, #GF-5352 or P&S 2091-S.

PART 4 - FLOOR RECEPTACLES

4.1 FLUSH FLOOR RECEPTACLES

A. Floor boxes on or below grade shall be P.V.C. type.
   1. Concrete pours greater than 3" shall be Hubbell B4214 fully adjustable.

B. COVERS
   1. Where indicated for flush mounting - use S3925 cover and Hubbell 5352 receptacle with proper box for tile floor.

   2. For carpet - use S3925 cover + 5352 Hubbell receptacle with proper box and carpet flange S3182.

PART 5 - SWITCHES

5.1 All switches shall be rated 20 amps. for 120 and 277 volt lighting circuits and shall be specification grade, back and side wired, with automatic ground clip and one piece contact arm. Switches shall be single pole, three or four way, or furnished with pilot where shown on the drawings.

5.2 Switches shall be equal to Hubbell 1221 Series, Arrow Hart, 1990 Series, Bryant 4900 Series, P&S Series 20AC or Leviton Series 1220, or GE # 5951 Series.

5.3 Mullion Switch - shall be a P&S 20A., 120-277V. single pole (#2241-S) or three-way (#2243-S) with vertical despard opening plate (301 stainless steel) #SWK-4-IN and #347 bracket.

PART 6 - DEVICE PLATES

6.1 All outlet boxes shall have a cover plate.

6.2 All device plates shall be stainless steel.

6.3 All unused telephone outlets shall have a one-hole cover plate.

PART 7 - REQUIRED SUBMITTALS

7.1 Submit manufacturer's data on all wiring devices and cover plates.

END OF SECTION

Section-16195

Electrical Identification

SECTION 16195

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 General Provisions of Contract and other Special Conditions and General Requirements apply to this Section.

1.2 Requirements of Section 16000 Electrical General Provisions govern work specified in this section.

PART 2 - DESCRIPTION OF WORK

2.1 Provide labor, materials, equipment and accessories necessary to provide required identification of electrical equipment, boxes, panelboards, conduit, etc.

2.2 Equipment disconnect switches, motor starters, pushbutton stations, panels, switchgear, special device plates, and similar material shall be clearly marked.

PART 3 - QUALITY ASSURANCE

3.1 Comply with National Electrical Code (NFPA 70) as applicable to provision and installation of electrical identification.

PART 4 - EQUIPMENT

4.1 CONDUIT MARKERS: Conduit markers shall be self-adhesive vinyl tape, a minimum of 3 mils thick by 1.5" wide, and color-coded orange, unless otherwise noted on the Drawings.

4.2 UNDERGROUND PLASTIC LINE MARKER TAPE: Acid and alkali-resistant polyethylene film tape, 6" wide with minimum thickness of 0.004". Tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3' deep. Tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect corrosion. Tape color shall be as specified below and shall bear a continuous printed inscription describing the specific utility:

Red:	electric.
Orange:	telephone, data, television, security, and fire communications.

4.3 PLASTICIZED TAGS: Tags shall be pre-printed or partially pre-printed accident prevention and operational tags, on plasticized card stock with matte finish for writing, approximately 3¼" by 5-5/8", with brass grommets and wire fasteners, and appropriate wording.

4.4 EQUIPMENT IDENTIFICATION: Equipment identification shall consist of black core plastic laminate nameplates with white engraved lettering. Signs for individual devices shall

have ¼" high letters. Mark panelboards, switchboards, motor control centers, and equipment giving panel designation in ½" high letters and voltage in ¼" high letters..

PART 5 - INSTALLATION

5.1 Where identification is applied to surfaces which require a finish, identification shall be installed after surface has been finished.

5.2 CONDUIT MARKERS: Identify electrical conduit with color-coded conduit markers where exposed in spaces with exposed mechanical piping which is color-coded. 277/480V.- Orange, 120/208V.- Yellow, Emergency - Green, Fire Alarm - Red, Telephone/Data - Blue.

5.3 UNDERGROUND PLASTIC LINE MARKER TAPE: During backfilling, install marker tape continuously at 6" to 8" below finished grade, above all buried power, communications, or signal cables or conduits. Install multiple markers where cables are installed in groups exceeding 16" width.

5.4 OPERATIONAL IDENTIFICATION AND WARNINGS: Install signs for instruction or warnings on switches, outlets, controls, devices and covers of electrical enclosures.

5.5 DANGER SIGNS: Install in areas constituting a danger for persons in or about the Project. All doors, hinged bolted panels, and screen doors giving access to equipment high voltage compartments or bus work shall be provided with a "DANGER-HIGH VOLTAGE-KEEP OUT" sign.

5.6 EQUIPMENT IDENTIFICATION:. Install engraved signs at or on each circuit breaker, switch, motor controller, panelboard, switchboard, special apparatus, and communications and signal systems, unless equipment is specified herein with its own self-explanatory identification. Text shall match terminology and numbering of the contract documents and shop drawings as close as practicable. Signs shall not cause interference with operation and maintenance of equipment. Attach signs with rustproof screws.

5.7 Identification of main entrance panelboard, distribution panelboards and branch panelboards shall be labeled indicating the panel designation, voltage and phase. Branch panelboards in finished areas shall have plate installed inside of door.

5.8 All remote disconnects, safety switches, motor starters, etc. shall have the name of the motor/equipment which it is controlling. The identification numbers on all junction or terminal boxes in finished areas shall be inside of cover or door.

5.9 CIRCUIT IDENTIFICATION: Install type written directories in all branch circuit panelboards describing the load served by each circuit. Identify spaces and spares in pencil. If room numbers assigned by the Owner do not match those on the drawings both sets of numbers must be cross referenced and identified in the panel directory.

5.10 JUNCTION BOX IDENTIFICATION: Identify circuits contained in each junction box on exterior cover w/permanent marker.

END OF SECTION

Section-16400

Distribution Equipment

SECTION 16400

DISTRIBUTION EQUIPMENT

PART 1 - INCOMING SERVICE

1.1 Service to this building shall originate at the new pole mounted transformer as shown on utility site plan, and riser diagram. All secondary conduit, duct system, secondary cable, cable connectors, opening and closing of primary and secondary trenches, to be provided by this contractor. Contractor shall also provide primary conduit with pull string. Utility company will supply and install the primary conductors and transformer. Service to this building shall be 120/208V., 3 Phase, 4W. 60 Hz. Contractor shall backfeed the existing electrical service at the existing building.

PART 2 – MOTOR CONTROL CENTER (MCC)

2.1 Furnish and install with a UL service entrance label where required. The MCC shall be free standing in a NEMA 3R enclosure. The panelboard bussing is to be tin plated copper. The panelboard, as a complete unit, shall have a short circuit rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or drawing. Provide starters for motors as shown.

PART 3 – BRANCH PANELS

3.1 Furnish and install circuit breaker panelboards as indicated in the panelboard schedule and where shown on the plans. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or drawings. The panelboard is to be 20"W x 5-3/4"D and shall be listed by UL. Panels shall be separate neutral and ground bus with lockable door. Panelboards shall be equal to Square D type NEHB, General Electric type NHB or Siemens.

PART 4 - BRANCH PANELS (120/208V)

4.1 Furnish and install circuit breaker panelboards as indicated in the panelboard schedule and where shown on the plans. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or drawings. The panelboard is to be 20"W x 5¾"D and shall be listed by UL. Panelboards shall be Square D type NQOD or equal.

PART 5 - BREAKERS

5.1 Breakers for branch panels shall be molded case bolt-in type. Single pole breakers in branch panels shall have an interrupting capacity of not less than 10,000 amp. symmetrical at 208/120V. unless otherwise noted on plans. Tandem breakers will not be allowed.

5.2 Breakers used for switching of lights shall be rated for switch duty and so noted.

PART 6 - DISCONNECT SWITCHES (NOT IN MAIN SWITCHGEAR)

6.1 Provide disconnect switches where indicated on drawings or where required by Code although not indicated on Drawings.

6.2 Disconnect switches shall be fused or unfused as required by Code as indicated on the Drawings or as specified. They shall be housed in an enclosure suitable for the location in which they are installed. For instance, all outdoor units shall be NEMA 3R.

6.3 All fusible switches shall be heavy duty. All unfused switches shall be general duty.

PART 7 - LOW VOLTAGE FUSE

7.1 Fuses 600 volts and less. Fuses shall not be shipped in switches in electrical equipment nor shall they be shipped to the job until the equipment is ready to be energized. All fuses shall be of the same manufacture to retain selectivity as designed. All fuses shall be installed by an Electrical Contractor.

A. All fuses shall be current limiting with 200,000 amperes interrupting capacity.

B. U.L., Inc. Class L fuses (bolt-type dimensions 601 to 6000 amps) shall have minimum time delay of 10 seconds at current of 5 times rating and shall have O-ring gas seals at the end bells and silver links. Bussmann KRP-C HI-CAP Time-Delay Fuse or Littelfuse KLP-C Time-Delay Fuse.

C. U.L., Inc. Class RK1 fuses (standard dimensions 600 amperes or less) shall be installed in the switches serving circuit breaker panels unless otherwise noted. Bussmann LPN-RK or LPS-RK LOW PEAK Dual-Element Fuses or Littelfuse LLN-RK or LLS-RK LittelPeak Dual-Element Fuses.

D. U.L., Inc. Class RK1 fuses (standard dimensions 600 amperes or less) shall be installed in all other switches and shall be dual-element, time-delay type with a spring actuated thermal overload element that operates at 284°F. temperature. Bussmann LPN-RK or LPS-RK LOW PEAK Dual-Element Fuse or Littelfuse LLN-RK or LLS-RK LittelPeak Dual-Element Fuses.

E. Motor protection dual-element fuses installed in individual circuits shall be sized at 125% of motor nameplate current rating or the next standard fuse size. Where excessive ambient temperature, high inertia motor loads or frequent "On-Off" cycling requires larger fuses, consult the Electrical Designer. Use fuse reducers where fuse gaps are larger than fuse dimension. Bussmann LPN-RK or LPS-RK LOW PEAK Dual-Element Fuse or Littelfuse LLN-RK or LLS-RK Littelpeak Dual-Element Fuse.

F. Ten percent spare fuses or a minimum of three of each size and type shall be placed in a spare fuse cabinet wall mounted near the electric service. Mount a spare fuse cabinet similar to the "Bussmann Spare Fuse Cabinet", Catalog No. SFC or "Littelfuse Spare Fuse Cabinet" Catalog # LSFC.

G. Lighting Fixture Fuse Protection.
   1. Fluorescent fixtures (1 Fuse/Fixture) shall be protected with Littelfuse LGR Fuse (LHR Holder) Type GLR fuses (HLR holders) installed at the fixture in addition to any internal ballast thermal protection. Size the fuse according to manufacturers recommendations.

2. Other lighting fixtures, H.I.D. fixture ballasts, etc. shall be protected individually with KTK (Littelfuse KLK fuses) fuses, mounted in HEB Series fuse holders. Size the fuse according to manufacturers recommendations.

PART 8 - REQUIRED SUBMITTALS

8.1 Submit manufacturer's data on all panelboards and disconnect switches.

END OF SECTION

Section-16425

Surge Suppression

SECTION 16425

SURGE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. These specifications describe the electrical and mechanical requirements for a hybrid high-energy suppression filter system that integrates transient voltage surge suppression (TVSS) with high-frequency electrical line noise filtering for high exposure applications.

B. The specified unit shall provide effective high energy transient voltage suppression, surge current diversion, high frequency attenuation and line control for all electrical modes of equipment connected downstream from the facility's meter or main overcurrent device in high exposure ANSI/IEEE C62.41-1991 environments. The unit shall be connected in parallel with the facility's wiring system.

C. The unit shall be designed and manufactured in the USA by a qualified manufacturer of suppression filter system equipment. The qualified manufacturer shall have been engaged in the commercial design and manufacture of such products for a minimum of five (5) years.

D. These specifications are based on Sine Control Technology Inc. "PowerClamp" TVSS Series. For consideration, other manufacturers shall provide detailed compliance or exception statements to all provisions of this specification fourteen (14) days prior to bid.

1.2 STANDARDS

A. The specified unit shall be designed, manufactured, tested, and installed in compliance with the following standards:

1. American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.41-1991 and C62. 45-1987);

2. Canadian Standards Association (CSA);

3. Federal Information Processing Standards Publication 94 (FIPS PUB 94);

4. National Electrical Manufacturers Association (NEMA);

5. National Fire Protection Association (NFPA 70 [NEC], 75, AND 78);

6. Underwriters Laboratories (UL 1449).

B. The unit shall be UL 1449 Listed and CSA Approved as a Transient Voltage Surge Suppressor and UL 1283 Listed as an Electromagnetic Interference Filter.

1.3 ENVIRONMENTAL REQUIREMENTS

A. Storage Temperature. Storage temperature range shall be -40 to +85 C (-40 to + 185F).

B. Operating Temperature. Operating temperature range shall be -40 to +60C (-40 to +140F).

C. Relative Humidity. Operation shall be reliable in an environment with 5% to 95% non-condensing relative humidity.

D. Operating Altitude. The unit shall be capable of operation in altitudes up to 13,000 feet above sea level.

E. Audible Noise. The unit shall not generate any audible noise.

F. Magnetic Fields. No appreciable magnetic fields shall be generated. Unit shall be capable of use directly in computer rooms in any location without danger to data storage systems or devices.

1.4 Electrical Requirements

A. Unit Operating Voltage. The nominal unit operating voltage at configuration shall be as indicated on the drawings.

MODEL NUMBER	VOLTAGE	POLES	CONFIGURATION
4827VF4-8	277/480	3	Grounded Wye; 4 Wire + ground
1208VF4-6	120/208	3	Grounded Wye; 4 Wire+ ground

B. Maximum Continuous Operating Voltage (MCOV). The maximum continuous operating voltage (MCOV) of all suppression components utilized in the unit shall not be less than 125% of the facility's nominal operating voltage for 120 volt nominal systems and not less than 115% of the facility's nominal operating voltage for 208 and 480 volt nominal systems.

C. Operating Frequency. The operating frequency range of the unit shall be 47 to 63 Hertz.

D. Protection Modes. In accordance with NEMA Standard LS 1-1992, the unit shall provide protection in all modes. For a wye-configured system the primary mode of protection shall be line-to-neutral, the secondary modes of protection shall be line-to-ground and neutral-to-ground. For a delta-configured system the primary mode of protection shall be line-to-line and the secondary mode shall be line-to-ground, if the system is grounded.

E. Tested Single-Pulse Surge Current Capacity. Based on ANSI/IEEE C62.41-1991's standard 8x20 microsecond current waveform, and in accordance with NEMA Publication No. LS 1-1992, the tested single-pulse surge current capacity, in amps, of the unit shall be no less than as follows:

MODE OF PROTECTION	L-L	L-N	L-G	N-G

Tested Single-Pulse Surge Current Capacity	150,000	150,000	150,000	150,000

F. Unit Performance Ratings. The unit's published performance ratings shall be the UL 1449 Listed suppression ratings. The UL 1449 suppression rating for all units shall be, for each mode of protection, as follows:

Category A waveform (6kV, 200 amps, 0.5us, 100kHz): TWO (2) VOLTS of the peak of the sine wave. Measured from the baseline at the 90° point of the power sine wave (@ WAVEFORM PEAK).

Category B ringwave (6kV, 500 amps, 0.5us, 100kHz): TEN (10) VOLTS of the peak of the sine wave. Measured from the baseline at the 90° point of the power sine wave (@ WAVEFORM PEAK).

Category B impulse (6kV, 1.2/50us, 3,000 amps): THIRTY (30) VOLTS of the peak of the sine wave. Measured from the baseline at the 90° point of the power sine wave (@ POSITIVE WAVEFORM PEAK).

Category C Impulse (20kV, 1.2/50us, 10,000 amps): TWO HUNDRED TWENTY (220) VOLTS of the peak of the sine wave. Measured from the baseline at the 90° point of the power sine wave (@ WAVEFORM PEAK).

PART 2 PRODUCTS

2.1 MAIN ENTRANCE AND SUBPANEL TVSS UNITS:

A. High-Performance Suppression System. The unit shall include an engineered solid-state high-performance suppression system, utilizing either selenium cells or metal oxide varistors with similar operating characteristics, or both.

1. The suppression systems' components shall optimally share surge currents in a seamless, low-stress manner assuring maximum performance. The suppression system shall not utilize gas tubes, spark gaps, silicon avalanche diodes or other components which might short or crowbar the line, thus leading to interruption of normal power to or system upset of connected loads. The suppression system shall not incorporate non-field replaceable fusing or any other components which may degrade performance or reliability of the suppression system.

B. High-Frequency Extended Range Tracking Filter. The unit shall include a high-frequency extended range tracking filter and shall be UL 1283 Listed as an Electromagnetic Interference Filter. The filter shall reduce fast rise-time, high frequency, error-producing transients and electrical line noise to harmless levels, thus eliminating disturbances which may lead to system upset. The filter shall provide minimum noise attenuation as follows:

Attenuation Frequency	100 kHz	1 MHz	10 MHz	100 MHz
Insertion Loss (ratio)	50-1	350-1	500-1	250-1
Insertion Loss (dB)	34	51	54	48

Note: Standardized insertion loss data obtained utilizing MIL-STD-E220A 50 ohm insertion loss methodology.

The TVSS device shall function in coordination with other suppression-filter devices within the facility-wide suppression-filter system to provide minimum noise attenuation as follows:

Attenuation Frequency	100 kHz	1 MHz	10 MHz	100 MHz
Insertion Loss (ratio)	355-1	50,000-1	500,000-1	1,000,000,-1
Insertion Loss (dB)	51	94	114	120

Note: Standardized insertion loss data obtained utilizing MIL-STD-E220A 50 ohm insertion loss methodology.

C. Internal Connections. All internal wiring associated with the suppression filter system and subject to surge currents shall utilize low-impedance circuitry. copper bus bar and/or #2 AWG copper conductor or larger

D. Field Connections. The unit shall include mechanical lugs for each phase, neutral and ground, if applicable. The lugs shall accommodate up to #4 AWG copper conductor.

E. Field Installation. The unit shall be installed as close as practical to the facility's wiring system in accordance with applicable national/local electrical codes and the manufacturer's recommended installation instructions. Connection shall be with #8 AWG copper conductor and not be any longer than necessary, avoiding unnecessary bends.

F. Unit Status Indicators. The unit shall include solid-state, long-life, externally mounted LED visual status indicators that monitor the fuse status of each phase of the unit.

G. Enclosure. Standard surface-mounted units shall be provided in a NEMA 1 type enclosure of 14 gauge steel, painted inside and out with Sherwin Williams Polane T or equal paint.

H. Circuit breaker. The unit shall be connected to the applicable circuit breaker panel via a standard circuit breaker rated at 15 amps or higher. The unit shall be UL 1449 Listed and the UL 1449 Suppression Rating for this configuration shall be provided. (1.4.6 Performance Ratings).

PART 3 - DOCUMENTATION AND TESTING

3.1 Equipment Manual. The manufacturer shall furnish an equipment manual with installation, operation, and maintenance instructions for the specified unit.

3.2 Drawings. Electrical and mechanical drawings shall be provided by the manufacturer which show unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.

3.3 UL 1449 Suppression Ratings. Documentation of unit's UL 1449 suppression rating shall be included as required product data submittal information. Manufacturer shall make available upon request certified documentation of applicable Location Category Testing in full compliance with ANSI/IEEE C62.41-1991 and ANSI/IEEE C62.45-1987 Guidelines.

3.4 Spare Parts. A list of customer-replaceable spare parts shall be included in the unit's installation, operation and maintenance instructions. All spare parts shall be quickly and easily field-replaceable.

3.5 Life Expectancy Testing. The unit shall be life-cycle tested to protect against and survive at least 2,500 ANSI/IEEE C62.41-1991 Category C3 surges without failing or degrading the UL 1449 Surge Suppression Rating by more than 10%. The EGP, when installed as part of a facility-wide suppression-filter system, shall be tested and capable of protecting against and surviving at least 6,000 ANSI/IEEE C62.41-1991 Category C3 surges without failing or degrading the UL 1449 Surge Suppression Rating by more than 5%.

3.6 MCOV Testing. The unit shall be factory-tested and burned-in at the applicable MCOV for a minimum of one (1) hour.

3.7 Warranty. The manufacturer shall provide a pro-rated five-year warranty from date of shipment against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's Installation, Operation and Maintenance Instructions.

3.8 Quality Assurance. The unit shall be thoroughly factory-tested before shipment. Testing of each unit shall include but shall not be limited to UL manufacturing and production-line tests, quality assurance checks, MCOV and clamping voltage verification tests.

PART 4 APPROVED VENDORS

4.1 Sine Control Technology, Inc., or approved equal capable of meeting or exceeding the Clamping Level performance (also called "Let-through Voltage") as listed in Part 1, paragraph 1.4, Sections E and F.

PART 5 REQUIRED SUBMITTALS

5.1 Submit manufacturer's data on surge suppression system and all its components.

END OF SECTION

Section-16600

Miscellaneous Systems

SECTION 16600

MISCELLANEOUS SYSTEMS

PART 1 - TELEPHONE SERVICE ENTRANCE

1.1 Furnish and install conduits and outlets, terminal board, etc. as shown on the drawings for a complete service entrance telephone conduit system. Install nylon pullstring in all empty conduit runs. The local telephone company will install service to building. Contractor to coordinate all work with local phone company and pay all fees required.

1.2 Furnish and install telephone terminal board as shown on the drawings.

PART 2 - PHOTO-CONTROL

2.1 Photo-control shall be an AMF Paragon, PJ201 Series with built-in weatherproof junction box for 120V. operation, swivel arm, 3 F/C "On"; 10 F/C "Off" and built-in 15 second time delay.

END OF SECTION

Section-16780

Control Systems

(SCADA)

SECTION 16780

CONTROL SYSTEMS (SCADA)

PART 1 - GENERAL

1.1 PROJECT DESCRIPTION

A. Description of Work

The work to be accomplished under this section shall consist of furnishing the equipment necessary for a complete automatic control and monitoring system to function as specified herein and as shown on the drawings. The system integrator's shall furnish a completely integrated all solid-state radio telemetry base Supervisory Control and Data Acquisition (SCADA) system. It shall be the system integrator's responsibility to supply a system that is compatible with existing equipment, new equipment supplied by others as part of this contract, and equipment supplied in other contracts. The complete system shall be designed, fabricated, programmed, tested, started up, and warranted by a single supplier to insure a single source of responsibility.

B. Scope of Work

This section covers a radio telemetry based SCADA and Instrumentation System to include:

(1) Sewage Lift Station Remote Units(s)
(1) Signal Repeater Station Units(s)
(1) Wastewater Treatment Plant Control System
(1) Central Terminal Unit with (1) Operator Display Console(s).
(1) Web Access/Control at the Pikeville WTP.

C. Contractor Shall Supply

1. All equipment required in other sections of the specifications.
2. All labor for installation and start-up of the system.

D. System Integrator Shall Supply:

1. Engineering submittal and shop drawings prior to installation.
2. All the paper work and fees necessary to obtain a FCC radio license in the name of the Owner.
3. All user licenses and fees for software supplied in this system with licenses in the name of the owner.
4. Spare parts and maintenance tools, as detailed in this section.
5. Operation and maintenance manuals, as detailed in this section.
6. All start-up labor and services, as required for equipment specified in this section.
7. Operator training as detailed in this section.

E. Owner Shall Supply:

1. Access and easements as needed for all sites.
2. 120VAC power at all sites.
3. Pressure sensing taps for all sensing points in the system.

4. Meter pits for sensing tank levels or line pressures in the system.
5. Desks and chairs for Operator Display Console computer.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications

The system specified herein shall be the product of a manufacturer who can demonstrate at least ten (10) years of satisfactory experience in furnishing and installing comparable radio based telemetry/control systems for water and wastewater installations.
The manufacturer of this system shall maintain a 24-hour available inventory of all replaceable modules to assure the Owner of prompt maintenance service and a single source of responsibility. The manufacture and shall certify this to the Engineer in writing at the time of bidder pre-qualification.

B. Pre-bid Approval

The Base Bid approved systems integrator for this project is:

Micro-Comm, Inc.
15895 S. Plfumm Rd
Olathe, KS 66066

Local Contact: Roger Schmitt
Tel 859-250-8013

Other integrators desiring to bid this project as "alternate" integrators must seek pre-bid approval by providing a submittal (14) days prior to the bid date. Submissions that fail to include a complete submittal as detailed shall be deemed unresponsive. The Consulting Engineer and the Owner shall be the sole judge as to whether the alternate equipment is considered an approved equal. Approval of an alternate system by the Engineer will not relieve the alternate system of strict adherence to these specifications. The pre-bid submittal shall include the following:

1. An installation list with the names and phone numbers of both the Owner and Consulting Engineer for at least ten projects of similar size and complexity.
2. A "statement of compliance" detailing paragraph by paragraph the bidders compliance to these specifications.
3. Block diagrams for the various sites in the proposed system showing the selected pieces of hardware equipment to be used.
4. Sample electrical drawings for typical sites proposed in this contract.
5. A product performance data sheet shall be included for each hardware component in the system (i.e. antennas, radios, coaxial cables & arrestors, programmable controllers, power supplies, time delays and relays, and the various sensors required) and each software component (programming & configuration software and operator display console software).
6. Radio path study for each radio path in the system. Bidders shall satisfy themselves that the necessary radio frequency(s) can be obtained. The radio path study provided by each bidder shall utilize either:
   a. Computer generated techniques utilizing a USGS 3 second terrain database to plot the path profiles for each radio path with elevation samples at not more that 200 foot increments.
   b. Actual field measurements to showing the necessary antenna heights, transmitter power, and antenna gains required to insure a 20db fade margin as detailed in Section 2.02 of these specifications. The a physical path analysis shall be made using temporary equipment installations and a radio communications analyzer to measure actual path margins. The bidder shall include in his bid, all the calculations used to extrapolate the measured data. The bidder is expected to obtain the necessary temporary FCC license for the study.

7. Communications diagram for the entire system showing normal CTU-RTU communications paths and Peer-to-Peer back-up communications paths.

C. Approval Agencies

The control system and its components shall comply will all applicable requirements of the following:

1. Electrical Code Compliance (National & Local)
2. UL 508A
3. NEMA Compliance
4. IEEE Compliance
5. EIA Compliance
6. FCC Compliance

1.3 SUBMITTALS:

A. Complete submittal shall be provided to the engineer for approval prior to equipment fabrication. The submittal data shall include the following:

1. Product Data - Provide product data sheets for each instrument and component supplied in the system. The data sheets shall show the component name as used on reference drawings, manufacturer's model number or other product designator, input and output characteristics, scale or ranges selected, electrical or mechanical requirements, and materials compatibility.
2. Shop Drawings - Provide drawings for each panel showing the wiring diagrams for control circuits and interconnections of all components. The drawings shall include wiring diagrams for all remote devices connected to the panel.
3. Panel Layout Drawings - A front panel and sub-panel layout shall be included as part of each control panel drawing. Components shall be clearly labeled on the drawing.
4. Installation Drawings - Typical installation drawings applicable to each site in the system shall be included.
5. Operator Interface Software - The submittal shall include a generic but detailed technical description of the Operator's Interface Software as proposed for this system including:
   a. Sample text screens and menus
   b. Sample graphics screens
   c. Sample report logs and printed graphs

1.4 MAINTENANCE INFORMATION

A. Maintenance Data Manuals

Submit maintenance manuals and "as built" drawings on all items supplied with the system. The manuals and drawings are to be bound into one or more books as needed. In addition to "as built" engineering submittal data and drawings, the manual shall include trouble shooting guides and maintenance and calibration data for all adjustable items.

B. Maintenance Data Manuals

The Systems Integrator shall also provide 10% spare fuses and lamps for each type used in the system. Provide one each spare parts to include:

1. (1) of each type of Radio Transceiver.
2. (1) of each type of radio modem in the system.
3. (1) of each type of Power Supply used in the system.
4. (1) of each type of Programmable Logic Controller.

5. (1) of each type of Level Transmitter in the system.
6. (1) of each type of Pressure Transmitter in the system.

Systems that require the zero or span adjustments of level transducers be adjusted to specific site conditions shall require a spare adjusted transducer for each different site location.
No spare parts will be required for the Operator Display Console Computer, CRT display, printer, passive back-planes, or wiring harnesses.

1.5 JOB CONDITIONS

A. All instruments and equipment shall be designed to operate under the environmental conditions where they are to perform their service. The equipment shall be designed to handle lightning and transient voltages as normal environmental hazards. The environmental conditions are as follows:

1. Outdoor - The equipment will be exposed to direct sunlight, dust, rain, snow, ambient temperatures from -20 to +120 degrees F, relative humidity of 10 to 100 percent, and other natural outdoor conditions. The installations shall be hardened to with stand normal vandalism.
2. Indoor - The equipment will be capable of operating in ambient temperatures of +32 to +130 degrees F and relative humidity of 20 to 100 percent.

1.6 DELIVERY, STORAGE, & HANDLING

A. All items shall be stored in a dry sheltered place, not exposed to the outside elements, until ready for installation. All items shall be handled with appropriate care to avoid damage during transport and installation.

1.7 SEQUENCING & SCHEDULING

A. Coordination

The Systems Integrator shall coordinate with other electrical and mechanical work including wires/cables, raceways, electrical boxes and fittings, controls supplied by others, and existing controls, to properly interface installation and commissioning of the control system.

B. Sequence

Sequence installation and start-up work with other trades to minimize downtime and to minimize the possibility of damage and soiling during the remainder of the construction period.

1.8 DISTRIBUTED CONTROL OPERATION

A. General

The control system shall use "Programmable Logic Controllers" (PLCs) at all locations in the system as detailed later in these specifications. Each site in the system shall have a unique digital address. The Central Processing Units (CPUs) and Input/Output (I/O) cards used in each of the PLCs shall all be identical, fully interchangeable with out reprogramming by the operator. The PLCs shall be "self-initializing" and "self restoring" so that operator intervention is not required after power interruptions, transients from lightning storms, or component changes.

The system shall be composed of a Central Terminal Unit (CTU) that monitors and or controls the operation of multiple Remote Terminal Units (RTUs). The CTU shall be composed of a PLC (as described above) and one or more Operator Display Consoles (ODCs) with Human-Machine-Interface (HMI) software to display, alarm, record, all data received and for operator input for changes to the system.

The control system shall be capable of implementing multiple modes of communications in a single system to include: radio, leased phone-line, dial-up phone-line, high speed data highway, fiber optic, and Ethernet communications as details in these specifications. The individual sites in the system shall simultaneously support both Master-Slave and Peer-to-Peer communications as needed implement the distributed control features listed in these specifications.

B. Distributed Control Software Features

The system shall be a "distributed control" type system that simultaneously provides for the features of both "supervisory control" (ie centralize control of RTUs from the CTU) and "distributed control" (ie RTU self initiated control using local inputs and peer-to-peer communications with other RTUs) in to a single unified control system. The control system shall simultaneously support both Master-Slave (ie CTU to RTU) and Peer-to-Peer (i.e. RTU to RTU) communications to provide completely automatic control with no single point of system wide failure in either the PLC system or the communications system. The systems integrator shall implement redundant communications paths between RTUs to maintain automatic control in the event of CTU or system wide communications failure.

The control algorithms shall have the ability to integrate both hardware and software operator inputs (ie ODC setpoints and selector switch inputs) along with hardware inputs at the remote sites (ie remote Hand/Off/Auto selector switches, etc.) in to a unified cohesive automatic control system. As data is received, changes, or lost (i.e. a loss of signal from a RTU or CTU), the Central Unit control logic shall automatically adjust the controlling algorithm to the new situation.

In general the RTUs shall receive and store control parameter commands as inputted by the operator from both the CTU or the RTU. These inputs shall be displayed at both the CTU and RTU. Distributed control shall provide for fully automatic by the RTU based on the pre-programmed control algorithm, operator inputs received from the CTU, operator inputs received from the RTU front panel display, data received from other RTUs, and local inputs monitored at the RTU. For example, the RTU shall based on operator inputs automatically control the operation of pumps or valves based on level data received from other RTUs and local pressure, flow, and discrete inputs monitored at the RTU. Pump call/run/fail status shall be reported to the CTU for centralize display, alarming, and recording. The RTU distributed control algorithm shall handle the daily pump call/run/fail, automatic alternation, automatic transfer on fail, high discharge cut-off, low suction cut-off, low & high flow cut-ff and basic tank fill or demand supply operations at the pump station for RTUs as detailed for each RTU.

Supervisory control shall automatically or manually provide for the CTU to be able to override or modify the automatic operation of RTUs based on a pre-programmed control algorithm. For example, the CTU shall be able to automatically turn on or off pumps at RTUs or change RTU operational parameters as needed to satisfy "system" wide requirements such as peak load shedding for power or water distribution management during peak demand periods.
The control system shall provide for multiple levels of control such that a single point of failure shall not render the control system in-operative:

1. In the event of a ODC failure, the PLC at the shall continue to poll all of the RTUs to collect data and provide supervisory control.
2. In the event of PLC failure at the CTU, the individual RTUs shall continue to provide fully automatic control using last stored operator inputs and peer-to-peer communications with other RTUs for control data as needed.
3. In the event of peer-to-peer communications failure between RTUs, the controlling RTUs (ie sites with pumps, valves, etc) shall continue to provide automatic control based on locally sensed pressures and flows.
4. In the event of complete failure of local RTU at a booster station (or similar site), the failure shall cause a "system normal" lamp and relay to be de-energized to automatically re-engage any existing back-up control system (such as pressure switches, float switches, etc.) to maintain automatic control.

The system shall automatically revert to the next higher level of control as communications or equipment failures are repaired.

C. Standard Control Software Features

The supplied software shall not be a one-of-a-kind system, but rather a comprehensively designed software platform that provides a number of built in features that monitor local & remote inputs combined with standard software algorithms to provide an integrated system as follows:

1. Monitor local Hand/Off/Automatic (HOA) selector switch positions (ie on existing pump control panels) and integrate the switch position in to the control logic such that a HOA in HAND or OFF shall be considered by the control system as 'un-available".
2. Provide for High Discharge Cut-off and Low Suction Cut-off control of pumps from locally entered setpoints at RTUs equipped with suction and discharge pressure transmitters and/or from existing pressure switches.
3. Provide automatic Pressure/Flow pump staging operation of pumps of different sizes (including variable speed pumps) from local discharge pressure and discharge flow inputs in a closed-loop system. The pumps shall be up-staged on decreasing discharge pressure and down-staged on decreasing flow rate. The control shall include PID (Proportional Integral Derivative) loop control of variable speed pumps mixed with constant speed pumps for the various stages required.
4. Provide "Compound Loop" PID control of final devices (ie chemical feeders) from multiple inputs (ie flow rate and a chemical process analyzer, such as chlorine residual).

1.9 RADIO CHANNEL DATA OPERATION

A. General

The control system shall be specifically designed for radio channel data communications. The core of the system shall be over FCC licensed radio frequency spectrum intended for SCADA and remote control purposes. The systems integrator shall be responsible of obtaining the necessary FCC licenses for one or more frequencies as needed to establish both supervisory and distributed control.

All of the equipment required for operation of the system shall be directly owned by the Owner and included as part of this contract. Systems using third party repeaters, trunking masters, or leased equipment will not be allowed. The Systems Integrator shall select radio equipment as detailed below to insure reliable operation and be able to implement all software features listed in this specification whether currently required or described as a "shall be capable" feature.

The overall system design and operation shall provide a 20db pad over the minimum required for operation on all primary data paths (primary paths may include data relays) to insure a 98% reliability of communications. Remote site communications for distributed peer-to-peer communications shall provide 30db of pad to insure operation under all weather conditions and provide a 99.9% communications reliability. The 20db and 30db pad requirements and FCC rule compliance shall be demonstrated (at no additional cost) to the Engineer at his request. The testing shall be accomplished using an IFR AM/FM 1000S communications analyzer or equal equipment.

B. Communications

The CTU-RTU supervisory communications and RTU-RTU distributed control communications system shall operate in a half-duplex mode over a single "licensed" radio frequency using "point-to-point" communication techniques. The RTUs shall monitor for the channel to avoid data collisions with other RTUs during peer-to-peer communications. The system shall be capable of sharing the radio channel with other radio telemetry system.

To facilitate system layout and future expansion all RTUs shall under the direction of the CTU be able to implement store-and-forward communications to relay data and commands to and from other RTUs as required to establish the desired path. Should the assigned relay site for a distant remote be inoperative, the Central Unit shall automatically choose another remote site to access the distant remote. Any RTU shall be able to provide automatic antenna switching as part of their relaying operations.

All data transmitted shall be in digital word form using FSK (frequency shift keying) transmission. All transmissions shall include the address of the sender and the receiver, and be subject to check sum, parity, and framing error checks, to insure a minimum data reliability of 1 error in 1,000,000,000 bits. Any transmissions that fail the data checking will be retried until correct. No data correction methods will be allowed. A plug-in RS232C data port shall be provided at all locations in the system to allow the use of a standard data terminal to view data exchanges between the sites and to provide a means of extensive de-bugging.

The system shall provide a complete data update at least once every (2) minutes with some functions updating faster as required by local system conditions.

C. Radio Channel Operation

The system shall be capable of operation on the narrow band splinter frequencies of the Private Land Mobile Radio Services within the Federal Communications Commissions (FCC) rules and regulations regarding these telemetry channels. The manufacture shall guarantee operation under co-channel conditions with other radio systems without interference to this system. FSK tones, data baud rates, transmitter output power, transmitter deviation, antenna gain, and antenna height shall be chosen to comply with the FCC requirements Part 90 - Subpart 90.35 and 90.238 for the Industrial/Business frequency pools. The radio system shall specifically meet the operating requirement that the sum of the highest FSK frequency and the amount of deviation shall not exceed 1.7 kHz for 3F2 emission (or 2.8 kHz for 6F2 emission) as detailed by the FCC for the specific frequency assigned.

CTUs and RTUs shall be capable of automatically switching antennas and/or radios (including radios on different frequencies) during CTU-RTU, RTU-RTU, and store & forward communications. The antenna/radio switching at remote units shall automatically default back to RTU-CTU paths if communications are lost with the CTU.

D. FCC Licensing

The system manufacturer/supplier shall be responsible for collecting all information, generating all paper work, and paying all fees required obtaining a license on behalf of the Owner.

PART 2 - PRODUCTS

2.1 PROGRAMMABLE LOGIC CONTROLLERS & LOCAL I/O EQUIPMENT

A. General

Industrial Programmable Logic Controllers (PLCs) shall be used at all locations. The PLCs shall have an operational range of 0-60degC and 5-95% relative humidity. The PLCs shall all be from the same family of controllers, scalable from very small to very large applications, and programmed from identical programming software used for all processors. The PLCs shall be readily available on and directly purchasable online from the manufacture's WEB page. The PLCs shall be Allen-Bradley CompactLogix or Micro-Comm M1500 Series controllers.

The software at all locations shall be stored in a user removable non-volatile CompactFlash or similar type ROM memory that can be exchanged under power, used to upgrade sites in the field, and store historical data (local trends, accumulators, etc) for retrieval locally or by the central unit. The memory modules shall store all site specific logic and configurations including communication parameters, control algorithms, analog input/output scaling, PID control parameters. The module shall be programmed via the CPU and without the use of external adapters. The PLCs shall include "watch-dog" circuitry and be "self-initializing" without operator intervention. In the event that the program or configuration data is corrupted, the CPU shall reload the program and configuration data from the EEPROM memory module.

The PLCs shall be fully online programmable while the PLC continues to communicate with the rest of the system and performs its assigned control tasks. The PLCs shall support "fill-in-the-blank" type configuration for basic operation and to set-up common features such as COM port set-up, peer-to-peer data collections, local back-up control set points, input and output setup, output on/off time delay settings, front panel display setup, etc. The PLC shall also support a process script language or ladder logic type programming for site-specific customizations including special input and output manipulations, local sequential control, math functions, and PID control as follows:

1. Relay (Bit) Type - Examine if ON, Examine if OFF
2. Timer & Counter - Timer ON, Timer OFF, Timer DONE
3. Compare Functions - Equal, Not Equal, Greater Than, Less Than, etc
4. Math Functions - Add, Subtract, Multiply, Divide, Square Root
5. Scaling Functions - Scale & Scale with Parameters
6. Logical Functions - AND, OR, & NOT
7. Program Control - Jump & Skip Next functions
8. PID - PID with compound loop input

The PLC programming software shall be written for the 32 bit interface of Windows XP. The supplier shall provide a licensed copy of the PLC configuration and programming software along with the necessary communications cables to the owner. Training on the use of the software shall be provided as part of the system training.

B. Construction

The PLC shall use modular construction. The base unit shall be composed of the power supply, CPU, communications modules, and basic inputs and outputs (I/O). The unit shall have expandable inputs and outputs using a "rack-less" DIN rail mount design and capable of supporting local I/O (via an integrated high-performance serial I/O bus) and remote I/O via a industrial serial bus. All terminations shall use removable, NEMA-style "finger-safe" terminal blocks so that individual modules may be removed with out disturbing adjacent modules.

The PLC shall be capable of being powered from AC, DC, or solar sources. DC and solar powered PLCs shall have an integral battery charging circuit that protects the external battery from over and under voltage conditions and provides automatic charging of the battery after power failures. The back-up power supply shall be either 12VDC with 24VDC DC/DC converter or 24VDC with a 12VDC DC/DC converter to run the 12VDC radio and 24VDC to power external sensors from a single battery source. Series tapped 24VDC batteries for 12VDC will not be allowed. Back-up batteries shall be rechargeable sealed lead-acid type batteries as manufactured by PowerSonic or equal. The back-up battery shall provide for 24 hours of back-up operation at water tower remote units and 3 hours at all other sites.

The PLC shall have a minimum of two (2) communications ports. The first shall be used primarily for CTU-RTU and RTU-RTU communications. It shall support baud rates of 110-19,200 baud and have a plug-in standard 25pin or 9pin sub-D connector that provides a full RS232 interface and radio modem interface. The second communications port shall provide programming, operator front panel interface, multiple PLC interconnect and other local communications. It shall support baud rates of 110-19,200 baud and have a 9-pin sub-D interface. The communications ports shall include LED's to show the status of all control lines. The PLC shall also optionally support Ethernet communications as detailed in the specifications.

The PLC shall utilize a rack-less design and provide for sufficient installed and configured spare inputs and outputs (I/O) to meet the site requirements as detailed and provide for 25% spares of each type. The unit shall have a minimum of (4) discrete (relay) outputs, (8) discrete inputs (DI), (4) analog inputs (AI), and (2) analog outputs (AO). The analog inputs shall provide for sensor excitation with separate fuses for each input. The fuses may be the self-resetting type. All input and output connections to the PLC shall be via Nema "finger-safe" plug-in terminal blocks.

The PLC shall support both local and remote I/O. Input/Output cards shall be mounted on a DIN rail channel. The PLC inputs, outputs, and operator interface shall be as follows: .

1. DISCRETE OUTPUTS - The discrete outputs shall be isolated relay outputs rated at 5.0A continuous @ 240VAC. LEDs on the front of the PLC base unit or expansion module shall indicate the status of each output point. Interposing relays shall be provided if the voltage or current of the external load on a contact exceed the 5.0A 240VAC ratings. Each output shall be provided with operator settable software ON and OFF time delays.

2. DISCRETE INPUTS - The discrete inputs shall be optically isolated and provide for 24VDC excitation to remote sensors and switches. Each input shall be separately fused or current limited such that accidental grounding shall not render the other inputs non-functional. LEDs on the front of the input module shall indicate the status of each input point.
3. ANALOG INPUTS - The analog inputs shall provide filtered and scalable analog to digital conversion of input signals. The analog inputs shall be switch selectable from 0-5VDC to 0-20mADC and provide a minimum of 0.3% resolution and 0.5% accuracy over the temperature range of 0-70degrees C. The PLC shall provide separately fused 24VDC excitations to the remote sensors.
4. ANALOG OUTPUTS - The analog outputs shall provide a 4-20mA isolated signal to other panels and devices as specified.
5. PULSE INPUTS - The high-speed counter/pulse inputs shall provide for pulse rates up to 1KHz direct from flow meter transmitter heads without interposing equipment. The pulse input shall include fused 12VDC excitation to the meter transmitter.
6. POWER SUPPLY - Each PLC assembly shall include an integral power supply. Power supplies shall be designed for 12VDC or 24VDC input power and suitable for use in battery back-up operations. DC/DC converters shall be required to insure that both the 12VDC and 24VDC are regulated separately from the common source.
7. KEYPAD & DISPLAY UNIT - The optional keypad & display unit shall have a 4x20 back-lighted LCD display to display the status of all local inputs and the tank level of the associated control water tower level. The 5x5 keypad shall provide for operator input of set points and timer settings. The operator interface shall be menu driven and provide for dedicated keys for cursor position and input functions. The operator interface shall provide for up to 50 screens of data display. The keypad & display unit shall be supplied and mounted on the front of the PLC enclosure if detailed in the specific PLC I/O requirement list. The keypad & display unit shall maintain the Nema 4 rating of the PLC enclosure.
8. GRAPHICAL TOUCH-SCREEN DISPLAY UNIT - The optional Graphical Touch-Screen display unit shall have an 6" diagonal (3.5" x 4.5") back-lighted 256-color TFT LCD display with resolution of at least VGA (640x480 pixels) resolution. The display shall have a resistive touch-screen with a touch accuracy of 2mm. The operator interface shall be graphical and provide for display of all data monitored and operator input of setpoints and operating commands. The Graphical Touch-screen unit shall be supplied and mounted on the front of the PLC enclosure if detailed in the specific PLC I/O requirement list. The unit shall maintain the Nema 4 rating of the PLC enclosure.
9. GRAPHICAL TOUCH-SCREEN FRONT PANEL PC – The optional Front Panel PC shall be a featured-pack industrial panel computer designed for various industrial applications. The processor shall be a low power 667MHz Eden powers all member of the ARP-2600 product family. The onboard CPU incorporates the VIA VT8606 chipset and the VT82C686B with built-in AGP-4x VGA controller; three or four RS-232, two USB 1.1 ports meet most of industrial interface requirements; the PC/104 bus is available for further expansions. The display shall be a minimum of 15" diagonal. The Front Panel PC shall be an Arista Model 2615 or approved equal.

C. Enclosures

The remote unit enclosures for indoor mounting shall meet all the requirements for NEMA Type 12 enclosures. The enclosures body shall be made of a minimum 14 gauge steel with continuously welded seems and be furnished with external mounting feet. The enclosure door shall be made of a minimum 16 gauge steel with have a 14 gauge steel hinge. Enclosures larger than 16x14 shall have a rolled lip on 3 sides of the door for added strength. The door opening shall have a rolled edge on 4 sides to protect the door gasket. The door gasket shall be heavy neoprene and attached to the door with oil resistant adhesive. Sub-panels shall be 14-gauge steel for 16x14 enclosures and 12 gauge for larger enclosures. The enclosure finish shall be gray polyester powder coating inside and out over phosphatized surfaces. The subpanels shall be finished in white. Nema 12 enclosures shall be Hoffman "CH" or "CONCEPT" wall mount enclosures.

Remote site installations requiring equipment to be mounted outside shall have a double box enclosure with the remote unit enclosure mounted inside a lockable NEMA 3R enclosure. The double enclosure shall be required to control vandalism, provide complete weather protection, reduce the heating effects of the sun, and prolong the life of the equipment. The NEMA 3R enclosure shall be constructed of 14 gauge galvanized steel, with a drip shield top and seems free sides front and back, and a stainless steel hinge pin. The enclosure finish shall be gray polyester powder coating inside and out over phosphatized surfaces. The NEMA 3R enclosure shall be Hoffman Bulletin A-3.

The remote unit enclosures mounted in damp corrosive areas (such as concrete meter vaults) shall be NEMA Type 4X rated enclosures. The enclosures shall be made of molded fiberglass polyester and be furnished with external mounting feet. The door shall have a seamless foam-in-place gasket and corrosion-resistant hinge pin and bails. Sub-panels shall be 14-gauge steel for 16x14 enclosures and 12 gauge for larger enclosures. The enclosure finish shall be a light gray inside and out. The subpanels shall be finished in white. Nema 4X enclosures shall be Hoffman "Fiberglass Hinged Cover".

Refer to Appendix for specific enclosure requirements.

D. Front Panel Hardware Displays

As detailed in the appendix, the PLC units may include front panel displays of the specified inputs and outputs. The indicator lamps, pushbuttons, and selector switches used in the system shall be IP65 oiltight/waterproof/corrosion resistant rated. The indicators use slide or bayonet based colored LED light sources. The lenses shall be acrylic and color matched to the LED color. The lamps shall have translucent marking plates for legends and be constructed such that the acrylic lens covers the legends for dust and water protection. The pushbutton and selector switch operators shall be Nema 600V rated with contacts rated for 6A @ 120VAC inductive. The contact blocks shall be stackable and snap-fit with screw terminals for termination.

Refer to Appendix for specific front panel display requirements.

E. Local Control Functions

In general the PLC shall be programmed to provide generic control functions as detailed earlier and to work in concert with the CTU. The integrator shall be responsible to meet with the owner and the engineer to develop the automatic control strategy required for the system.

Refer to Appendix for special input and output control requirements.

2.2 RADIO TRANSCEIVERS & ACCESSORIES

A. General

The radio transceivers shall be standard "un-modified" radios that can be tuned, aligned, and repaired at any two-way radio shop. Interface to external data modems shall be through the front panel microphone jack. The radios shall be synthesized and fully field programmable and include a built-in time-out timer to disable the transmitter after 0-60seconds. The units shall be tuned to FCC specifications for the specific frequency assigned. The radio equipment shall be FCC type approved and the system capable of operation on the 3KHz ot 6KHz narrow band splinter frequencies (154 or 173MHz) in the Industrial/Business radio service.

B. VHF Radio Transceiver (154Mhz or 173Mhz)

The system manufacturer shall supply a 5-watt VHF radio transceiver to insure a high level of quality and reliability. The radios shall be adjustable to 4 watts output power as may be required by the FCC for ERP (Effective Radiated Power) restrictions. All connections to the radio shall be plug-in. The VHF radio transceiver shall have the following specifications:

Transmitter:

RF output power	25 watts minimum (adjustable to 4)
Spurs & Harmonics	16 dBm (25uW) (or -50dBc)
Frequency stability	±0.00025% (-30 to +60 degrees C)
Emission	6F2 (2.5kHz DEV max) or 3F2 (1.2kHz DEV max)
FM hum and noise	-40 dB

Receiver:

Sensitivity	0.35uV @ 12 dB SINAD (.5uV @ 20db quieting)
Selectivity	-65 dB
Spurious image rejection	-50 dB
Inter-modulation	-65 dB
Frequency stability	±0.00025% (-30 to +60 degrees C)
Receive bandwidth	*6kHz (or 3kHz) as required to match the transmitter

* The receiver bandwidth shall be reduced to match the transmit bandwidth of the transmitter and provide a minimum adjacent channel rejection of -50db.

The radio transceivers shall be a Motorola Radius CM200 or a Microwave Data Systems 1710.

C. UHF Radio Transceiver (450Mhz)

If the system supplier can demonstrate to the satisfaction of the Engineer that no VHF (154-173 MHz) frequency can be obtained, an UHF (450-470 MHz) frequency may be used. The UHF shall operate under Part 90.35 and 90.238 for secondary fixed operations. The system will still be required to operate with point-to-point operation within the FCC rules and regulations and provide the same RF path margins as detailed in these specifications.

The UHF radios must meet or exceed the requirements set forth in these specifications for VHF radios, except that the radio output power must be adjustable to 2 watts as needed to meet FCC requirements. The radios shall be tuned to operate in 6KHz of bandwith to meet the proposed FCC standards for 2005. Antennas shall provide a minimum 10db of gain.

The radio transceivers shall be Motorola Radius CM200 or Microwave Data Systems 4710. No changes to the contract amount will be made for a change to UHF operation.

D. Antenna & Coaxial Cable

The radio antennas at all locations shall be a five element Yagi, constructed with 3/8" diameter solid aluminum rod elements and 1-1/16" diameter aluminum pipe element support with a type N coaxial connector. The antenna shall have a minimum 8.0db forward gain with a 20.0db front-to-back ratio. The antenna shall be wind rated for a 100-MPH wind speed. The VHF antennas shall be MC-Yagi, Decibel Products DB292, or Celwave PD390S. The UHF antennas shall be MC-Yagi or Celwave PD688S.

Antennas shall be cabled to the transmitter enclosure connection by a RG/8U type low loss (less than 1.8db per 100ft @ 100MHz) coaxial cable with cellular polyethylene (foam) dielectric. The coaxial cable shall have a braided copper shield coverage of 97% and a long life weather resistant polyvinyl chloride jacket. The antenna coaxial cable connection shall be a constant impedance weatherproof Type N connector, taped with a weather resistant electrical tape to insure a lifetime watertight assembly. The coaxial cable shall be Belden 8214 or 9913 cable.

E. Antenna Lightning Protection

Coaxial connection to remote and central unit enclosures shall be by means of a coaxial type bulkhead lightning arrestor. The units shall be rated at 1 kilowatt with a minimum 500V and maximum 2000V-breakdown voltage. Coaxial lightning arrestors shall be a PD-593 or PolyPhaser IS-B50LN-C1.

F. Antenna Mounting Systems

Antennas shall be mounted at a height above ground that is consistent with FCC rules and regulations and provides adequate signal fade margin as described earlier. Antennas must be a minimum of 15 feet above ground and mounted as follows:

1. Water Towers: The antenna shall be mounted on the ladder or the water tower catwalk railing at a height consistent with FCC requirements. The coaxial cable shall be secured to the ladder or obstruction lighting conduit. A 3/4" rigid conduit with a weather-head shall be provided from the transmitter to the ladder on the tower.
2. Above Ground Structures: The antenna shall be mounted on a 10' long X 1-1/2" diameter galvanized mast with top mounted weather-head. The mast assembly shall be secured to the side of the structure with Uni-strut clamps. The coaxial cable shall feed through the mast assembly to the interior of the building.
3. Below Ground Structures: The antenna shall be mounted on a 20' high Class II power pole with a 10' long X 1-1/2" galvanized mast secured to the side of the pole and extending 5' above the pole or a 20' high free-standing antenna tower. A 3/4" rigid conduit with a weather-head shall be provided from the below ground vault to a location 10 feet up the power pole for the coaxial cable.

4. Antenna Towers (>20feet): A bracketed antenna tower shall be supplied where specifically noted on the plans or in the RTU & CTU site descriptions. The tower shall be assembled from 10 sections built on a 12-1/2" (or 18" for ROHN 45G) equilateral triangle design. Tower sections shall be constructed of 1-1/4" steel tubing with continuous solid steel rod "zigzag" cross bracing electrically welded to the tubing. The entire 10' sections shall be Hot-Dip Galvanized after fabrication for long life. The antenna towers shall be ROHN Model 25G (for unsupported heights of up to 33 feet) or ROHN Model 45G (for unsupported heights less that 45 feet).

2.3 INSTRUMENTATION & ACCESSORIES

A. General

All items in the control system (electronic cards, power supplies, radios, time delays, relays, etc.) shall be of plug- in construction, make use of a plug-in wiring harness, use plug-in terminal blocks, and be interchangeable without recalibration. To insure field repair-ability by non-technical personnel, equipment that must be un-wired for replacement will not be accepted.

The following instrumentation devices and techniques shall be used as specifically called for in the RTU and CTU input/output sections of this specification.

B. Power Supplies

The DC power supplies shall provide ±0.1% line and load regulation with ±10% input variations. They shall have a temperature coefficient of ±0.02% per degree C. The input/output isolation shall be 100 Mohms DC (900Volts AC) with output transient response of 50 microseconds maximum. The power supplies shall be sized to operate the remote unit equipment with or without the back-up battery in place. Power Supplies shall be a Power One Series MAP130, Sola SLS, or approved equal.

C. Battery Back-up Operation

The remote units indicated shall be supplied with battery back-up operation. The rechargeable batteries shall be the sealed solid gelled electrolyte types, designed for float or standby service. Unless noted otherwise in the RTU descriptions, batteries shall be sized to maintain 24-hour service at water tower remotes and 8 hour service at pump stations and other remotes. The remote shall include a charging module to recharge the battery when power is resumed, maintain the charge between outages, and provide a low voltage cut-off to protect the battery from excessive discharge during prolonged outages. All discrete, analog, and pulse inputs (i.e. switch closures, pressure, level, flows, etc.) shall continue to function on battery back up. Batteries shall be Globe Gel/Cell or approved equal.

D. Single Phase 120VAC Power Line Lightning Protection

Every site in the system shall be equipped with AC line filtering and lightning protection. The equipment shall provide 2-stage lighting/transient protection including inductive and capacitive filtering and MOV over-voltage protection.

E. Level & Pressure Transducers

Level & pressure transducers shall be of the all solid-state two-wire transmitter type with a 4-20mA output from a 10.5-24VDC excitation. The units shall be powered from the RTU power supply. The transducers shall have a combined error (linearity and hysteresis) of ±0.25% full scale and be temperature compensated to ±2.5% per 100 degrees Fahrenheit. Zero and span adjustments shall be standardized so that transducers are interchangeable without recalibration. All exposed or wetted parts shall be series 316 stainless steel, PVC, or Buna-N. The units shall be capable of a three times full scale over pressure with out damage or change of calibration.

The transducers shall be mounted at the sensing point and wired to the enclosure. The transducers shall have a 1/4" or 1/2" NPT process pressure connection. Transducers for above ground mounting shall have a 1/2" conduit connection for cable entry. Transducers at water towers (and other outside locations) shall be mounted below grade and below frost line to prevent freezing. Below grade mounted units shall have factory signal cabling and be suitable for a minimum of 100' submerged duty.

Level transducers for clear-wells and wetwells shall be suspended in the clearwell or wetwell and supplied with sufficient factory installed cable to access a "clean/dry area" junction box. The suspension cable shall have a polyethylene jacket and internal venting to provide for atmospheric sensing of the non-process side of the diaphragm. The sensors shall have a multi-ported pressure-sensing end that protects the diaphragm while sensing the level of viscous liquids or slurries. The cable connection in wet-well applications shall have a non-fouling guard to prevent build up of foreign materials.

Pressure/Level transducers shall be Micro-Comm L5N series, Consolidated A300 Model 221GEE, or Ametek Model 57S.

F. Station Flooding Float Switches

The station flooding sensors shall be a wall bracket mounted float switch capable of sensing less that 1-1/2" of water on the floor. The units shall be constructed with a Buna N float, 304 stainless steel float guide, a clear plastic protective shield, and a sealed neoprene cable connection. The float switch shall be Omega LV-70 or approved equal.

G. Entry Alarm

Unauthorized entry alarms at remote sites shall be accomplished through a perimeter alarm system powered from the common 12VDC-power supply. The system shall include the necessary structure entrance magnetic door switches. Should an intruder enter the structure without acknowledging his presence, an entry alarm will be sent to the Central Unit. The entry alarm shall have an adjustable time delay (0-60 seconds) to allow authorized personnel time to acknowledge their presence when entering the structure and provide a re-arming delay when leaving the structure. The RTU door mounted key switch shall be constructed so that the key can only be removed in the "armed" position. The alarm system can be implemented as part of the RTU logic system or be a Digital Control Systems (DCS) or approved equal.

H. High/Low Wetwell Floats

The high/low wetwell alarm floats shall be direct acting float switches. The floats shall have a polypropylene case containing a hermetically sealed mercury switch and be supplied with 40' of PVC type STO cable. The float switches shall be Anchor Scientific Roto-Float or approved equal.

2.4 CENTRAL UNIT EQUIPMENT

A. General

The "Central Unit" shall be composed of two or more separate CPUs communicating over a high-speed serial data links. The first computer (called the Central Terminal Unit or CTU) shall be a PLC as specified earlier and provide all communications with remote units, local inputs and outputs, and local hardware display devices. The second computer (called the Operator Display Console or ODC) shall be responsible for the operator interface to the system and provide display, alarm, and logging of all data.

B. Construction

The CTU shall be as specified for the PLCs used on the project. The CTU control panel shall be equipped with a battery back up. The CTU shall operate for a minimum of 8 hours controlling all radio/RTU operations. The rechargeable 12 amp hour batteries shall be sealed solid gelled electrolyte type batteries. The CTU shall recharge, maintain, and contain a low voltage cut-off protecting the battery from excessive discharge.

C. Enclosures

All of the CTU and PLC equipment (including CPU card cage, radio, power supplies, automatic antenna switching, and local inputs & outputs) at the master shall be housed in a free standing or wall mount NEMA 12 enclosure.

Refer to Appendix for specific enclosure requirements.

D. Front Panel Hardware Displays

As detailed in the appendix, the Central Unit may include front panel displays of the specified remote unit data for each remote unit. In such case, each remote unit shall have its own display. Single unit display devices that provide scanning displays of information or that require operator intervention to display the desired data will not be allowed. HOA switches CRF lamps, alternator selector switches, and associated alarm/status lamps shall be grouped in a logical manner.

The indicator lamps, pushbuttons, and selector switches used in the system shall be IP65 oiltight/waterproof/corrosion resistant rated. The indicators use slide or bayonet based colored LED light sources. The lenses shall be acrylic and color matched to the LED color. The lamps shall have translucent marking plates for legends and be constructed such that the acrylic lens covers the legends for dust and water protection. The pushbutton and selector switch operators shall be Nema 600V rated with contacts rated for 6A @ 120VAC inductive. The contact blocks shall be stackable and snap-fit with screw terminals for termination.

1. Levels & Pressures - Front panel displays of levels and pressures shall be .5" high 3.5 digit LCD displays.
2. HOA Selector Switches - Front panel HAND/OFF/AUTO selector switches shall be oiltight rated 3 position selector switches with engraved nameplates.
3. Indicator Lamps - Front panel indicator lamps shall be oiltight rated LED lamps with engraved lenses.

Refer to Appendix for specific front panel display requirements.

E. Local Control Functions

In general the CTU shall be programmed to provide generic control functions as detailed earlier. The integrator shall be responsible to meet with the owner and the engineer to develop the automatic control strategy required for the system.

Refer to Appendix for special input and output control requirements.

2.5 OPERATOR DISPLAY CONSOLE (ODC)

A. General

As described previously the Central Unit shall have two microprocessors tied together with separate operating responsibilities. The first processor (Central Terminal Unit or CTU-PLC) shall handle all the telemetry, set-point comparison and command duties. The second processor (Operator Display Console or ODC) shall handle the LCD displays, operator keyboard, alarm/log printer, and data storage duties. The system shall be capable of supporting multiple OCDs connected to a single CTU-PLC.

B. System Unit

The Operator Display Console (ODC) computer shall be an Intel/Windows base processor with the following features:

1. Intel Core 2 Duo Processor operating at 3GHz (minimum)
2. Windows XP Service Pack 2 operating system
3. 2GB RAM (minimum)
4. 160GB SATA Hard Drive (minimum)
5. 16x DVD+/-RW optical storage drive
6. Dual monitor DVI video card
7. USB 104-Key QWERTY Keyboard with integral numeric keypad & 6ft cable
8. USB 2-button Mouse with Scroll Wheel
9. Integral Gigabit wired Network Adapter
10. Internal 56K V.92 Data/Fax modem
11. (8) USB 2.0 ports, (1) parallel printer port, & (1) RS-232 serial port

The system unit shall be housed in a desktop or mini-tower case as required by the owner. The CTU shall store all command inputs and set points as downloaded from the ODC. The hard drive in the ODC shall be used for program and data storage. The R/W CD-ROM shall be used for archive data storage and back-up protection of the operating program.

The separately mounted keyboard shall have a standard typewriter format with tactile feedback, twelve special function keys, and a separate numeric keypad for entering set point data and cursor control. The 256-character symbol set shall include 96 ASCII characters and the IBM (International Business Machine) graphic symbols. The system shall include a 2-button Windows compatible mouse with mouse pad. The ODC shall be a minimum Dell Optiplex Model 760 or latest current model.

C. LCD Video Displays

The system unit shall be equipped with two (2) LCD Flat Panel displays. Each LCD display shall be a 19" high-resolution (1600 x 1200) color display terminal with minimum .264mm dot pitch, 600:1 contrast ratio, and IBM SXGA compatibility. The LCDs shall be utilized for display of station and system graphics and real-time data display. The first LCD shall provide for operator input and output data, report generation, and access to system utilities. The second LCD shall provide for multiple graphic overviews of the process system and/or sub-systems. The LCD display shall be a minimum Dell 19inch UltraSharp 1908FP Flat Panel Monitor or latest available model.

D. Printer

The system shall include a color "graphic" Laserjet printer with a 600dpi X 600dpi resolution, color resolution, 21ppm color output speed, and 1000 page/month duty cycle. The printer shall provide for printing of alarms summaries, data logs, trend graphs, and reports. The printer shall be a HP DeskJet CP2020 printer or equal.

E. Internal Modem

The internal modem shall be reserved for phone-line debug & remote access.

The ODC shall include Symantec's current version of PCAnywhere for remote access by the Owner's or Systems Integrator's remote computers.

F. Enclosures

The Operator Display Console unit (including CRT display, Keyboard, and System Unit) and the graphic printer shall be located on top of a desk supplied by the Owner. All interconnecting cabling shall be plug-in and supplied by the contractor.

G. Battery Back-up Operation

The ODC shall include 20 minutes of back up. The ODC back-up unit shall be a Stand-by Uninterruptible Power Supply (UPS) system that provides power line filtering and transient protection. The unit shall automatically take over (within 4mS) when the power line fails without interrupting or restarting the system and automatically recharge the battery within 10hours after the power returns to normal. The UPS shall be located at the desk location of the ODC and shall power the System Unit and display. The UPS shall be a APC Back-UPS 650, 1000, or 1400 as required.

2.6 MAIN OPERATOR DISPLAY CONSOLE SOFTWARE

A. General

The software shall be 32bit compatible and capable of operating in the ODC hardware described above as well as in customer supplied Windows XP Professional compatible hardware similar to the unit specified above. The contractor shall supply a fully functional "developmental" version of the SCADA software (including any required software protection keys) for the first ODC as well as a separate configured "runtime" version for installation and use in a customer supplied back-up computer. The software may be modular, however the operator interface shall provide an integrated interface to all areas of the program. Demo program copies will not be allowed.

The software shall operate in the 32-bit Windows XP Professional/Vista Business environment. The software shall be the latest "full developmental" version of SCADAview 32 (Optional SC), Wonderware InTouch, GE-Fanuc iFIX, or Allen-Bradley RSView 32 (Optional SE). The software shall be licensed to the owner.

B. System Back-up & Installation

The contractor shall provide a back-up copy of the installed software on a USB-Thumb drive. Back-up copies of any setup or graphic files shall be on a USB-Thumb drive. In the event of a catastrophic failure, the Owner shall utilize the USB-Thumb drive for emergency reloading the software. The contractor shall provide an easy to use installation (or re-installation) program that will automatically setup the hard drive operating system and automatically load (or reload) the software.

C. System Capacity

At a minimum, the operating software shall be capable of accommodating 32,000 tag points as follows:

1. Discrete status & alarm points
2. Measured variables
3. Accumulated variables
4. Calculated status & alarm points
5. Calculated control points

D. Communications

The HMI shall have several methods for exchanging data from programmable controllers and other software programs.

1. Direct
2. DDE Client/Server
3. OPC Client
4. ODBC
5. SQL Database (MySQL, MS-SQL, PostgreSQL)

E. HMI Operational Characteristics:

In general, the HMI software shall display all received data in engineering units with appropriate generated labels, generate and print alarms, print logs, store manually entered data, update displays, and perform operator commands as required by the database. The system shall automatically generate the following system displays:

1. Main Menu page (with direct access to all screens and other program modules)
2. System Summary page listing key data points for all RTUs in the system
3. RTU specific display pages showing all data for each RTU in the system

Beyond the basic operating software required for SCADA operations, the software package shall accommodate the following:

Status Point Operations:
Display ODC, CTU, and RTU status functions
Input/Display control database

Analog Data:
Display value directly in engineering units
Accept operator High & Low alarm limits and generate alarms
Accept operator rate of change alarm limit and generate alarm
Store data for trending displays

Flow Rate Data:
Display value directly in engineering units
Accept operator High & Low rate alarm limits and generate alarms
Totalize flow total and display in engineering units
Accept operator High/Low 24 hour total limits and alarms
Store data for trending displays

Pump Control Operations:
Display ODC, CTU, and RTU HAND/OFF/AUTO functions
Display Pump CALL/RUN/FAIL status for each pump
Input/Display control database

Alarm Point Operations:
Display ODC, CTU, and RTU alarm functions
Enter new alarm in data log archive and send alarm to printer
Sound alarm horn until alarm is acknowledge by the operator
Log alarm acknowledgment to data log and printer
Log alarm clearing and send alarm clear to printer
Input/Display control database

Event Point Operations:
Display ODC, CTU, and RTU alarm functions
Display ODC, CTU, and RTU event functions
Enter new event in data log archive and send alarm to printer
Log event clearing and send alarm clear to printer
Input/Display control database

Historical Trending Operations:
Real-time and historical trending functions
Create a multi-pen trend.

a. Ability to be shaded to compare two or more different trends
b. Create a trend that is part of a graphic display
c. The trends shall have a marker displaying the pen's date, time, and value

F. Graphical Screen Display Editor

The HMI shall provide a graphics display editor for creating displays using graphic objects. The graphics display editor shall have the ability to drag and drop objects from a pre-configured graphics library, paste objects that are copied to the clipboard from another Windows application, and insert objects created by another Windows application using OLE. True OLE support is required in that it shall be possible to call up the native application that created the object being inserted and use the naïve object editing tools from within the HMI. The graphics display editor shall have tear-away toolbars and color palettes. It shall be possible to customize the color pallet. Graphics drawn with a customized color pallet shall not require the customized color pallet to be present on all runtime computers. Colors must be stored internal to the graphic files as Red, Green, Blue numbers, not pallet indexes. The graphics display editor shall have:

1. Context sensitive "right-mouse" support on all objects.
2. As a minimum the following drawing tools:
   Rectangle, line, ellipse, wedge, and text
3. As a minimum the following editing tools:
   Tag substitute, flip, rotate, resize, reshape, align, cut, paste, copy, duplicate, bring to front, send to back, space, fill, undo, redo, line, and color.
4. As a minimum the following viewing tools:
   Zoom in, zoom out, pan, and view entire graphic.
5. The ability to use tag placeholders to provide a way to use one graphic display to represent a number of similar operations.
6. Provide tools for each of the following as a minimum:
   Numeric input, numeric display, string input, string display, label, arrow, recipe, alarm summary, tag monitor, input command line, trend, button, OLE object, and ActiveX object.
7. The ability to create a screen background by converting objects to wallpaper. These wallpaper objects cannot be selected or edited.
8. Allow the user to create libraries of graphic objects.
9. Allow the user to assign control to any object or grouping of objects. It shall also allow the user to drill down in a group to modify any object or object attribute without losing any object control property.
10. Allow control to be copied from any object to another object.
11. Permit the user to specify screen placement anywhere on the display.

2.7 HMI CLIENT SERVER (OPTIONAL HMI SOFTWARE PACKAGE)

A. General

The HMI option shall permit Client/Server operation whereby graphics functionality (full operations) shall be provided at a client station. The HMI sever shall permit up to 10 remote clients at any one time. HMI Client server communications shall be based upon STANDARD TCP/IP communications and permit remote operation across a WAN or a high speed radio based network.

B. The HMI Server shall:

1. Support redundant HMI servers and Data Servers.
2. Support data server redundancy.

3. Support seamless fail over from a primary server to a secondary server.
4. Support seamless fail back from a secondary server to a primary server.
5. Support notification of a service disruption including computer name of failed server.
6. Support notification service recovery including the computer name of active server.
7. Support redundancy without the need to write application logic.
8. Automatically synchronize the alarm state information on the primary and secondary so there is no disruption or loss of alarm state information on a failover.
9. Permit client/server operation whereby graphics functionality (full operations) shall be provided at a client station.
10. Client stations are desired to be thin clients. Performance shall not degrade at the thin client in terms of display refresh or display call-up. (For example, displays on the client refresh at a rate equal to or better than the rate possible on the server).
11. The client computers must cache copies of the HMI project graphics locally and be able to automatically copy the latest graphic from the server(s) as required.

2.8 WEB SERVER

A. General

The ODC shall include an integral WEB Server allowing the operator to remotely access the system using standard WEB Browser software (MS Explorer). The operator shall have the ability to monitor the main display screen, view current alarms, view RTU sub-screens, draw trend graphs, and make changes to the HOA and operator setpoints.

The integral WEB Server will use the same ODC HMI software security to control un-authorized access.

2.9 VOICE ALARM PHONE-DIALER

A. General

The ODC shall be equipped with software based automatic alarm dialer software. The software shall be tied to the MMI software database to provide automatic dialing of operator selected alarms. The software shall be 32bit compatible and capable of operating in the ODC hardware described above. The contractor shall supply a fully functional "developmental" version of the Alarm Dialer Software (including any required software protection keys) for the first ODC as well as a separate configured "runtime" version for installation and use in a customer supplied back-up computer. The software may be modular, however the operator interface shall provide an integrated interface to all areas of the program.

The software shall dial a pre-programmed list of phone numbers to provide a natural voice describing generated the specific alarm and time of occurrence. The dialer software shall have provisions to accept an operator acknowledgement of the alarm that will cancel further calls. If a proper acknowledgement is not received, the software will continue to dial phone numbers from the list until an acknowledgement is received.

The alarm dialer software shall allow operators to dial into the system to retrieve current alarm status and via a voice driven menu system access current operational data for each remote station.

B. Phone Dialer Modem

The phone dialer software shall include a voice modem that will allow the ODC computer to interface with standard dial-up phone-lines. The modem shall be FCC type approved. The Alarm Dialer Software shall be SCADAdial, Win911, or SCADAlarm.

PART 3 - EXECUTION

3.1 EQUIPMENT EXAMINATION

The control system shall be completely tested prior to shipment. The entire control system shall be "Burned In" at the factory for a period of at least 20 days. The component equipment shall be computer tested and temperature cycled at zero degrees and at fifty degrees centigrade.

3.2 SYSTEM START-UP

The manufacturer shall supply "Factory" personnel for start-up service as needed to insure satisfactory operation. Subsequent trips to the job site to correct defects shall be made at no charge to the Owner during the warranty period.

3.3 TRAINING

The system manufacturer shall supply "factory" personnel to conduct two separate on-site training sessions, totaling a minimum of three days of training.

The initial training session shall be conducted during start-up as needed until the Owner and Engineer are satisfied that the operators are comfortable with the operation and maintenance of the system. Training shall be done on site with the owner's personnel.

Three to six months after the Owner commencing system operation, the system manufacturer shall supply "factory" personnel to conduct follow-up training of the Owner's personnel. The follow-up training shall be conducted on-site and consist of reviewing the operation and maintenance of the system. The Owner shall be contacted a minimum of two weeks in advance, prior to scheduling the training session to allow proper coordination.

3.4 SUBSTANTIAL COMPLETION

The Engineer will grant substantial completion only after completion of the start-up and initial training phase of the project. The Engineer shall make an inspection of the system to determine the status of completion. Substantial completion will be awarded only when the system is providing usable service to the Owner. If the system is commissioned in phases, the Contractor may request substantial completion for the completed phases.

3.5 ACCEPTANCE TEST

After start-up and debugging of the entire system has been completed, the system manufacturer shall notify the Engineer that he is ready to begin the 60-day acceptance test. The system must run continuously for 60 consecutive calendar days. During this period, all system functions shall be exercised in automatic control, including all levels of back-up control. During the initial phase of the acceptance test, the multiple levels of control and radio path pad shall be demonstrated to the Owner as follows:

1. Primary level control shall be demonstrated by allowing the operators to manually initiate remote device operation and observing the automatic operation by comparing trend charts to operator entered stop/start values.
2. Secondary level control shall be demonstrated by turning off the ODC and verifying that each automatic control loop continues to function by monitoring operation with a passive monitor.
3. Third level control shall be demonstrated by turning off the CTU radio and verifying that the RTUs continue automatic operation and communications between RTUs by monitoring one full cycle of automatic operation using a passive monitor.
4. The fourth level of control shall be demonstrated by placing selected RTUs in back-up pressure mode and monitoring tower levels to observe one full pumping cycle.

Any level test or system interruption and accompanying component, subsystem, or program failure shall be logged for cause of failure, as well as the time of occurrence and the duration of each failure.

The Owner's representative shall classify failures as either major or minor. A minor failure would be a small, non-critical component failure that is corrected by the operators. This occurrence shall be logged but shall not be grounds for non-acceptance unless the same or similar failure occurs repeatedly (more than two such failures of similar components). A major failure shall be considered to have occurred when a component, subsystem, or program fault causes a halt in the operation of the any portion of the system and/or when a "factory" technician's work is required to make a repair or to reinitiate operation of the system.

A major failure shall cause termination of the 60-day acceptance test. When the causes of a major failure have been corrected, a new 60-day acceptance test shall be started. Final Acceptance of the control system shall not occur until satisfactory completion of this 60-day test.

The manufacturer shall provide "factory" personnel who shall be on site and conduct the initial system exercise portion of the testing. The manufacturer shall be responsible for maintaining a checklist type test report wherein each function is checked-off and initialed by the Owner's representative as it is demonstrated. During the remainder of the 60-day acceptance test, the manufacturer shall provide 24-hour response to calls from the owner in order to correct any failure.

3.6 WARRANTY/SUPPORT PROGRAM

The control system manufacturer shall supply a two (2) year parts and labor warranty and comprehensive support program for all items and software supplied under this section (except as noted below). Power surges and lightning damage shall be included as part of the warranty.

The warranty shall begin from the time of "substantial completion" as issued by the engineer. The manufacturer shall provide a 24-hour response to calls from the Owner. The manufacturer, at his discretion, may dispatch replacement parts to the Owner by next-day delivery service for field replacement by the Owner. Any damage to the control system caused by the actions of the Owner in attempting these field replacements shall be the sole responsibility of the manufacturer. If, during the warranty period, satisfactory field repair can not be attained by field replacement of parts by the Owner, the manufacturer shall dispatch "factory" personnel to the job site to complete repairs at no cost to the Owner.

The support program shall begin from the time of "substantial completion" as issued by the engineer. The support program shall include free updating of all software as needed and providing free phone support from the integrator throughout the warranty period.

The ODC Computer System Unit, keyboard, CRT display, printer, and associated UPS (and Portable Operator Display Console if specified in this contract) shall be covered by a one (1) year warranty beginning with "substantial completion". Lightning damage shall be included as part of the warranty on these components.

PART 4 - APPENDIX: DETAILED EQUIPMENT DESCRIPTION

4.1 SEWAGE PUMP STATION REQUIREMENTS:

A. Installation Requirements:

Sites: Proposed Sewage Lift Station Site
Telemetry Control and Pump Command outputs to other panels shall be dry isolated contacts on relays. Local pressure inputs shall be by two-wire transducers as specified.

The Pump Station equipment shall be housed in a NEMA 12 wall mount enclosure for indoor locations or a NEMA 3R enclosure as specified. The pump station equipment shall include an internal power switch, bulkhead coaxial cable lightning arrestor, and a power line lightning arrestor as specified earlier.

The antenna shall be mounted on a 10' long X 1-1/2" diameter mast secured to the side of the structure for pump stations buildings or on a 20' power pole with 3/4" rigid conduit and a weather-head run to the RTU enclosure as previously specified.

B. Front Panel Display Requirements:

1. Keypad & Display assembly to display all inputs and output status

C. Discrete Outputs:

1. Pump #1 CALL
2. Pump #2 CALL
3. spare
4. spare

D. Discrete Inputs:

1. Power Failure
2. Pump #1 RUNNING
3. Pump #2 RUNNING
4. Pump #1 FAIL
5. Pump #2 FAIL
6. High Float Alarm (Wetwell Overflow)
7. spare
8. spare

E. Analog Inputs:

1. Wetwell Water Level (New Submersible Transducer)
2. FUTURE Well Drawdown (Reserved for future input)
3. spare
4. spare

F. Pulse Inputs:

1. FUTURE Flow Rate & Total (Reserved for future flow meter interface)
2. spare

4.2 REPEATER STATION REQUIREMENTS:

A. Installation Requirements:

Sites: Repeater Site

The Repeater RTU shall be housed in a NEMA 3R enclosure as specified. The repeater equipment shall include an internal power switch, bulkhead coaxial cable lightning arrestor, and a power line lightning arrestor as specified earlier.

The antenna shall be mounted on a 20' Rohn Tower or on a 20' power pole with 3/4" rigid conduit and a weather-head run to the RTU enclosure as previously specified.

B. Front Panel Display Requirements:

1. Keypad & Display assembly to display all inputs and output status

C. Discrete Outputs:

1. spare
2. spare
3. spare
4. spare

D. Discrete Inputs:

1. Power Failure
2. spare
3. spare
4. spare
5. spare
6. spare
7. spare
8. spare

E. Analog Inputs:

1. spare
2. spare
3. spare
4. spare

F. Pulse Inputs:

1. spare
2. spare

4.3 WWTP CENTRAL UNIT RTU REQUIREMENTS:

A. Installation Requirements:

Sites: WWTP Site
Telemetry Control and Pump Command outputs to other panels shall be dry isolated contacts on relays. Local pressure inputs shall be by two-wire transducers as specified.

The Central PLC equipment shall be housed in a NEMA 12 wall mount enclosure as specified. The equipment shall include an internal power switch, bulkhead coaxial cable lightning arrestor, and a power line lightning arrestor as specified earlier.

The CTU antenna(s) shall be mounted on a 10' long X 1-1/2" diameter mast secured to the side of the structure or on a 40' antenna tower with rigid conduit and a weather-head run to the CTU-PLC enclosure. The antennas should be mounted as close as possible to the CTU-PLC enclosure.

B. Front Panel Display Requirements:

1. Keypad & Display assembly to display all inputs and output status

C. Discrete Outputs:

1. – 16. Please Refer to I/O Table in Section 4.4

D. Discrete Inputs:

1. – 16. Please Refer to I/O Table in Section 4.4

E. Analog Inputs:

1. – 4. Please Refer to I/O Table in Section 4.4

F. RS-485 / Ethernet IP Network Communication:

1. The SBR PLC I/O shall be networked to the Central PLC-RTU. Please Refer to the SBR I/O Table in Section 4.4

4.4 WWTP PLC-RTU INPUTS/OUTPUTS REQUIREMENTS:

Location	Equipment	Function	Type	Notes
Inf EQ	Mixing Pump	Call to run	DO	Remote
Inf EQ	Mixing Pump	Run status	DI	Remote
Inf EQ	Mixing Pump	Common alarm	DO	Remote
Inf EQ	Mixing Pump	Seal fail	DI	
Inf EQ	Mixing Pump	Seal fail alarm light	DO	
Inf EQ	Transfer Pump 1	Call to run	DO	Remote
Inf EQ	Transfer Pump 1	Run status	DI	Remote
Inf EQ	Transfer Pump 1	Common alarm	DO	Remote
Inf EQ	Transfer Pump 1	Seal fail	DI	
Inf EQ	Transfer Pump 1	Seal fail alarm light	DO	
Inf EQ	Transfer Pump 1	in Auto'	DI	Remote
Inf EQ	Transfer Pump 2	Call to run	DO	Remote
Inf EQ	Transfer Pump 2	Run status	DI	Remote
Inf EQ	Transfer Pump 2	Common alarm	DO	Remote
Inf EQ	Transfer Pump 2	Seal fail	DI	
Inf EQ	Transfer Pump 2	Seal fail alarm light	DO	
Inf EQ	Transfer Pump 2	in Auto'	DI	Remote
Inf EQ	Influent EQ float	Emergency high level	DI	Remote
Inf EQ	Influent EQ float	Pump cutout/low level	DI	Remote
Inf EQ	Influent EQ	Level	AI	Remote
SBR	SBR 1 Motive Pump	Call to run	DO	Remote
SBR	SBR 1 Motive Pump	Run status	DI	Remote
SBR	SBR 1 Motive Pump	Common alarm	DO	Remote
SBR	SBR 1 Motive Pump	Seal fail	DI	
SBR	SBR 1 Motive Pump	Seal fail alarm light	DO	
SBR	SBR 2 Motive Pump	Call to run	DO	Remote
SBR	SBR 2 Motive Pump	Run status	DI	Remote
SBR	SBR 2 Motive Pump	Common alarm	DO	Remote
SBR	SBR 2 Motive Pump	Seal fail	DI	
SBR	SBR 2 Motive Pump	Seal fail alarm light	DO	
SBR	SBR 1 Sludge Pump	Call to run	DO	Remote
SBR	SBR 1 Sludge Pump	Run status	DI	Remote
SBR	SBR 1 Sludge Pump	Common alarm	DO	Remote
SBR	SBR 1 Sludge Pump	Seal fail	DI	
SBR	SBR 1 Sludge Pump	Seal fail alarm light	DO	
SBR	SBR 2 Sludge Pump	Call to run	DO	Remote
SBR	SBR 2 Sludge Pump	Run status	DI	Remote
SBR	SBR 2 Sludge Pump	Common alarm	DO	Remote
SBR	SBR 2 Sludge Pump	Seal fail	DI	
SBR	SBR 2 Sludge Pump	Seal fail alarm light	DO	
SBR	SBR Blower 1	Call to run	DO	Remote
SBR	SBR Blower 1	Run status	DI	Remote
SBR	SBR Blower 1	Common alarm	DO	Remote
SBR	SBR Blower 1	in Auto'	DI	Remote
SBR	SBR Blower 2	Call to run	DO	Remote
SBR	SBR Blower 2	Run status	DI	Remote
SBR	SBR Blower 2	Common alarm	DO	Remote
SBR	SBR Blower 2	in Auto'	DI	Remote
SBR	SBR 1 Influent Valve	Call to open/close	DO	Remote
SBR	SBR 1 Influent Valve	Open status	DI	Remote
SBR	SBR 1 Influent Valve	Close status	DI	Remote
SBR	SBR 1 Influent Valve	Common alarm	DO	Remote
SBR	SBR 2 Influent Valve	Call to open/close	DO	Remote
SBR	SBR 2 Influent Valve	Open status	DI	Remote
SBR	SBR 2 Influent Valve	Close status	DI	Remote
SBR	SBR 2 Influent Valve	Common alarm	DO	Remote
SBR	SBR 1 Effluent Valve	Call to open/close	DO	Remote
SBR	SBR 1 Effluent Valve	Open status	DI	Remote
SBR	SBR 1 Effluent Valve	Close status	DI	Remote
SBR	SBR 1 Effluent Valve	Common alarm	DO	Remote
SBR	SBR 2 Effluent Valve	Call to open/close	DO	Remote
SBR	SBR 2 Effluent Valve	Open status	DI	Remote
SBR	SBR 2 Effluent Valve	Close status	DI	Remote
SBR	SBR 2 Effluent Valve	Common alarm	DO	Remote
SBR	SBR 1 Air Valve	Call to open/close	DO	Remote
SBR	SBR 1 Air Valve	Open status	DI	Remote
SBR	SBR 1 Air Valve	Close status	DI	Remote
SBR	SBR 1 Air Valve	Common alarm	DO	Remote
SBR	SBR 2 Air Valve	Call to open/close	DO	Remote
SBR	SBR 2 Air Valve	Open status	DI	Remote
SBR	SBR 2 Air Valve	Close status	DI	Remote
SBR	SBR 2 Air Valve	Common alarm	DO	Remote
SBR	SBR 1 float	Emergency high level	DI	Remote
SBR	SBR 1	Level	AI	Remote
SBR	SBR 1	D.O.	AI	Remote
SBR	SBR 2 float	Emergency high level	DI	Remote
SBR	SBR 2	Level	AI	Remote
SBR	SBR 2	D.O.	AI	Remote
Digester	Digester Blower 1	Call to run	DO	Remote
Digester	Digester Blower 1	Run status	DI	Remote
Digester	Digester Blower 1	Common alarm	DO	Remote
Digester	Digester Blower 1	in Auto'	DI	Remote
Digester	Digester Blower 2	Call to run	DO	Remote
Digester	Digester Blower 2	Run status	DI	Remote
Digester	Digester Blower 2	Common alarm	DO	Remote
Digester	Digester Blower 2	in Auto'	DI	Remote
Digester	Digester float	Emergency high level	DI	Remote
Digester	Digester	Level	AI	Remote

4.5 WWTP CENTRAL UNIT SOFTWARE REQUIREMENTS:

A. Installation Requirements:

The CTU shall communicate with the remote PLC/RTUs via VHF/UHF radio frequency data network. The Systems Integrator shall provide the communications cable to link the PLCs into a wired local area network.

B. Operator Workstation Requirements:

The WWTP workstation will include the desktop computer system and SCADA HMI software (as detailed earlier). This workstation will be the primary control/monitoring/alarm station for the SCADA system. This workstation will include all standard day-to-day operation duties, Web Access – primarily for remote control at Pikeville Water District, and alarm dialer duties. This workstation shall meet the specification as detailed previously.

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

Application of Troublesome Creek	)	
Environmental Authority, Inc.	)	
a Public Non-Profit	)	
Corporation for	)	**Case No. 2010-00017**
Certificate of Convenience	)	
and Necessity, to Construct Facility;	)	
to Set Initial Rates;	)	
to Incur Indebtedness	)	
and Authority to Operate	)	

SUPPLEMENTAL PETITION

EXHIBIT 27

CD CONTAINING EXHIBITS 24, 25 and 26

Contents of CD Rom

1. Contract 1 - Map Plans
2. Contract 2 - Map Plans
3. Contract Documents and Technical Specifications

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

Application of Troublesome Creek	)	
Environmental Authority, Inc.	)	
a Public Non-Profit	)	
Corporation for	)	**Case No. 2010-00017**
Certificate of Convenience	)	
and Necessity, to Construct Facility;	)	
to Set Initial Rates;	)	
to Incur Indebtedness	)	
and Authority to Operate	)	

SUPPLEMENTAL PETITION

EXHIBIT 28

KIA LOAN PACKAGE

TroublesomeCreek
ENVIRONMENTAL AUTHORITY

c/o KRADD
917 Perry Park Road, Hazard, Kentucky 41701
Phone: (606) 436-3158 Fax: (606) 436-2144

December 16, 2009

Sandy Williams
Kentucky Infrastructure Authority
1024 Capital Center Drive
Suite 340
Frankfort, KY 40601

Dear Sandy:

Please find enclosed the completed and signed conditional commitment letter as requested. If you have any questions or need additional information, please feel free to contact me.

Thank you,

Jennifer McIntosh
Administrator

Enclosures

KENTUCKY INFRASTRUCTURE AUTHORITY
1024 Capital Center Drive, Suite 340
Frankfort, Kentucky 40601
Phone (502) 573-0260
Fax (502) 573-0157
http://kia.ky.gov

Steven L. Beshear
Governor

John E. Covington III
Executive Director

2009

December 7, 2009

Mr. Lewis H. Warrix, Chairman
Troublesome Creek Environmental Authority
917 Perry Park Road
Hazard, KY 41701

KENTUCKY INFRASTRUCTURE AUTHORITY
AMERICAN RECOVERY AND REINVESTMENT ACT
FEDERALLY ASSISTED WASTEWATER REVOLVING LOAN FUND
CONDITIONAL COMMITMENT LETTER (A2 09-43)

Dear Chairman Warrix:

The Kentucky Infrastructure Authority ("the Authority") commends your efforts to improve public service facilities in your community. On December 3, 2009, the Authority approved your American Recovery and Reinvestment Act ("ARRA") loan for the Ball Creek Sewer Plant and Collection Lines Phase I project subject to the conditions stated below. The total cost of the project shall not exceed $3,425,000 of which the Authority loan shall provide $1,500,000 of the funding. Other anticipated funding for the project is reflected in Attachment A. The final loan amount will be equal to the Authority's portion of estimated project cost applied to the actual project cost. Attachment A incorporated herein by reference fully describes the project.

An Assistance Agreement will be executed between the Authority and the Troublesome Creek Environmental Authority upon satisfactory performance of the conditions set forth in this letter. You will have until January 29, 2010, to meet the conditions set forth in this letter and enter into an Assistance Agreement. No extensions shall be granted. Funds will be available for disbursement only after execution of the Assistance Agreement.

The Assistance Agreement and this commitment shall be subject, but not limited to, the following terms:

1. The Authority project loan shall not exceed $1,500,000.

2. The loan shall contain principal forgiveness in the amount of 52.1%.

3. The loan shall bear interest at the rate of 1.0% per annum commencing with the first draw of funds.

4. The loan shall be repaid over a period not to exceed 20 years from the date the loan is closed.

5. Interest shall be payable on the unforgiven amount of actual funds received. The first payment shall be due on June 1 or December 1 immediately succeeding the date of the initial draw of funds, provided that if such June 1 or December 1 shall be less than three months since the date of the initial draw of funds, then the first interest payment date shall be the June 1 or December 1 which is at least six months from the date of the initial draw of funds. Interest payments will be due each six months thereafter until the loan is repaid.

6. Full principal payments will commence on the appropriate June 1 or December 1 within twelve months from initiation of operation. Full payments will be due each six months thereafter until the loan is repaid.

7. A loan servicing fee of 0.20% of the annual outstanding loan balance shall be payable to the Authority as a part of each interest payment.

8. Loan funds will be disbursed after execution of the Assistance Agreement as project costs are incurred.

9. The Authority loan funds must be expended within six months of the official date of initiation of operation.

10. Fund "A" loan funds are considered to be federal funds. OMB Circular A-133, "Audits of States, Local Governments and Non-Profit Organizations, requires that all recipients and subrecipients **expending $500,000 or more in a year in federal awards must have a single or program-specific audit conducted for that year** in accordance with the Circular. If the federal amount expended plus all other federal funds expended exceeds the threshold, you are required to arrange for an A-133 audit to be performed by an independent, licensed CPA, or in special cases, the Auditor of Public Accounts of the Commonwealth of Kentucky. The Authority requires an annual audit to be preformed for the life of the loan.

The following is a list of the standard conditions to be satisfied prior to execution of the Assistance Agreement or incorporated in the Assistance Agreement. Any required documentation must be submitted to the party designated.

1. The Authority to Award (bid) package must be submitted to the Division of Water for approval within 14 days of bid opening.

2. The Assistance Agreement must be executed January 29, 2010.

3. The Borrower must agree to expend all Authority loan funds within six months of the date of initiation of operation.

4. Documentation of final funding commitments from all parties other than the Authority as reflected in the credit analysis shall be provided prior to preparation of the Assistance Agreement and disbursement of the loan monies. Rejections of any anticipated project funding shall be immediately reported and may cause this loan to be subject to further consideration.

5. The loan must undergo review by the Capital Projects and Bond Oversight Committee of the Kentucky Legislature prior to the state's execution of the Assistance Agreement. The committee typically meets monthly on the third Tuesday. At this time we know of no further submission required for their review; however, they may request information as needed.

6. Any required adjustment in utility service rates shall be adopted by ordinance, municipal order or resolution by the appropriate governing body of the Borrower. Public hearings as required by law shall be held prior to the adoption of the service rate ordinance, order, or resolution. Any required approvals by the Kentucky Public Service Commission shall be obtained.

7. All easements or purchases of land shall be completed prior to commencement of construction. Certification of all land or easement acquisitions shall be provided to the Division of Water.

8. The Borrower must complete and return to the Authority the attached "Authorization For Electronic Deposit of Vendor Payment" Form.

9. The Authority to Award Package documentation shall be submitted to and approved by DOW.

10. An environmental review, shall be conducted by the Division of Water for all construction projects receiving CWSRF funds, within the term of this binding commitment and prior to project bid.

11. Technical plans and specifications and a complete CWSRF specifications checklist shall be approved by the Division of Water prior to project bid.

12. A clear site certificate shall be obtained and DOW representatives shall be notified for attendance of the pre-construction conference.

13. Project changes or additions shall require a complete environmental and change order review before they can be included in the CWSRF loan project.

The following is a list of American Recovery and Reinvestment Act conditions to be satisfied prior to execution of the Assistance Agreement or incorporated in the Assistance Agreement. Any required documentation must be submitted to the party designated.

1. A sign shall be erected at the construction site in a form as prescribed by the Authority. The sign shall indicate that project funding has been provided in whole or in part by ARRA.

2. The project specifications must include the ARRA supplemental general conditions.

3. The project shall comply with the Buy American requirements of ARRA.

4. The project shall use federal wage rates as described in the Davis/Bacon Act.

5. The project shall comply with the reporting requirements of ARRA.

6. If the project has a "Green Reserve" component, the Borrower must submit a Business Case, if required.

7. The project shall be under construction contract by February 10, 2010. If this deadline is not met, the funding commitment will be rescinded.

Any special conditions listed below and/or stated in Attachment A must be resolved.

1. The Troublesome Creek Environmental Authority shall provide to KIA the Public Service Commission approved rates and service charges within 2 weeks of the final approval of those rates.

2. KIA requests that the Knott County Fiscal Court put a high priority on their authorization request for Coal Severance funding to retire the debt for the Economic Stimulus Funding Loan of the Troublesome Creek Environmental Authority for the purpose of constructing a wastewater treatment plant and sewer collection system in the Ball Creek area.

3. If Coal Severance funding is unavailable to repay this loan, the Troublesome Creek Environmental Authority shall include annual debt service of $41,164 in their budget

submitted to the Public Service Commission in their rate case submittal and shall charge rates sufficient to repay the KIA loan.

Please inform the Authority of any changes in your financing plan as soon as possible. We wish you every success for this project which will benefit both your community and the Commonwealth as a whole.

Sincerely,

Sandy Williams

Sandy Williams
Financial Analyst

Attachments

cc: Jennifer McIntosh, Kentucky River Area Development District
Ron Johnson, R.M. Johnson Engineering
Division of Water
Dirk Bedarff, Peck, Shaffer & Williams LLP
State and Local Debt Office, DLG
Borrower File - Troublesome Creek Environmental Authority - A2 09-43

Please sign and return a copy of this letter indicating your acceptance of this commitment and its terms. Also attach the completed "Authorization For Electronic Deposit of Vendor Payment" Form.

Accepted

Dec 4, 09
Date

AUTHORIZATION FOR ELECTRONIC DEPOSIT
OF BORROWER PAYMENT
KENTUCKY INFRASTRUCTURE AUTHORITY
(FUND A2 09-43)

Borrower Information:

Name: Troublesome Creek Environmental Authority

Address: 917 Perry Park Rd

City: Hazard State: KY Zip: 41701

Telephone: 606-436-3158 Contact: Jennifer McIntosh

Federal I.D. # 26-1090383

Financial Institution Information:

Bank Name: 1st Trust Bank

Branch: Hazard Phone No: 606-435-2265

City: Hazard State: KY Zip: 41702

Transit / ABA No.: 042108449

Account Name: Troublesome Creek Environmental Authority

Account Number: 3003118

I, the undersigned, authorize payments directly to the account indicated above and to correct any errors which may occur from the transactions. I also authorize the Financial Institution to post these transactions to that account.

Signature: _____ Date: Dec 14, 09

Name Printed: Lewis H. Darrix Job Title: Chairman

Please return completed form to:

Kentucky Infrastructure Authority
1024 Capital Center Drive, Suite 340
Frankfort, KY 40601
phone: 502-573-0260
fax: 502-573-0157

AMERICAN RECOVERY AND REINVESTMENT ACT (ARRA) REPORTING INFORMATION FOR RECIPIENT

This form is required for projects funded in whole or in part form the American Recovery and Reinvestment Act of 2009. This form is to be completed and returned with the signed Conditional Commitment Letter from the Kentucky Infrastructure Authority.

Recipient Information:

Name:	Troublesome Creek Environmental Authority
Data Universal Numbering system (DUNS) No.*:	824492063
Central Contractor Registration (CCR) No.*:	538R1
KIA Loan Number:	A2 09-43
Federal Congressional District(s) of Utility Service Area:	5th

*If the DUNS No. or CCR No. provided above is registered under a different name than the recipient of ARRA funding, please provide the registration name below:

DUNS Name	
CCR Name	

*If the recipient has not yet obtained a CCR or DUNS Number, please do so no later than September 30th and provide notification to KIA of the numbers once issued. For instructions on CCR or DUNS registration, please see the information at the bottom of the next page.

Physical Location of Project (Primary Place of Performance) for ARRA funded activity…

Street Address	Hwy 1087 West
City, State and Zip (Zip must include 4 digit extension)	Soft Shell, KY 41831
Federal Congressional District(s) of Project Location	5th

Davis Bacon Administrator Information:

Name	Jennifer McIntosh
Firm/Agency/Municipality Name	KY River ADD
Phone	606-436-3158
Email	jennifer@kradd.org

Reliance upon Federal Assistance (please answer the below questions Yes or No):

Did recipient receive 80% or more of its annual gross revenues in federal awards during the last fiscal year?	No
Did recipient receive $25 million or more in annual gross revenues from federal awards during the last fiscal year?	No
Does the public have access to compensation of senior executives of the recipient through periodic reports filed under Section 13A or 15D of the Securities Exchange Act of 1934 or Section 6104 of the Internal Revenue Code of 1986?	Yes

DUNS and CCR Registration Information:

DUNS http://fedgov.dnb.com/webform
1-866-705-5711
Registration can be completed over the phone or via the web. Phone registration requests take approximately 10 minutes and are free. Internet requests are fulfilled within 24 hours.

CCR http://www.ccr.gov
Registration can be completed online. The User Guide and handbook can provide information on what information needs to be gathered for the registration process. Links are below:

User Guide www.ccr.gov/doc/CCRUsersGuide
Handbook www.ccr.gov/Handbook.aspx

Once registration information has been submitted, it will usually take a minimum of 48 hours to complete.

ATTACHMENT A

Troublesome Creek Environmental Authority
A2 09-43

EXECUTIVE SUMMARY
KENTUCKY INFRASTRUCTURE AUTHORITY
FUND A, FEDERALLY ASSISTED WASTEWATER REVOLVING LOAN FUND

Reviewer:	Sandy Williams
Date:	December 3, 2009
KIA Loan Number:	**A2 09-43**
WRIS Number	**SX21119810**
HUC Code:	05100201120

BORROWER:	**TROUBLESOME CREEK ENVIRONMENTAL AUTHORITY**
	KNOTT COUNTY
BRIEF DESCRIPTION:	The Troublesome Creek Environmental Authority is requesting a Clean Water SRF loan in the amount of $1,500,000 to be funded through the American Recovery and Reinvestment Act for construction of a new 100,000 gallon per day wastewater treatment plant with collection lines initially running to 85 individual residences, 2 businesses, 18 apartments and a car wash. The project will eliminate straight pipes and failing systems in the area and restore the condition of Troublesome Creek. The creation of this wastewater treatment plant will also aid in the development of Knott County through Chestnut Mountain. Once the plant is operational, development can begin. It is expected that over 400 new homes will be constructed along with several new businesses. The development is expected to create over 100 new jobs for the area.

PROJECT FINANCING:		PROJECT BUDGET	
Fund A Loan	$ 1,500,000	Administrative Expenses	$ 40,000
HB608 (LGEDF)	1,425,000	Legal Expenses	10,000
Section 531	500,000	Land, Easements	70,000
	-	Engineering Fees	463,790
		Construction	2,654,325
		Contingency	186,885
TOTAL	$ 3,425,000	TOTAL	$ 3,425,000

REPAYMENT				
	Rate	1.00%	Est. Annual Payment	$41,164
	Term	20 years	1st Payment	6 Mo. after first draw

PROFESSIONAL SERVICES	Engineer	R.M. Johnson Engineering
	Bond Counsel	Peck, Shaffer, & Williams

PROJECT SCHEDULE	
Bid Opening:	January 6, 2010
Construction Start:	January 29, 2010
Construction Stop:	February 10, 2011

DEBT PER CUSTOMER	Existing:	N/A
	Proposed:	$ 5,207
OTHER DEBT	See Attached	
OTHER STATE-FUNDED PROJECTS LAST 5 YRS	See Attached	

RESIDENTIAL RATES		Users	Avg. Bill	
	Current	0	N/A	(for 4,000 gallons)
	Additional	88	$ 35.00	(for 4,000 gallons)
REGIONAL COORDINATION	This project is consistent with regional planning recommendations.			

CASHFLOW	Cash Available for Debt Service	Debt Service	Income after Debt Service	Coverage Ratio
#REF!	0	9,344	(9,344)	0.00
#REF!	37,344	0	37,344	n/a
#REF!	193,097	185,127	7,970	1.04
#REF!	193,097	185,127	7,970	1.04
#REF!	193,097	185,127	7,970	1.04
Projected 2015	193,097	185,127	7,970	1.04

Reviewer: Sandy Williams
Date: December 3, 2009
Loan Number: A2 09-43

KENTUCKY INFRASTRUCTURE AUTHORITY
WASTEWATER REVOLVING LOAN FUND (FUND "A")
TROUBLESOME CREEK ENVIRONMENTAL AUTHORITY
KNOTT COUNTY
PROJECT REVIEW
SX21119810

I. PROJECT DESCRIPTION

The Troublesome Creek Environmental Authority (TCEA) is requesting a Clean Water SRF loan in the amount of $1,500,000 to be funded through the American Recovery and Reinvestment Act for construction of a new 100,000 gallon per day wastewater treatment plant with collection lines initially running to 85 individual residences, 2 businesses, 18 apartments and a car wash. The project will eliminate straight pipes and failing systems in the area and restore the condition of Troublesome Creek. The creation of this wastewater treatment plant will also aid in the development of Knott County through Chestnut Mountain. Once the plant is operational, development can begin. It is expected that over 400 new homes will be constructed along with several new businesses. The development is expected to create over 100 new jobs for the area.

II. PROJECT BUDGET

		Total
Administrative Expenses	$	40,000
Legal Expenses		10,000
Land, Easements		70,000
Engineering Fees		463,790
Construction		2,654,325
Contingency		186,885
TOTAL	$	3,425,000

III. PROJECT FUNDING

Funding Sources	**Amount**	**%**
Fund A Loan	1,500,000	44%
HB608 (LGEDF)	1,425,000	41%
Section 531	500,000	15%
Total	3,425,000	100%

IV. KIA DEBT SERVICE

Construction Loan	$1,500,000
Less: Principal Forgiveness (52.1%)	$ 781,500
Amortized Loan Amount	$ 718,500
Interest Rate	1.00%
Loan Term (Years)	20
Estimated Annual Debt Service	$ 39,727
Administrative Fee (0.20%)	1,437
Total Estimated Annual Debt Service	**$ 41,164**

V. PROJECT SCHEDULE

Bid Opening:	January 6, 2010
Construction Start:	January 29, 2010
Construction Stop:	February 10, 2011

VI. RATE STRUCTURE

Customers	Current	Proposed	Total
Residential Customers	0	85	85
Commercial Customers	0	3	3
Industrial Customers	0	0	0
Total	0	88	88

Rates

The monthly charge for wastewater utility service is estimated to be:

Effective Date of Rate Implementation	February 2011
Minimum Bill (2,000 gallons)	$19.00
Next 8,000 gallons (per 1,000 gal)	$8.00
Over 10,000 gallons (per 1,000 gal)	$6.00
Cost for 4,000 gallons	$35.00
Affordability Index (Rate/MHI)	1.9%

These proposed rates are based on assumptions regarding the operations budget for the Ball Creek Sewer Project and average customer usage. Should there be any significant changes in those assumptions, the proposed rate structure may have to be modified accordingly. Further, the proposed rates are subject to review and approval by the Public Service Commission and formal adoption by the Troublesome Creek Environmental Authority once the PSC review process has been completed. Proposed rates are anticipated to go into effect in February 2011.

VII. DEMOGRAPHICS

In 2000, Knott County's population was 17,649 with a Median Household Income (MHI) level of $20,373. Based on a MHI of 60.5% of the MHI for the Commonwealth ($33,672), the loan will qualify for a 1% interest rate.

Despite its colorful name which some attribute to bouts of flash flooding and others to the carrying on of some early 'creekers', the communities along Troublesome Creek enjoy a true cross section of the best of traditional Kentucky Mountain life. The Creek meanders from its headwaters in Knott County, down through Homeplace in Perry County and flows into the North Fork of the Kentucky River in Breathitt County. While the Creek is still 'post-card' beautiful in many areas its seasonal flooding still causes problems for residents and overall it suffers from serious water quality problems that need to be addressed.

VIII. FINANCIAL ANALYSIS (See Exhibit 1)

The Troublesome Creek Environmental Authority was formed in October 2006 to represent areas of Breathitt, Knott and Perry Counties with the mission of improving water quality in the Kentucky River by implementing a program to address all needed remedial measures in the Troublesome Creek Water Shed. The Authority's board is comprised of five directors. Each county has one representative, and the board also includes one member from the Kentucky Coal Association and one local business entrepreneur. The Authority has partnered with The Kentucky River Area Development District for its Administration. Approximately 14,000 people call the watershed of Troublesome Creek home, but very few have adequate wastewater treatment means.

While the first project of the Authority will be the Ball Creek Wastewater Treatment Plant in Knott County, future projects include the Ball Creek Phase II project, the Perry County Project Phase I, the Perry County Phase II project, and the Breathitt Co project. The Ball Creek Phase II project will expand the plant to 200,000 gallons per day. It will extend service to 550 customers over a 20 mile span in Knott County. The new plant is expected to provide service to the former Beckham Combs Elementary School eliminating an existing package treatment plant. The Perry County Project Phase I project will construct a wastewater treatment that will provide service to 215 customers, the Homeplace Clinic and Robinson Elementary School. The Perry County Phase II project will extend service to 745 households. The Breathitt County project will encompass the Lost Creek area along HWY 15 and HWY 476. The discharge will be the North Fork of the Kentucky River at Haddix. It is expected to provide service to several local schools in the area including Riverside Christian and Marie Roberts-Caney Schools.

Projections are based on the following assumptions:

- The Knott County Fiscal Court passed a resolution on September 16, 2009 supporting this project and authorizing the County Judge Executive to appropriate and request $750,000 in Coal Severance Funds from the next two bienniums to retire the debt for the Economic Stimulus Funding Loan of the Troublesome Creek Environmental Authority for the purpose of constructing a wastewater treatment plant and sewer collection system in the Ball Creek area.
- Knott County Coal Severance funds are authorized for the repayment of the KIA loan in each of the next 2 bienniums and will be used to repay the KIA loan equally over a 4 year period.
- TCEA's existing debt (a bridge loan to be repaid with a HB 608 grant) is repaid in 2010 with the line item grant funds.
- The WWTP begins operations in February 2011 and completes 4 billing cycles in Fiscal year 2011 (March through June).
- At start-up, there are 133 total residential customers and 5 total commercial customers.
- The new KIA loan will be underwritten with a 20-year amortization with estimated annual payments of $41,164. There is no pre-payment penalty associated with this loan. If the loan is repaid over a 4 year period, the new debt service is estimated to be $185,127 annually.
- This loan represents the only debt on the system.
- A replacement reserve of $1,800 will be funded annually.
- Debt service coverage is 1.04 in 2012 when principal and interest repayments begin.

Based on the proforma assumptions, the utility shows adequate cashflow to repay the KIA Fund A loan.

REPLACEMENT RESERVE

The annual replacement cost is $1,800. This amount should be added to the replacement account each December 1 until the balance reaches $18,000 and maintained for the life of the loan.

IX. DEBT OBLIGATIONS

Debt Issue	Outstanding	Maturity
Kentucky Rural Water Association (2.25%)	$509,344	2010
Total	**$509,344**	

This debt is interim financing to be repaid by proceeds of the HB 608 line item grant.

X. OTHER STATE OR FEDERAL FUNDING IN PAST FIVE YEARS

Project Title	Funding Source	Amount	Type
Ball Creek Wastewater	HB608	$1,425,000	Grant
Total		**$1,425,000**	

XI. CONTACTS

Applicant

Name	Troublesome Creek Environmental Authority
Address	917 Perry Park Road
	Hazard, KY 41701
County	Perry
Contact	Lewis H. Warrix
Phone	(606) 436-3158
Email	

Applicant Contact

Name	Kentucky River Area Development District
Address	917 Perry Park Road
	Hazard, KY 41701
Contact	Jennifer McIntosh
Phone	(606) 436-3158
Email	jennifer@kradd.org

Engineer

Name	Ron Johnson
Firm	R.M. Johnson Engineering
Address	P.O. box 444
	Hindman, KY 41822
Phone	(606) 785-5926
Email	rjohnson@rmje.net

XII. RECOMMENDATIONS

KIA staff recommends approval of the loan with the standard conditions, the additional ARRA conditions and the following special conditions.

1. The Troublesome Creek Environmental Authority shall provide to KIA the Public Service Commission approved rates and service charges within 2 weeks of the final approval of those rates.
2. KIA requests that the Knott County Fiscal Court put a high priority on their authorization request for Coal Severance funding to retire the debt for the Economic Stimulus Funding Loan of the Troublesome Creek Environmental Authority for the purpose of constructing a wastewater treatment plant and sewer collection system in the Ball Creek area.
3. If Coal Severance funding is unavailable to repay this loan, the Troublesome Creek Environmental Authority shall include annual debt service of $41,164 in their budget submitted to the Public Service Commission in their rate case submittal and shall charge rates sufficient to repay the KIA loan.

EXHIBIT 1
TROUBLESOME CREEK ENVIRONMENTAL AUTHORITY
CASH FLOW ANALYSIS

	Projected 2010	Projected 2011	Projected 2012	Projected 2013	Projected 2014	Projected 2015
Operating Revenues						
Sewer Revenues		37,344	112,032	112,032	112,032	112,032
Total Revenues	0	37,344	112,032	112,032	112,032	112,032
Operating Expenses						
Operating Expenses			102,262	102,262	102,262	102,262
Replacement Reserve			1,800	1,800	1,800	1,800
Total Expenses	0	0	104,062	104,062	104,062	104,062
Net Operating Income	0	37,344	7,970	7,970	7,970	7,970
Non-Operating Income and Expenses						
Coal Severance Funding from Knott County Fiscal Court			185,127	185,127	185,127	185,127
Total Non-Operating Income & Expenses	0	0	185,127	185,127	185,127	185,127
Cash Available for Debt Service	**0**	**37,344**	**193,097**	**193,097**	**193,097**	**193,097**
Debt Service						
Existing Interest	9,344	0	0	0	0	0
Proposed KIA Loan	0	0	185,127	185,127	185,127	185,127
Total Debt Service	9,344	0	185,127	185,127	185,127	185,127
Income After Debt Service	(9,344)	37,344	7,970	7,970	7,970	7,970
Debt Coverage Ratio	0.00	n/a	1.04	1.04	1.04	1.04

TROUBLESOME CREEK ENVIRONMENTAL AUTHORITY
BALANCE SHEETS

ASSETS	2006	2007	2008	2009	2010	2011	2012	2013	2014
Current Assets									
Cash									
Accounts Receivable									
Inventory									
Prepaid									
Other Current Assets									
Total Current Assets	0	0	0	0	0	0	0	0	0
Restricted Assets									
Investments									
Other									
Escrow Account									
Debt Service Reserve Fund									
Debt Service Fund									
Total Restricted Assets	0	0	0	0	0	0	0	0	0
Utility Plant									
Land, System, Building and Equipment									
Bond Issuance Costs									
Total	0	0	0	0	0	0	0	0	0
Less Accumulated Depreciation ( )									
Net Fixed Assets	0	0	0	0	0	0	0	0	0
Other Assets									
Notes Receivable									
Unamortized Bond Costs and Discount, Net									
Total Other Assets	0	0	0	0	0	0	0	0	0
Total Assets	0	0	0	0	0	0	0	0	0
LIABILITIES									
Current Liabilities									
Accounts Payable									
Customer Deposits									
Current Portion Long Term Debt									
Other									
Total Current Liabilities	0	0	0	0	0	0	0	0	0
Liabilities Payable - Restricted Assets									
Notes and Bonds Payable									
Customer Deposits									
Accrued Interest Payable									
Current Portion of Long Term Debt									
Total Liabilities Payable - Restricted Assets	0	0	0	0	0	0	0	0	0
Long Term Liabilities									
Revenue Refunding Bonds									
Notes Payable - KIA									
Customer Deposits Less Current Portion									
Total Long Term Liabilities	0	0	0	0	0	0	0	0	0
Total Liabilities	0	0	0	0	0	0	0	0	0
Retained Earnings:									
Invested in Capital Assets Net of Related Debt									
Restricted									
Unrestricted									
Total Retained Earnings	0	0	0	0	0	0	0	0	0
Total Liabilities and Equities	0	0	0	0	0	0	0	0	0
Balance Sheet Analysis									
Current Ratio	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Debt to Equity	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Working Capital	0	0	0	0	0	0	0	0	0
Percent of Total Assets in Working Capital	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Percent of Operating Revenue in Receivables									

Randall Tackett

From: "Jennifer McIntosh" <jennifer@kradd.org>
To: "'Randall Tackett'" <crtackett@setel.com>
Cc: "'Recktenwald, Roger - KACo'" <roger.recktenwald@kaco.org>
Sent: Monday, January 25, 2010 1:22 PM
Attach: TCEA_Stimulus_Loan.pdf
Subject: RE: PSC Petition

Randall,

Please find attached the resolution for the $750,000 from Knott County. I have asked Kasi to assist me with 1 and 2 and will get those to you ASAP once they are provided to me. As for the letter on no debt, we may ask Roger to write this as he has a better way with words than I do. I will copy him. No need for us to meet. I'll get with Roger and Kasi and let you know what turns up.

Jennifer

From: Randall Tackett [mailto:crtackett@setel.com]
Sent: Monday, January 25, 2010 1:13 PM
To: Jennifer McIntosh
Subject: Fw: PSC Petition

Jennifer,

Here are the PSC questions for us on the financial end:

1) A description of the bonds/notes to be issued, to include their terms, interest rates, security and amount. At a minimum, recommend that the applicant provide letter or other communications from KIA that states the terms of the proposed loan.

2) The amortization schedules for the proposed loan.

3) While not required to meet the PSC's filing requirements, Commission Staff recommends that the applicant explain the statement in its application that the applicant will not have any debt service for the project. Based upon our discussions prior to the filing, Commission Staff understands that a county fiscal court has agreed to assume the debt service requirements for the proposed financings. The records, however, needs to reflect this fact.

Call me and we can discuss them or I can come over.

RESOLUTION

AT THE REGULAR MEETING OF THE KNOTT COUNTY FISCAL COURT HELD IN THE FISCAL COURT MEETING ROOM IN THE OLD COURTHOUSE ON THE 16TH DAY OF SEPTEMBER 2009 AT THE HOUR OF 5:30 PM THE FOLLOWING RESOLUTION WAS OFFERED:

A RESOLUTION TO AUTHORIZE THE USE OF COAL SEVERANCE FUNDS TO RETIRE THE DEBT OF THE TROUBLESOME CREEK ENVIRONMENTAL AUTHORITY BALL CREEK WASTE WATER TREATMENT PLANT AND SEWER COLLECTION PROJECT

WHEREAS, the Troublesome Creek Environmental Authority has received and Economic Stimulus Funding Loan in the amount of $750,000.00 to construct a waste water treatment plant and sewer collection system in the Ball Creek area, and

WHEREAS, the Fiscal Court desires to support this project by appropriating and requesting Coal Severance Funds from the next two biennium to retire this debt.

NOW THEREFORE, be it resolved by the Knott County Fiscal Court that Judge-Executive Randy Thompson be authorized to sign and execute all documentation necessary to appropriate and request Coal Severance Funds totaling $750,000.00 to retire the debt for the Economic Stimulus Funding Loan of the Troublesome Creek Environmental Authority for the purpose of constructing a waste water treatment plant and sewer collection system in the Ball Creek area.

Motion for adoption of this resolution was made by Kirby Hall, seconded by Hashel Ritchie, and vote taken as follows:

FOR	AGAINST
Hashel Ritchie	
Joe Short	
Wade Hobbs	
Kirby Hall	

THEREUPON, said motion was declared passed and the resolution adopted, this 16th day of September 2009.

Attest:
By: _____
Clerk of the Fiscal Court of Knott County

_____
Judge/Executive

KENTUCKY INFRASTRUCTURE AUTHORITY
REPAYMENT SCHEDULE
LOAN #A A2 09-43
TROUBLESOME CREEK ENVIRONMENTAL AUTHORITY
PRELIMINARY

1.00% Rate
$19,863.31 P & I Calculation

Payment Date	Principal Due	Interest Due	Interest Rate	Principal & Interest	Servicing Fee
					Less: F
12/01/11	$16,270.81	$3,592.50	1.00%	$19,863.31	$718.50
06/01/12	$16,352.16	$3,511.15	1.00%	$19,863.31	$702.23
12/01/12	$16,433.92	$3,429.39	1.00%	$19,863.31	$685.88
06/01/13	$16,516.09	$3,347.22	1.00%	$19,863.31	$669.44
12/01/13	$16,598.67	$3,264.64	1.00%	$19,863.31	$652.93
06/01/14	$16,681.66	$3,181.64	1.00%	$19,863.31	$636.33
12/01/14	$16,765.07	$3,098.23	1.00%	$19,863.31	$619.65
06/01/15	$16,848.90	$3,014.41	1.00%	$19,863.31	$602.88
12/01/15	$16,933.14	$2,930.16	1.00%	$19,863.31	$586.03
06/01/16	$17,017.81	$2,845.50	1.00%	$19,863.31	$569.10
12/01/16	$17,102.90	$2,760.41	1.00%	$19,863.31	$552.08
06/01/17	$17,188.41	$2,674.89	1.00%	$19,863.31	$534.98
12/01/17	$17,274.35	$2,588.95	1.00%	$19,863.31	$517.79
06/01/18	$17,360.72	$2,502.58	1.00%	$19,863.31	$500.52
12/01/18	$17,447.53	$2,415.78	1.00%	$19,863.31	$483.16
06/01/19	$17,534.77	$2,328.54	1.00%	$19,863.31	$465.71
12/01/19	$17,622.44	$2,240.87	1.00%	$19,863.31	$448.17
06/01/20	$17,710.55	$2,152.75	1.00%	$19,863.31	$430.55
12/01/20	$17,799.10	$2,064.20	1.00%	$19,863.31	$412.84
06/01/21	$17,888.10	$1,975.21	1.00%	$19,863.31	$395.04
12/01/21	$17,977.54	$1,885.76	1.00%	$19,863.31	$377.15
06/01/22	$18,067.43	$1,795.88	1.00%	$19,863.31	$359.18
12/01/22	$18,157.77	$1,705.54	1.00%	$19,863.31	$341.11
06/01/23	$18,248.55	$1,614.75	1.00%	$19,863.31	$322.95
12/01/23	$18,339.80	$1,523.51	1.00%	$19,863.31	$304.70
06/01/24	$18,431.50	$1,431.81	1.00%	$19,863.31	$286.36
12/01/24	$18,523.65	$1,339.65	1.00%	$19,863.31	$267.93
06/01/25	$18,616.27	$1,247.03	1.00%	$19,863.31	$249.41
12/01/25	$18,709.35	$1,153.95	1.00%	$19,863.31	$230.79
06/01/26	$18,802.90	$1,060.41	1.00%	$19,863.31	$212.08
12/01/26	$18,896.91	$966.39	1.00%	$19,863.31	$193.28
06/01/27	$18,991.40	$871.91	1.00%	$19,863.31	$174.38
12/01/27	$19,086.36	$776.95	1.00%	$19,863.31	$155.39
06/01/28	$19,181.79	$681.52	1.00%	$19,863.31	$136.30
12/01/28	$19,277.70	$585.61	1.00%	$19,863.31	$117.12
06/01/29	$19,374.09	$489.22	1.00%	$19,863.31	$97.84
12/01/29	$19,470.96	$392.35	1.00%	$19,863.31	$78.47
06/01/30	$19,568.31	$294.99	1.00%	$19,863.31	$59.00
12/01/30	$19,666.15	$197.15	1.00%	$19,863.31	$39.43
06/01/31	$19,764.48	$98.82	1.00%	$19,863.31	$19.76

Totals	**$718,500.00**	**$76,032.21**	**$794,532.21**	**$15,206.44**

Created by KIA on 1/25/2010

Credit Due	Total Payment	Principal Balance	R & M Reserve	Total Reserve	
	Construction Loan	**$1,500,000.00**			
Principal Forgiveness (52.1%)		**$781,500.00**			
	Amortized Loan Amount	**$718,500.00**			
$0.00	$20,581.81	$702,229.19	$1,800.00	$1,800.00	10 verify reserve funding
$0.00	$20,565.53	$685,877.04	$0.00	$1,800.00	
$0.00	$20,549.18	$669,443.12	$1,800.00	$3,600.00	
$0.00	$20,532.75	$652,927.03	$0.00	$3,600.00	
$0.00	$20,516.23	$636,328.36	$1,800.00	$5,400.00	
$0.00	$20,499.63	$619,646.69	$0.00	$5,400.00	
$0.00	$20,482.95	$602,881.62	$1,800.00	$7,200.00	
$0.00	$20,466.19	$586,032.72	$0.00	$7,200.00	
$0.00	$20,449.34	$569,099.58	$1,800.00	$9,000.00	
$0.00	$20,432.40	$552,081.78	$0.00	$9,000.00	
$0.00	$20,415.39	$534,978.88	$1,800.00	$10,800.00	
$0.00	$20,398.28	$517,790.47	$0.00	$10,800.00	
$0.00	$20,381.10	$500,516.12	$1,800.00	$12,600.00	
$0.00	$20,363.82	$483,155.39	$0.00	$12,600.00	
$0.00	$20,346.46	$465,707.86	$1,800.00	$14,400.00	
$0.00	$20,329.01	$448,173.10	$0.00	$14,400.00	
$0.00	$20,311.48	$430,550.66	$1,800.00	$16,200.00	
$0.00	$20,293.86	$412,840.11	$0.00	$16,200.00	
$0.00	$20,276.15	$395,041.00	$1,800.00	$18,000.00	
$0.00	$20,258.35	$377,152.90	$0.00	$18,000.00	
$0.00	$20,240.46	$359,175.36	$0.00	$18,000.00	
$0.00	$20,222.48	$341,107.93	$0.00	$18,000.00	
$0.00	$20,204.41	$322,950.17	$0.00	$18,000.00	
$0.00	$20,186.26	$304,701.61	$0.00	$18,000.00	
$0.00	$20,168.01	$286,361.81	$0.00	$18,000.00	
$0.00	$20,149.67	$267,930.32	$0.00	$18,000.00	
$0.00	$20,131.24	$249,406.66	$0.00	$18,000.00	
$0.00	$20,112.71	$230,790.39	$0.00	$18,000.00	
$0.00	$20,094.10	$212,081.04	$0.00	$18,000.00	
$0.00	$20,075.39	$193,278.14	$0.00	$18,000.00	
$0.00	$20,056.58	$174,381.23	$0.00	$18,000.00	
$0.00	$20,037.69	$155,389.83	$0.00	$18,000.00	
$0.00	$20,018.69	$136,303.47	$0.00	$18,000.00	
$0.00	$19,999.61	$117,121.68	$0.00	$18,000.00	
$0.00	$19,980.43	$97,843.99	$0.00	$18,000.00	
$0.00	$19,961.15	$78,469.90	$0.00	$18,000.00	
$0.00	$19,941.78	$58,998.95	$0.00	$18,000.00	
$0.00	$19,922.30	$39,430.63	$0.00	$18,000.00	
$0.00	$19,902.74	$19,764.48	$0.00	$18,000.00	
$0.00	$19,883.07	($0.00)	$0.00	$18,000.00	

$0.00	**$809,738.65**	**$18,000.00**

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

Application of Troublesome Creek	)	
Environmental Authority, Inc.	)	
a Public Non-Profit	)	
Corporation for	)	**Case No. 2010-00017**
Certificate of Convenience	)	
and Necessity, to Construct Facility;	)	
to Set Initial Rates;	)	
to Incur Indebtedness	)	
and Authority to Operate	)	

SUPPLEMENTAL PETITION

EXHIBIT 29

KNOTT COUNTY FISCAL
COURT RESOLUTION

RESOLUTION

AT THE REGULAR MEETING OF THE KNOTT COUNTY FISCAL COURT HELD IN THE FISCAL COURT MEETING ROOM IN THE OLD COURTHOUSE ON THE 17TH DAY OF JUNE 2009 AT THE HOUR OF 5:30 PM THE FOLLOWING RESOLUTION WAS OFFERED:

A RESOLUTION TO AUTHORIZE THE FILING OF A KENTUCKY LOCAL GOVERNMENT ECONOMIC DEVELOPMENT FUND (LGEDF) PROJECT PROPOSAL/GRANT APPLICATION FOR UP TO $450,000.00 IN LOCAL GOVERNMENT ECONOMIC DEVELOPMENT SINGLE COUNTY FUNDS WITH THE DEPARTMENT FOR LOCAL GOVERNMENT (DLG) AND TO AUTHORIZE KNOTT COUNTY JUDGE-EXECUTIVE RANDY THOMPSON TO SIGN AND EXECUTE ANY DOCUMENTS WHICH ARE DEEMED NECESSARY BY DLG TO CARRY OUT THIS PROJECT AND TO AUTHORIZE THE JUDGE-EXECUTIVE TO ACT AS THE AUTHORIZED CORRESPONDENT FOR THIS PROJECT

WHEREAS, the Knott County Fiscal Court desires to promote and carry out economic development efforts on behalf of the residents of Knott County by supporting the Troublesome Creek Environmental Authority Project, and

WHEREAS, it is recognized that LGEDF monies available to the County for the purposes stated herein, pursuant to KRS 42.4582 to 42.495 and 2008 Kentucky General Assembly House Bill 406 (Budget Bill), impose certain obligations and responsibilities upon the County and will require among other things:

1. Approval of a satisfactory application transmitted to DLG for approval: and,
2. Other obligations of the County in connection with receiving the LGEDF grant of monies for the purposes stated herein;

NOW THEREFORE, be it resolved by the Knott County Fiscal Court that a Project Proposal/Grant Application on behalf of the County for LGEDF monies up to $450,000.00 for the Troublesome Creek Environmental Authority Project shall be submitted to DLG and the County shall provide such additional information and furnish such documentation as may be required, and the County Judge-Executive shall act as the authorized correspondent for this Project.

Motion for adoption of this resolution was made by Wade Noble, seconded by Haskel Ritchie, and vote taken as follows:

FOR	AGAINST
Haskel Ritchie	
J.C. Stivers	
Wade Noble	
Kathy Hall	

THEREUPON, said motion was declared passed and the resolution adopted, this 17th day of June 2009.

Attest:
By: _____
Clerk of the Fiscal Court of Knott County

_____
Judge/Executive


30% PCW

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

Application of Troublesome Creek	)	
Environmental Authority, Inc.	)	
a Public Non-Profit	)	
Corporation for	)	**Case No. 2010-00017**
Certificate of Convenience	)	
and Necessity, to Construct Facility;	)	
to Set Initial Rates;	)	
to Incur Indebtedness	)	
and Authority to Operate	)	

SUPPLEMENTAL PETITION

EXHIBIT 30

TROUBLESOME CREEK
ENVIRONMENTAL AUTHORITY, INC.
RESOLUTION

JOINT RESOLUTION
Troublesome Creek Environmental Authority

ADOPTION OF RESOLUTION OF THE TROUBLESOME CREEK ENVIRONMENTAL AUTHORITY AUTHORIZING THE FILING OF A KENTUCKY LOCAL GOVERNMENT ECONOMIC DEVELOPMENT FUND ("LGEDF") PROJECT PROPOSAL/GRANT APPLICATION FOR UP TO $388,817 IN LOCAL GOVERNMENT ECONOMIC DEVELOPMENT MULTI COUNTY FUNDS WITH THE DEPARTMENT FOR LOCAL GOVERNMENT (DLG); AUTHORIZING AND DIRECTING THE TROUBLESOME CREEK ENVIRONMENTAL AUTHORITY CHAIRPERSON TO EXECUTE ANY DOCUMENTS WHICH ARE DEEMED NECESSARY BY DLG TO CARRY OUT THIS PROJECT; AND AUTHORIZING THE CHAIRPERSON TO ACT AS THE AUTHORIZED CORRESPONDENT FOR THIS PROJECT.

WHEREAS, The Troublesome Creek Environmental Authority desires to promote and carry out economic and community development efforts on behalf of the area's residents; and

WHEREAS, it is recognized that LGEDF monies available to the Authority's Counties for the purposes stated herein, pursuant to KRS 42.4582 to 42.495 and 2008 Kentucky General Assembly House Bill 406/410 (Budget Bill), impose certain obligations and responsibilities upon the Counties and will require among other things:

(1) Approval of a satisfactory application transmitted to DLG for approval; and,
(2) Other obligations of the Counties in connection with receiving the LGEDF grant of monies for the purposes stated herein;

NOW, THEREFORE, be it resolved this 2nd day of February 2010, by the Troublesome Creek Environmental Authority:

That a Project Proposal/Grant Application on behalf of the Authority for LGEDF multi-county monies up to $388,817 for The Ball Creek WWTP and Collection Lines Project shall be submitted to DLG; all grant funds shall be administered by Troublesome Creek Environmental Authority; Troublesome Creek Environmental Authority shall provide such additional information and furnish such documentation as may be required, and the Troublesome Creek Environmental Authority Chairperson shall act as the authorized correspondent for this Project.

Done this 2nd day of February 2010. Motion by Jim Childers and seconded by Lewis H. Warrix, members present voting unanimously in favor.

By: _____
Troublesome Creek Environmental Authority Chairperson

ATTEST:

By: _____


30% PCW

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

Application of Troublesome Creek	)	
Environmental Authority, Inc.	)	
a Public Non-Profit	)	
Corporation for	)	**Case No. 2010-00017**
Certificate of Convenience	)	
and Necessity, to Construct Facility;	)	
to Set Initial Rates;	)	
to Incur Indebtedness	)	
and Authority to Operate	)	

SUPPLEMENTAL PETITION

EXHIBIT 31

BID TAB SHEETS AND RECOMMENDATIONS
SEWER LINES

RMJE
R.M. JOHNSON ENGINEERING, INC.

P. O. Box 444
Hindman, Kentucky 41822
Telephone: (606) 785-5926
Fax: (606) 785-0244
E-mail: info@rmje.net

3213 Summit Square Place
Suite 100
Lexington, Kentucky 40509
Telephone: (859) 543-1256
Fax: (859) 543-9873

February 2, 2010

Mr. Lewis Warrix, Chairman
Troublesome Creek Environmental Authority
917 Perry Park Road
Hazard, KY 41701

RE: Letter of Recommendation of Bidder
Ball Creek WWTP & Sanitary Sewer Collection Project – Contract 2

Dear Mr. Warrix:

We, at R.M. Johnson Engineering Inc., are pleased to submit this letter of recommendation for award of the Ball Creek WWTP & Sanitary Sewer Collection Project, Contract 2. All timely submitted bids were opened and read aloud on January 7, 2010 at approximately 2:00 P.M. at the Knott County Sportsplex conference room in Softshell, KY. The apparent low-bidder for this project was Cleary Construction, Inc.

Attached you will find the official bid tabulation showing all bids submitted for this project. Cleary Construction is the official low-bidder with a lump sum bid of **$1,452,675.00**. We feel that Cleary Construction is fully capable and competent to complete the project at hand.

Please accept this letter as our recommendation to award Cleary Construction, Inc. the Ball Creek WWTP & Sanitary Sewer Collection Project, Contract 2.

We appreciate the opportunity to serve you and look forward to working with you in the future. If you have any questions regarding the contents of this letter please feel free to contact me at (606) 785-5926 or by email at sharris@rmje.net.

Sincerely,
RM JOHNSON ENGINEERING, INC.

Ron Johnson, P.E.
Principal Engineer

Cc: Jennifer McIntosh, KRADD
File

Prepared by:
R.M. Johnson Engineering, Inc.
Phone: (606) 785-5926
Fax: (606) 785-0244
Email: info@rmje.net

Item No.	ITEM DESCRIPTION FOR BASE BID	Estima Quant	4 ɔnstruction Co., Inc. ɡgold Road Kentucky 42503 Subtotal	5 B.P. Pipeline 269 Pebble Lane Quincy, Kentucky 41166 Unit Price	Subtotal
1A	4' Diameter Manholes	2	$ 52,500.00	$ 5,000.00	$ 125,000.00
1B	12" PVC SDR 35 Sewer Pipe	4,52	$ 203,400.00	$ 55.00	$ 248,600.00
1C	6" PVC SDR 35 Sewer Pipe	35	$ 13,300.00	$ 25.00	$ 8,750.00
1D	6" PVC Sewer Cleanout	2	$ 6,160.00	$ 1,500.00	$ 33,000.00
1E	12" X 6" Tees	2	$ 6,600.00	$ 700.00	$ 15,400.00
1F	Rainguard Manhole Inserts	2	$ 1,500.00	$ 200.00	$ 5,000.00
					$ -
2A	200 GPM Lift Station		$ 70,000.00	$ 95,000.00	$ 95,000.00
2B	Telemetry & Controls		$ 45,000.00	$ 80,000.00	$ 80,000.00
2C	Electrical Service		$ 10,000.00	$ 10,000.00	$ 10,000.00
2D	8' Chain Link Security Fence	7	$ 2,450.00	$ 100.00	$ 7,000.00
2E	8' Chain Link Security Gate		$ 2,000.00	$ 10,000.00	$ 10,000.00
3A	Repeater Station		$ 15,000.00	$ 75,000.00	$ 75,000.00
3B	8' Chain Link Security Fence	7	$ 2,450.00	$ 110.00	$ 7,700.00
3C	8' Chain Link Security Gate		$ 2,000.00	$ 10,000.00	$ 10,000.00
3B	Electrical Service		$ 10,000.00	$ 10,000.00	$ 10,000.00
					$ -
4A	6" HDPE DR 11 Force Main	27,58	$ 795,683.00	$ 16.00	$ 441,280.00
4B	2" HDPE DR 11 Force Main	5,45	$ 136,250.00	$ 12.00	$ 65,400.00
4C	Residential Grinder Stations	4	$ 180,000.00	$ 6,000.00	$ 240,000.00
4D	Sportsplex Lift Station		$ 50,000.00	$ 90,000.00	$ 90,000.00
4E	Combination Air/Vacuum Release Valves	4	$ 126,000.00	$ 2,000.00	$ 90,000.00
4F	Creek Crossings (Directional Bores)	95	$ 85,500.00	$ 200.00	$ 190,000.00
4G	12" Bored Steel Encasement	91	$ 136,500.00	$ 200.00	$ 182,000.00
4H	18" Bored Steel Encasement	33	$ 59,400.00	$ 300.00	$ 99,000.00
4I	Asphalt Replacement	25	$ 16,250.00	$ 60.00	$ 15,000.00
4J	Concrete Replacement	25	$ 21,250.00	$ 120.00	$ 30,000.00
4K	Gravel Replacement	50	$ 20,000.00	$ 20.00	$ 10,000.00
4L	2" HDPE Road Crossing (Directional Bores)	1,00	$ 60,000.00	$ 20.00	$ 20,000.00
		Bi	**$ 2,129,193.00**		**$ 2,213,130.00**
Please Note: All Bid Tabulations where based on unit prices.					
ALTERNATES					
A-1	Alternate Force Main Route 'B'	11,45	$ 286,250.00	$ 24.00	$ 274,800.00
A-2	Replace 8" PVC Waterline with HDPE DR 11	11,45	$ 229,000.00	$ 26.00	$ 297,700.00
A-3	Opposite-Side 6" PVC Laterals with 12" Encmnts.	1,90	$ 285,000.00	$ 25.00	$ 47,500.00

NOTICE OF AWARD

To: **Cleary Construction, Inc.**
2006 Edmonton Road
Tompkinsville, KY 42167

PROJECT Description: **Ball Creek WWTP & Sewer Collection Project, Contract 2**

The OWNER has considered the BID submitted by you for the above described WORK in response to its Advertisement for Bids dated **December 18, 2009**, and Information for Bidders.

You are hereby notified that your BID has been accepted for items in the amount of **$ 1,452,675.00**.

You are required by the Information for Bidders to execute the Agreement and furnish the required CONTRACTOR's Performance Bond, Payment Bond and Certificates of Insurance within ten (10) calendar days from the date of this Notice to you.

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

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

Dated this _____ day of _____, 20 **10**.

Troublesome Creek Envr. Auth.
Owner

By _____

Name/Title _____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged

by _____

this the _____ day of _____, 20 **10**.

By _____

Name/Title _____


30% PCW

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

Application of Troublesome Creek	)	
Environmental Authority, Inc.	)	
a Public Non-Profit	)	
Corporation for	)	**Case No. 2010-00017**
Certificate of Convenience	)	
and Necessity, to Construct Facility;	)	
to Set Initial Rates;	)	
to Incur Indebtedness	)	
and Authority to Operate	)	

SUPPLEMENTAL PETITION

EXHIBIT 32

BID TAB SHEETS AND RECOMMENDATIONS
PLANT

RMJE
R.M. JOHNSON ENGINEERING, INC.

P. O. Box 444
Hindman, Kentucky 41822
Telephone: (606) 785-5926
Fax: (606) 785-0244
E-mail: info@rmje.net

3213 Summit Square Place
Suite 100
Lexington, Kentucky 40509
Telephone: (859) 543-1256
Fax: (859) 543-9873

February 2, 2010

Mr. Lewis Warrix, Chairman
Troublesome Creek Environmental Authority
917 Perry Park Road
Hazard, KY 41701

RE: Letter of Recommendation of Bidder
Ball Creek WWTP & Sanitary Sewer Collection Project – Contract 1

Dear Mr. Warrix:

We, at R.M. Johnson Engineering Inc., are pleased to submit this letter of recommendation for award of the Ball Creek WWTP & Sanitary Sewer Collection Project, Contract 1. All timely submitted bids were opened and read aloud on January 7, 2010 at approximately 2:00 P.M. at the Knott County Sportsplex conference room in Softshell, KY.

The apparent low-bidder for this project was initially Howard Engineering & Construction, Inc., however their bid was withdrawn at their request. Because the project bids were over budget we entered into negotiations with the remaining three bidders. The new low bidder by negotiated price is Bristol Group with a lump sum bid of **$1,993,517.00.**

Attached you will find the official bid tabulation showing all bids submitted for this project along with a collection of documents which outline our negotiation process. We feel that Bristol Group is fully capable and competent to complete the project at hand.

Please accept this letter as our recommendation to award Bristol Group the Ball Creek WWTP & Sanitary Sewer Collection Project, Contract 1.

We appreciate the opportunity to serve you and look forward to working with you in the future. If you have any questions regarding the contents of this letter please feel free to contact me at (606) 785-5926 or by email at sharris@rmje.net.

Sincerely,
RM JOHNSON ENGINEERING, INC.

Ron Johnson, P.E.
Principal Engineer

Cc: Jennifer McIntosh, KRADD
File

TROUBLESOME CREEK ENVIRONMENTAL AUTHORITY (TEA)

Ball Creek WWTP & Sewer Collection Project – Phase I
CONTRACT 1 – WWTP

BID OPENING
BID TOTALS

DATE: January 7, 2010 2:00 P.M.

	Contractor	Bid Total
1.	Howard Engineering	2,070,000.00
2.	Bristol Group	2,273,405.00
3.	Herrick Company, Inc.	2,312,000.00
4.	Kenney, Inc.	2,615,500.00
5.		
6.		
7.		
8.		
9.		
10.		
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15.		
16.		
17.		
18.		
19.		
20.		
21.		

NOTICE OF AWARD

To: **Bristol Group**
1115 Delaware Avenue, Ste. 200
Lexington, KY 40505

PROJECT Description: **Ball Creek WWTP & Sewer Collection Project, Contract 1**

The OWNER has considered the BID submitted by you for the above described WORK in response to its Advertisement for Bids dated **December 18, 2009**, and Information for Bidders.

You are hereby notified that your BID has been accepted for items in the amount of **$ 1,993,517.00**.

You are required by the Information for Bidders to execute the Agreement and furnish the required CONTRACTOR's Performance Bond, Payment Bond and Certificates of Insurance within ten (10) calendar days from the date of this Notice to you.

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

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

Dated this _____ day of _____, 20**10**.

Troublesome Creek Envr. Auth.
Owner

By _____

Name/Title _____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged

by _____

this the _____ day of _____, 20**10**.

By _____

Name/Title _____


30% PCW

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

Application of Troublesome Creek	)	
Environmental Authority, Inc.	)	
a Public Non-Profit	)	
Corporation for	)	**Case No. 2010-00017**
Certificate of Convenience	)	
and Necessity, to Construct Facility;	)	
to Set Initial Rates;	)	
to Incur Indebtedness	)	
and Authority to Operate	)	

SUPPLEMENTAL PETITION

EXHIBIT 33

CONSTRUCTION BUDGET

R.M. Johnson Engineering
P.O. Box 444
Hindman, Kentucky 41822

CONSTRUCTION COST ESTIMATE

Project : EPA Ball Creek Sewer Project, Phase I
Date : 01/26/10 **Job No. :**
Est. By : SRH **Checked By :** RMJ
DRAWING NO. :

Ball Creek WWTP & Sewer Project 0.10 MGD WWTP with 6.0 miles of collection.	QUANTITY NO OF UNITS	UNIT MEAS.	COST PER UNIT		TOTAL COST
SEWER COLLECTION					
12" PVC Gravity Sewer Pipe, SDR 35	4,520	LF	$ 55.00		$ 248,600.00
6" PVC Gravity Sewer Pipe, SDR 35	350	LF	$ 20.00		$ 7,000.00
6" PVC Sewer Cleanouts	22	LF	$ 100.00		$ 2,200.00
12" X 6" Tees or Wyes	22	EA	$ 100.00		$ 2,200.00
Sanitary Sewer Manhole	25	EA	$ 3,000.00		$ 75,000.00
Rainguard	25	EA	$ 150.00		$ 3,750.00
2" HDPE Force Main, SDR 17	6,450	LF	$ 4.00		$ 25,800.00
6" HDPE Force Main, SDR 17	27,580	LF	$ 14.00		$ 386,120.00
200 GPM Lift Station/w Telemetry	1	EA	$ 115,000.00		$ 115,000.00
Repeater Telemetry Station	1	LS	$ 40,000.00		$ 40,000.00
8' Chain Link Security Fence	140	LF	$ 45.00		$ 6,300.00
8' Chain Link Security Gate	2	LS	$ 1,000.00		$ 2,000.00
40 GPM Sportsplex Lift Station	1	EA	$ 45,000.00		$ 45,000.00
Residential Grinder Pump Station (Complete)	40	EA	$ 3,500.00		$ 140,000.00
Air/Vacuum Relief Assembly	45	EA	$ 1,500.00		$ 67,500.00
Sanitary Sewer Creek Crossing	950	LF	$ 70.00		$ 66,500.00
Concrete Replacement	250	SY	$ 25.00		$ 6,250.00
Asphalt Pavement Replacement	250	SY	$ 25.00		$ 6,250.00
Gravel Replacement	500	SY	$ 15.00		$ 7,500.00
12" Bored Steel Encasement	910	LF	$ 125.00		$ 113,750.00
18" Bored Steel Encasement	330	LF	$ 175.00		$ 57,750.00
WWTP & SITE FACILITIES					
Erosion & Sediment Control	1	LS	$ 5,000.00		$ 5,000.00
3-Phase Power to Site	1	LS	$ 150,000.00		$ 150,000.00
Electrical & Controls Installation	1	LS	$ 481,297.00		$ 481,297.00
WWTP Power Generator	1	EA	$ 70,000.00		$ 70,000.00
WWTP Site Preparation	1.5	AC	$ 25,000.00		$ 37,500.00
Influent Metering	1	LS	$ 30,000.00		$ 30,000.00
Aqua Aerobic SBR Equipment	1	EA	$ 355,000.00		$ 355,000.00
Onsite Plant Piping Installation	1	LS	$ 30,000.00		$ 30,000.00
Sanitary Sewer Manhole	1	EA	$ 3,000.00		$ 3,000.00
8" PVC SDR 35 Sewer	155	LS	$ 45.00		$ 6,975.00
Fiberglass Walkway Grating	500	SF	$ 27.50		$ 13,750.00
4 - 20' X 20' X 20' CIP Concrete SBR Basins	450	CY	$ 600.00		$ 270,000.00
Composite Sampler	2	EA	$ 7,500.00		$ 15,000.00
Influent Screening	1	EA	$ 75,000.00		$ 75,000.00
Ultraviolet Disinfection	1	LS	$ 145,000.00		$ 145,000.00
Post Aeration	1	LS	$ 40,000.00		$ 40,000.00
Effluent Metering	1	LS	$ 30,000.00		$ 30,000.00
Outlet Headwall Structure	1	EA	$ 5,000.00		$ 5,000.00
Sludge Handling	1	LS	$ 60,000.00		$ 60,000.00
Telemetry	1	LS	$ 35,000.00		$ 35,000.00
8' Chain Link Security Fencing	725	LF	$ 45.00		$ 32,625.00
8' Chain Link Security Gate	1	EA	$ 1,000.00		$ 1,000.00
DGA Base	875	TON	$ 25.00		$ 21,875.00
Access Road Gravel	35	TON	$ 20.00		$ 700.00
Onsite WWTP Lift Station	1	LS	$ 65,000.00		$ 65,000.00
Site Lighting	1	LS	$ 3,000.00		$ 3,000.00
Water Meter Installation (Basin, Meter, Setter, PRV)	1	EA	$ 1,500.00		$ 1,500.00
Potable Water Plumbing	1	LS	$ 5,000.00		$ 5,000.00
Non-Potable Water Supply Pump	1	LS	$ 6,000.00		$ 6,000.00
Non-Potable Water Plumbing	1	LS	$ 10,000.00		$ 10,000.00
Non-Potable Water Yard Hydrants	8	EA	$ 1,250.00		$ 10,000.00
Seeding & Cleanup	1.5	AC	$ 5,000.00		$ 7,500.00
	SUBTOTAL AMOUNT				**$ 3,446,192.00**
	5% CONST. CONTINGENCY				**$ 172,310.00**
	PRELIMINARY ENGINEERING				**$ 25,000.00**
	ENGINEERING DESIGN	7.08%			**$ 243,900.00**
	RESIDENT INSPECTION	4.87%			**$ 167,700.00**
	ADDITIONAL ENGINEERING				**$ 105,000.00**
	ADMINISTRATION				**$ 40,000.00**
	LEGAL and LAND				**$ 63,715.00**
	TOTAL ESTIMATED CONSTRUCTION COST				**$ 4,263,817.00**