

TECHNICAL SPECIFICATIONS

FOR

**POWELL'S VALLEY WATER DISTRICT
POWELL COUNTY, KENTUCKY**

**SLADE WASTEWATER TREATMENT
PLANT AERATED EQUALIZATION BASIN**

August 2026



OF KENTUCKY, INC.

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**POWELLS VALLEY WATER DISTRICT POWELL
COUNTY, KENTUCKY**

SLADE WWTP AERATED EQUALIZATION BASIN

TECHNICAL SPECIFICATIONS

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SECTION 00020 - INVITATION TO BID

Sealed bids for the construction of the Powell's Valley Water District's Slade Wastewater Treatment Plant Aerated Equalization Basin Project , will be received in the office of Randy Ledford, Superintendent at 31 Adams Ridge Rd., Clay City, KY 40312, until 1:00 p.m., local time, Tuesday, September 1, 2026. The bid opening will be at 2:00 p.m., local time, Tuesday, September 1, 2026, at the Powell County Emergency Management Office, 33 Commerce Drive, Stanton, KY 40383 and will be publicly opened and read aloud. Hand carried bids will be received from 1:00 p.m. to 2:00 p.m. local time, at the Powell County Emergency Management Office, Tuesday, September 1, 2026. Therefore, you may mail or have delivered your bid to the Powell's Valley Water District Office at 31 Adams Ridge Road in Clay City by 1:00 p.m. or you may hand deliver it to the Powell County Emergency Management Office at 33 Commerce Drive in Stanton by 2:00 p.m.. Bids will be opened at the Powell County Emergency Management Office at 2:00 p.m.

The Contract Documents may be reviewed at the following locations:

Powells Valley Water District, 31 Adams Ridge Road, Clay City, Kentucky

MSE of Kentucky, Inc., 624 Wellington Way, Lexington, Kentucky

Copies of the Contract Documents may be obtained at the office of Lynn Imaging, 328 Old Vine Street, Lexington, Kentucky 40507 (859) 226-5850 upon receipt of a nonrefundable printing and shipping charge of \$200.00.

The Owner reserves the right to waive any informalities or to reject any or all bids.

Each bidder must deposit with his bid, security in the amount, form, and subject to the conditions provided in the information for Bidders.

The Owner may consider informal any bid not prepared and submitted in accordance with the provisions of this advertisement and/or the specifications and may waive any informalities or reject any and all Bids.

Prevailing wages **do not** apply to this project.

No Bidder may withdraw his Bid for a period of thirty (30) days after the actual date of the opening thereof.

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

End of Section

SECTION 00200 - INFORMATION FOR BIDDERS

Sealed bids for the construction of the Powell's Valley Water District's Slade Wastewater Treatment Plant Aerated Equalization Basin Project , will be received in the office of Randy Ledford, Superintendent at 31 Adams Ridge Rd., Clay City, KY 40312, until 1:00 p.m., local time, Tuesday, September 1, 2026. The bid opening will be at 2:00 p.m., local time, Tuesday, September 1, 2026, at the Powell County Emergency Management Office, 33 Commerce Drive, Stanton, KY 40380 and will be publicly opened and read aloud. Hand carried bids will be received from 1:00 p.m. to 2:00 p.m. local time, at the Powell County Emergency Management Office, Tuesday, September 1, 2026. Therefore, you may mail or have delivered your bid to the Powells Valley Water District Office at 31 Adams Ridge Road in Clay City by 1:00 p.m. or you may hand deliver it to the Powell County Emergency Management Office at 33 Commerce Drive in Stanton by 2:00 p.m.. Bids will be opened at the Powell County Emergency Management Office at 2:00 p.m.

All Bids must be made on the required Bid Form. All blank spaces for Bid prices must be filled in, in ink or typewritten, and the Bid Form must be fully completed and executed when submitted. Only one copy of the Bid Form is required.

The OWNER may waive any informalities or minor defects or reject any and all Bids. Any Bid may be withdrawn prior to the above scheduled time for the opening of Bids or authorized postponement thereof. Any Bid received after the time and date specified shall not be considered. No BIDDER may withdraw a Bid within thirty (30) days after the actual date of the opening thereof. Should there be reasons why the contract cannot be awarded within the specified period the time may be extended by mutual agreement between the OWNER and the BIDDER.

BIDDERS must satisfy themselves of the accuracy of the estimated quantities in the Bid Schedule by examination of the site and a review of the drawings and specifications including Addenda. After Bids have been submitted, the BIDDER shall not assert that there was a misunderstanding concerning the quantities of Work or of the nature of the Work to be done.

The OWNER shall provide to BIDDERS prior to bidding, all information which is pertinent to, and delineates and describes, the land owned and rights-of-way acquired or to be acquired.

The Contract Documents contain the provisions required for the he project. Information obtained from an officer, agent, or employee of the OWNER or any other person shall not affect the risks or obligations assumed by the CONTRACTOR or relieve the CONTRACTOR from fulfilling any of the conditions of the contract.

Each Bid must be accompanied by a Bid bond payable to the OWNER for five percent of the total amount of the Bid. As soon as the Bid prices have been compared, the OWNER will return the bonds of all except the three lowest responsible BIDDERS. When the Agreement is executed the bonds of the two remaining unsuccessful BIDDERS will be returned. The Bid Bond of the successful BIDDER will be retained until the Payment Bond and Performance Bond have been executed and approved, after which it will be returned. A certified check may be used in lieu of a Bid Bond.

A Performance Bond and a Payment Bond each in the amount of 100 percent of the Contract Price, with a corporate surety approved by the OWNER, will be required for the faithful performance of the contract.

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

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

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

The Notice to Proceed shall be issued within ten (10) days of the execution of the Agreement by the OWNER. Should there be reasons why the Notice to Proceed cannot be issued within such period, the time may be extended by mutual agreement between the OWNER and CONTRACTOR. If the Notice to Proceed has not been issued within the ten (10) day period or within the period mutually agreed upon, the CONTRACTOR may terminate the Agreement without further liability on the part of either party.

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

A conditional or qualified Bid will not be accepted.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the PROJECT shall apply to the contract throughout.

Each BIDDER is responsible for inspecting the site and for reading and being thoroughly familiar with the Contract Documents. The failure or omission of any BIDDER to do any of the foregoing shall in no way relieve any BIDDER from any obligation in respect to its Bid.

The low BIDDER shall supply the names and addresses of major material suppliers and subcontractors when required to do so by the OWNER.

End of Section

SECTION 00310 - BID FORM

POWELL'S VALLEY WATER DISTRICT

Proposal of _____ (hereinafter called "BIDDER"), organized and existing under the laws of the State of _____, doing business as _____ (insert "a corporation", "a partnership", or "an individual" as applicable) to the Powell's Valley Water District (hereinafter "OWNER").

In compliance with your Invitation to Bid, BIDDER hereby proposes to furnish all equipment, materials, and labor for the work required for Slade Wastewater Treatment Plant Aerated Equalization Basin Project, in strict accordance with the Contract Documents, within the time set forth therein, and at the prices stated below. The Owner reserves the right to award all of the items in the bid or a portion may be deleted as necessary to work within the project budget.

1. Construction and installation of equipment and supplies - includes all equipment, excavation, construction and installation of equipment for each of the following components:

A. Equalization basins including site grading, excavation, concrete and reinforcing steel, weirs, installation of air lines, valves, diffusers, oxygen sensors and all other equipment and facilities related to the basins

Equalization Basins \$ _____

B. Drying Beds including excavation site grading, concrete and reinforcing steel, filter plates, discharge and inlet piping and all other equipment and facilities related to the drying beds.

Drying Beds \$ _____

C. Blower, VFD, Office / Lab building - including site grading, excavation, concrete and reinforcing steel, block walls, trusses and roofing. 2 blowers and air lines to the basins, VFDs and controls, HVAC and climate control monitoring and controls, chemical mixing and metering equipment and feed piping, office equipment, desk, chairs, lab sink and counters, bathroom sink and toilet, control panels for VFDs and plant operations.

Blowers, VFDs and Office/Lab \$ _____

D. Ultraviolet Disinfection and DO Facilities including site grading, excavation, concrete, UV equipment, electrical connections, control lines to the office/lab.

UV and DO Facilities \$ _____

2. Site Work including general grading, seeding and drainage, yard piping for potable water, sludge lines, influent lines, lateral lines, yard hydrants, light poles and fixtures.

Site Work \$ _____

3. All other items for the complete wastewater treatment plant and facilities.

All Other Items \$ _____

Total Items 1-3 \$ _____

The bid prices shall include all labor, materials, overhead, profit, insurance, and other costs necessary to provide equipment and services called for. Changes shall be processed in accordance with the General Conditions.

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

BIDDER hereby agrees to commence Work under this contract on or before a date to be specified in the Notice to Proceed and to complete the work within ninety (90) days. BIDDER further agrees to pay as liquidated damages, the sum of \$500 for each consecutive calendar day thereafter as provided in the General Conditions and the Special Conditions.

Accompanying this Proposal is a certified check or standard Bid Bond in the sum of

Dollars (\$ _____), in accordance with the Information for Bidders. The BIDDER, by submittal of this Bid, agrees with the OWNER that the amount of the bid security deposited with this Bid fairly and reasonably represents the amount of damages the OWNER will suffer due to the failure of the BIDDER to fulfill his agreements as provided in this Proposal.

BIDDER acknowledges receipt of the following Addenda:

No. _____ Date: _____ No. _____ Date: _____ No. _____ Date: _____
No. _____ Date: _____ No. _____ Date: _____ No. _____ Date: _____

BIDDER understands that the OWNER reserves the right to reject any or all Bids and to waive any informalities in the Bidding. BIDDER agrees that this Bid shall be good and may not be withdrawn for a period of thirty (30) calendar days after the actual date of bid opening.

Within ten (10) calendar days after receiving written notice of the acceptance of this Bid by the OWNER, the Bidder will execute and deliver to the OWNER one (1) copies of the Agreement and such other required Contract Documents.

BIDDER: _____
(Name of Company or Partnership)

By: _____
(Signature) (Date)

(Print Name)

(Title)

(Address) (City, State) (Zip)

(Email Address) (Phone Number)

Attested By: _____
(Signature) (Date)

Seal (If bid is by a corporation)

End of Section

SECTION 00320 - BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, _____ as Principal, hereinafter called the Principal, and _____ as Surety, hereinafter called the Surety, are held and firmly bound unto _____, as Obligee, hereinafter called the Obligee, in the sum of _____ Dollars for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents. The Condition of the above obligation is such that whereas the Principal has submitted to _____, a certain BID, attached hereto and hereby made a part hereof to enter into a contract in writing, for the construction of _____.

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or contract documents with good and sufficient surety for the faithful performance of said contract, and for the prompt payment of labor and materials furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this _____ day of _____ 20____.

Principal

Witness

By: _____

Surety

Witness

By: _____
Attorney-in-fact

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

End of Section

SECTION 00480 - NON-COLLUSION AFFIDAVIT

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Non-Collusion Affidavit for the project shall be submitted with the bid proposal, and a copy of this document is bound herewith.

1. When properly executed, this Document shall become a part of the successful bidder's Contract Document.

END OF SECTION

NON-COLLUSION AFFIDAVIT

The undersigned bidder, on behalf of its officers and agents or representatives being duly sworn, states that it has not in any way, directly or indirectly, entered into any arrangement or agreement with any other bidder, or with any other person or public officer whereby bidder has paid or is to pay to such other bidder or other person or public officer any sum or money, or has given or is to give to such other bidder or other person or public officer anything of value whatever, or such agent or affiant or either of them has not, directly or indirectly, entered into any arrangement or agreement with any other bidder or bidders, which tends to or does lessen or destroy free competition in the letting of the contract sought for by the attached bids; that no inducement of any form or character other than that which appears upon the face of the bid will be suggested, offered, paid or delivered to any person whomsoever to influence the acceptance of the said bid or awarding of the contract, nor has this bidder any agreement or understanding of any kind whatsoever, with any person whomsoever to pay, deliver to, or share with any other person in any way or manner, any of the proceeds of the contract sought by this bid.

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

My Commission expires:

Notary Public

END OF AFFIDAVIT

SECTION 00490 - NOTICE OF AWARD

To:

Project Description: Slade Wastewater Treatment Plant Aerated Equalization Basin

The Owner has considered the Bid submitted by you for the above-described Work in response to its Advertisement for Bids dated _____, 2026 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 to such other rights as may be granted by law.

You are required to return an acknowledged copy of this Notice of Award to the Owner.

Dated this 6th day of August, 2026.

Powell's Valley Water District
Owner

By:

Steve Everman, Chairman

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged by _____ this the _____ day of _____, 2026.

By:

(Name/Title)

SECTION 00500 - AGREEMENT

THIS AGREEMENT, made this _____ day of _____, 2026, by and between Powell's Valley Water District, hereinafter called "OWNER", and _____, doing business as a corporation hereinafter called "CONTRACTOR".

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

1. The CONTRACTOR will commence and complete all work as specified or indicated in the Contract Documents for Slade Wastewater Treatment Plant Aerated Equalization Basin.
2. The CONTRACTOR will furnish all of the material, supplies, tools, equipment and other services necessary for the completion of the project described herein.
3. The CONTRACTOR will commence the work required by the contract documents within 10 calendar days after the date of the Notice To Proceed and will complete the same within 180 calendar days unless the period for completion is extended otherwise by the Contract Documents. The CONTRACTOR further agrees to pay as liquidated damages, the sum of \$1,000 for each consecutive calendar day thereafter as provided in the Specifications.
4. The CONTRACTOR agrees to perform all of the work described in the Contract Documents and comply with the terms therein for the sum of \$_____ or as shown in the Bid Schedule.
5. The term "CONTRACT DOCUMENTS" means and includes the following:
 - A. Invitation to Bid
 - B. Information for Bidders
 - C. Bid Form
 - D. Bid Bond
 - E. Agreement
 - F. Performance Bond
 - G. Payment Bond
 - H. Notice of Award
 - I. Notice to Proceed
 - J. General Conditions
 - K. Special Conditions
 - L. Technical Specifications
 - M. Drawings and Plan Sheets
 - N. Addenda
6. The project has been designed by MSE of Kentucky, Inc. who will act as ENGINEER in connection with completion of the project in accordance with the Contract Documents.
7. CONTRACTOR shall submit Applications for Payment in accordance with the General Conditions. Applications for Payment will be reviewed by the ENGINEER as provided in the General Conditions.
8. OWNER shall make progress payments on account of the Contract Price on the basis of CONTRACTOR'S Application for Payment as approved by the ENGINEER, on or about the _____ of each month during construction as provided in the General Conditions. All progress payments will be on the basis of the progress of work measured by the schedule of values provided for in the General Conditions. Progress Payments, retainage, and withheld payments shall all be done in compliance with the General Conditions. Upon final completion of the work and settlement of all claims, OWNER shall pay the remainder of the Contract Price.

9. Neither OWNER nor CONTRACTOR shall, without the prior written consent of the other, assign or sublet in whole or in part his interest under any of the Contract Documents; and, specifically, CONTRACTOR shall not assign any moneys due or to become due without the prior written consent of the OWNER.
10. OWNER and CONTRACTOR each binds himself, his partners, heirs, executors, administrators, successors, assigns and legal representatives to the other party hereto in respect to all covenants, agreements and obligations contained in the Contract Documents.

IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their duly authorized officials, the Agreement in four (4) copies, each of which shall be deemed an original on the date first above written.

Powell's Valley Water District

(Owner)

(Contractor)

By: _____
(Signature)

By: _____
(Signature)

Steve Everman, Chairman
(Name, Title)

(Name, Title)

Attest:

Attest:

By: _____
(Signature)

By: _____
(Signature)

(Name, Title)

(Name, Title)

End of Section

SECTION 00602 - PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: that

(Name of Contractor)

(Address of Contractor)

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

_____, hereinafter called Surety, are held and firmly bound unto
(Name of Surety)

(Name of Owner)

(Address of Owner)

hereinafter called OWNER, in the penal sum of _____
_____ Dollars,
(\$_____)

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

The CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER, dated the _____ day of _____, 20_____, a copy of which is hereto attached and made a part hereof for the construction of:

NOW, THEREFORE, if the Principal shall promptly make payments to all persons, firms, SUBCONTRACTORS, and corporations furnishing materials for or performing labor in the prosecution of the WORK provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment, and tools, consumed or used in connection with the construction of such WORK, and all insurance premiums on said WORK, and for all labor, performed in such WORK whether by SUBCONTRACTOR or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

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

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

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

ATTEST:

_____	_____
(Principal) Secretary	Principal
(SEAL)	By: _____
_____	_____
(Witness as to Principal)	(Address)
_____	_____
(Address)	
_____	_____
	(Surety)

ATTEST:

(Surety) Secretary	
(SEAL)	
_____	_____
(Witness as to Surety)	Attorney-in-fact
_____	_____
(Address)	(Address)
_____	_____

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

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

End of Section

SECTION 00680 - NOTICE TO PROCEED

To:

Date:

Project: Slade WWTP Equalization Basin

You are hereby notified to commence WORK in accordance with the Agreement dated _____, 2026 on or before _____ 2026, and you are to complete the WORK within 180 consecutive calendar days thereafter.

The date of completion of all work is therefore, _____, 2026.

By:

Powell's Valley Water District
Owner

Steve Everman, Chairman

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by
_____ this the _____ day of _____, 2026.

By:

(Name/Title)

SECTION 00700 - GENERAL CONDITIONS

1. Definitions
2. Execution, Correlation and Intent of Documents
3. Starting the Project
4. Contract Documents
5. Contractor's Pre-Start Representations
6. Indemnity
7. Insurance
8. Guaranty Bond
9. Additional Bonds and Insurance
10. Availability of Lands
11. Unforeseen Physical Conditions
12. Reference Points
13. Superintendence - Supervision
14. Materials, Appliances, Employees
15. Substitute Materials or Equipment
16. Subcontracts
17. Patent Fees and Royalties
18. Permits, Laws and Regulations
19. Taxes
20. Safety and Protection
21. Shop Drawings and Samples
22. Record Drawings
23. Use of Premises
24. Cleaning
25. Work By Others
26. Engineer's Status During Construction
27. Engineer's Decision on Disagreements
28. Status of Engineer's Project Representative
29. Changes in the Work
30. Changes of Contract Price
31. Cash Allowance
32. Delays and Extension of Time
33. Warranty and Guarantee
34. Tests and Inspections
35. Access to Work
36. Uncovering Work
37. Stopping the Work
38. Correction of Work Before Final Payment
39. One Year Correction Period
40. Acceptance of Defective Work
41. Neglected Work By Contractor
42. Application for Payment
43. Approval of Payments
44. Substantial Completion
45. Partial Utilization
46. Final Payment
47. Owner's Right to Suspend Work
48. Owner's Right to Terminate Contract
49. Contractor's Right to Stop Work or Terminate
50. Arbitration by Mutual Consent
51. Computation of Time
52. Assignments
53. Ownership of Drawings
54. Compliance With Prevailing Wage Law (Where Applicable)
55. Measurement and Computation of Quantities
56. Project Signs

1. Definitions

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

Addendum - Written or graphic instrument issued to the execution of the agreement which modifies or interprets the Contract Documents, drawings and specifications.

Agreement - The written agreement between Owner and Contractor covering the work to be performed; other Contract Documents are attached to the Agreement.

Application for Payment - the form furnished by Engineer which is to be used by Contractor in requesting progress payments and which is to include the schedule of values required by Article 42.

Engineer - The person, firm or corporation named as such in the Agreement.

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

Bidder - Any person, firm or corporation submitting a Bid for the work.

Bonds - Bid, performance and payment bonds and other instruments of security, furnished by Contractor and his surety in accordance with the Contract Documents.

Change Order - A written order to Contractor signed by Owner authorizing an addition, deletion or revision in the work, or an adjustment in the Contract Price or the Contract Time issued after execution of the Agreement.

Contract Documents - The Advertisement for Bids, Agreement, Addenda (whether issued prior to the opening of Bids or the execution of the Agreement), Instructions to Bidders, Contractor's Bid, the Bonds, the Notice of Award, these General Conditions, the Supplementary Conditions, the Specifications, Drawings and Modifications.

Contract Price - The total moneys payable to Contractor under the Contract Documents.

Contract Time - The number of days stated in the Agreement for the completion of the work.

Contractor - The person, firm or corporation with whom Owner has executed the Agreement.

Day - A calendar day of twenty-four hours measured from midnight to the next midnight.

Drawings - The drawings which show the character and scope of work to be performed and which have been prepared or approved by Engineer and are referred to in the Contract Documents. Included with the plan sheet drawings are Atmos Energy drawings and standard details.

Field Order - A written order issued by Engineer to the Contractor which clarifies or interprets the Contract Documents or orders minor changes in the work without involving a change in the contract price or time.

Modification - (a) A written amendment of the Contract Documents signed by both parties, (b) a Change Order, (c) a written clarification or interpretation issued by Engineer, or (d) a written order for a minor change or alteration in the work issued by Engineer. A Modification may only be issued after execution of the Agreement.

Notice of Award - The written notice by Owner to the apparent successful bidder stating that upon compliance with the conditions precedent to be fulfilled by him within the time specified Owner will execute the Agreement with him.

Notice to Proceed - A written notice given by Owner to Contractor (with a copy to Engineer) fixing the date on which the contract time will commence to run and on which Contractor shall start to perform his obligations under the Contract Documents.

Owner - A public body or authority, corporation, association, partnership, or individual for whom the work is to be performed.

Project - The entire construction to be performed as provided in the Contract Documents.

Resident Project Representative - The authorized representative of Engineer who is assigned to the Project site or any part thereof.

Shop Drawings - All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by Contractor, a Subcontractor, manufacturer, supplier or distributor and which illustrate the equipment, material or some portion of the work.

Specifications - Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the work. Included by reference are Atmos Energy gas system construction standards and specifications.

Subcontractor - An individual, firm or corporation having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the work at the site.

Substantial Completion - The date as certified by Engineer when the construction of the project or a specified part thereof is sufficiently completed, in accordance with the Contract Documents, so that the project or specified part can be utilized for the purposes for which it was intended.

Work - Any and all obligations, duties and responsibilities necessary to the successful completion of the project assigned to or undertaken by Contractor under the Contract Documents, including all labor, materials, equipment and other incidentals, and the furnishing thereof.

Written Notice - A notice in writing to any party of the Agreement and considered delivered and the service thereof completed, when posted by certified or registered mail to said party at his last given address or delivered in person to said party or his authorized representative.

2. Execution, Correlation and Intent of Documents

At least six copies of the Agreement and such other Contract Documents as practicable will be executed and delivered to the Owner by the Contractor within ten days of the Notice of Award. Owner shall execute and deliver one counterpart to Contractor within ten days after receipt of the executed Agreement from Contractor. Engineer will identify those portions of the Contract Document not signed and such identification will be binding on all parties.

Contractor shall also deliver to Owner such Bonds as he may be required to furnish when he delivers the executed agreement to Owner.

It is the intent of the Specifications and Drawings to describe a complete project to be constructed in accordance with the Contract Documents. The Contract Documents comprise the entire Agreement between Owner and Contractor. They may be altered only by a modification.

The Contract Documents are complementary; what is called for by one is as binding as if called for by all. If Contractor finds a conflict, error or discrepancy in the Contract Documents, he shall call it to Engineer's

attention in writing at once and before proceeding with the work affected thereby; however, he shall not be liable to Owner or Engineer for his failure to discover any conflict, error or discrepancy in the Specifications or Drawings. In resolving such conflicts, errors and discrepancies, the documents shall be given precedence in the following order: Agreement, Modifications, Addenda, Special Conditions, Information for Bidders, General Conditions, Specifications and Drawings. Figure dimensions on Drawings shall govern over general Drawings. Any work that may reasonably be inferred from the Specifications or Drawings as being required to produce the intended result shall be supplied whether or not it is specifically called for. Work, materials or equipment described in words which so applied have a well-known technical or trade meaning shall be deemed to refer to such recognized standards.

3. Starting the Project

Before undertaking each part of the work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. He shall at once report in writing to Engineer any conflict, error or discrepancy which he may discover; however, he shall not be liable to Owner or Engineer for his failure to discover any conflict, error or discrepancy in the Drawings or Specifications.

Within ten days after delivery of the executed Agreement by Owner to Contractor, Contractor shall submit to Engineer for approval, an estimated progress schedule indicating the starting and completion dates to the various stages of the Work, and a preliminary schedule of Shop Drawing submissions.

Before starting the Work at the site, Contractor shall furnish Owner and Engineer certificates of insurance as required by Article 7. Within twenty days after delivery of the executed Agreement by Owner to Contractor, but before starting the work at the site, a conference will be held to review the above schedules to establish procedures for handling Shop Drawings and other submissions and for processing Applications for Payment, and to establish a working understanding between the parties as to the Project. Present at the conference will be Owner or his representative, Engineer, Resident Project Representative, Contractor and his Superintendent.

Contractor shall start to perform his obligations under the Contract Documents on the date when the Contract Time commences to run. No Work shall be done at the site prior to the date on which the contract time commences to run.

4. Contract Documents

Unless otherwise provided in the Special Conditions, the Owner or his representative will furnish the Contractor, free of charge, up to six copies of drawings and specifications and other Contract Documents. Additional copies shall be provided for the cost of reproduction.

5. Contractor's Pre-Start Representations

Contractor represents that he has familiarized himself with, and assumes full responsibility for having familiarized himself with, the nature and extent of the Contract Documents. Work, locality, and with all local conditions and federal, state and local laws, ordinances, rules and regulations that may in any manner affect performance of the work, and represents that he has correlated his study and observations with the requirements of the Contract Documents. Contractor also represents that he has studied all surveys and investigation reports of subsurface and latent physical conditions referred to in the Plans and Specifications and made such additional surveys and investigations as he deems necessary for the performance for the work at the Contract Price in accordance with the requirements of the Contract Documents and that he has correlated the results of all such data with the requirements of the Contract Documents.

6. Indemnity

The Contractor shall indemnify and hold harmless the Owner and the Engineer and their agents and employees from and against all claims, damages, losses and expenses including attorney's fees arising out of or resulting from the performance of the work, providing that any such claim, damage, loss or expense (a) is attributable to bodily injury, sickness, diseases or death, or to injury to or destruction of tangible property (other than the work itself) including the loss of use resulting therefrom and (b) is caused in whole or in part by any negligent act or omission of the Contractor and Subcontractor, anyone directly or indirectly employed by any of them or any one for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

In any and all claims against the Owner or the Engineer or any of their agents or employees by any employee of the Contractor, any Subcontractor, any one directly or indirectly employed by any of them or any one for whose acts any of them may be liable, the indemnification obligation under these General Conditions shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any Subcontractor under workmen's compensation acts, disability benefit acts or other employee benefit acts.

The obligations of the Contractor under these General Conditions shall not extend to the liability of the Engineer, his agents or employees arising out of (a) the preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, designs or specifications or (b) the giving of or the failure to give instructions or directions by the Engineer, his agents or employees provided such giving or failure to give is the primary cause of injury or damage.

7. Insurance

Contractor shall purchase and maintain such insurance as will protect him from claims under workmen's compensation laws, disability benefit laws or other similar employee benefit laws; from claims for damages because of bodily injury, occupational sickness or disease, or death of his employees, and claims insured by usual personal injury liability coverage; from claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees including claims insured by usual personal injury liability coverage; and from claims for injury to or destruction of tangible property, including loss of use resulting therefrom -- any or all of which arise out of or result from Contractor's operations under the Contract Documents, whether such operations be by himself or by any Subcontractor or anyone directly or indirectly employed by any of them or for whose acts any of them may be legally liable. This insurance shall include the specific coverages and be written for not less than any limits of liability and maximum deductibles specified in the Special Conditions or required by law, whichever is greater, shall include contractual liability insurance and shall include Owner and Engineer as additional insured parties. Before starting the Work, Contractor shall file with Owner and Engineer certificates of such insurance, acceptable to Owner; these certificates shall contain a provision that the coverage afforded under the policies will not be canceled or materially changed until at least fifteen days' prior written notice has been given to Owner and Engineer.

The Contractor shall procure and maintain, at his own expense, during the contract time, liability insurance as hereinafter specified; and in the amounts listed in the Special Conditions.

- a. Compensation Insurance - The Contractor shall take out and maintain during the life of this contract Workmen's Compensation Insurance for all of his employees employed at the site of the project, and, in case any work is sublet, the Contractor shall require the subcontractor similarly to provide Workmen's Compensation Insurance for all of the latter's employees unless such employees are covered by the protection afforded by the Contractor.
- b. Public Liability and Property Damage Insurance - The Contractor shall take out and maintain during the life of this contract such Public Liability and Property Damage Insurance as shall protect him and any subcontractor performing work covered by this contract, from claims for

damages for personal injury, including accidental death, as well as for claims for property damages which may arise from operations under this contract, whether such operations be by himself or by any subcontractor or by anyone directly or indirectly employed by either of them. The insurance will include as additional named insured: the Owner and Engineer and his Consultants; and each of their officers, agents and employees.

- c. Contingent Public Liability and Property Damage Insurance - If any subcontracts are awarded, subparagraph "b" above shall be interpreted to require that the General Contractor shall take out and maintain Contractor's contingent public liability and property damage insurance in the amounts required under the "Special Conditions".
- d. Builder's Risk Insurance or Installation Floater - The Contractor shall provide "All Risk" type Builder's Risk Insurance including coverage for fire, lightning, explosion, wind, hail, riot, aircraft, smoke, collapse, extended coverage, vandalism and malicious mischief. Unless specifically authorized by the Owner, the amount of such insurance shall not be less than the contract price totaled in the bid. Deductible amount shall not exceed \$250.

In case of pipeline contracts, this coverage shall be provided by an installation floater for the full cash value of materials and accessories on hand to be used in conjunction with the project. Coverage shall include insuring against transportation loss or damage. The policy shall name as the insured the Contractor, the Engineer and the Owner.

- e. Railroad Protective Liability Insurance - Where work on railroad rights-of-way is involved, the Contractor shall also be covered by Railroad Protective Liability Insurance with limits of liability as required by the railroad company on whose property the work is being performed.
- f. Flood Hazard Insurance - The Contractor will be required to acquire and maintain during the life of the Contract any flood insurance made available under the National Flood Insurance Act of 1968, as amended. The insurance shall be in an amount at least equal to the contract amount costs excluding cost of uninsurable improvements, or to the maximum limit of coverage made available under the National Flood Insurance Act of 1968, as amended, whichever is less.

8. Guaranty Bond

Contractor shall furnish performance and payment bond as security for the faithful performance and payment of all his obligations under the Contract Documents. These Bonds shall be in amounts at least equal to the contract price, and (except as otherwise provided in the Supplementary Conditions) in such form and with such sureties as are licensed to conduct business in the state where the project is located and are named in the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Federal Register by the Audit Staff Bureau of Accounts, U.S. Treasury Department.

If the surety on any Bond furnished by Contractor is declared a bankrupt or becomes insolvent or its rights to do business is terminated in any state where any part of the Project is located is revoked, Contractor shall within five days thereafter substitute another Bond and Surety, both of which shall be acceptable to Owner.

9. Additional Bonds and Insurance

Prior to delivery of the executed Agreement by Owner to Contractor, Owner may require Contractor to furnish such other Bonds and such additional insurance, in such form and with such sureties or insurers as Owner may require. If such other Bonds or such other insurance are specified by written instructions given prior to opening of bids, the premiums shall be paid by Contractor: if subsequent thereto, they shall be paid by Owner (except as otherwise provided in Article 15.)

10. Availability of Lands

Prior to issuance of Notice to Proceed, the Owner shall obtain all land and rights-of-way necessary for carrying out and for the completion of the work to be performed pursuant to the Contract Documents, unless otherwise mutually agreed.

The Owner shall provide the Contractor information which delineates and describes the land owned and rights-of-way acquired.

The Contractor shall provide at his own expense and without liability to the Owner any additional land and access thereto that the Contractor may desire for temporary construction facilities, or for storage of materials.

11. Unforeseen Physical Conditions

Contractor shall promptly notify Owner and Engineer in writing of any subsurface or latent physical conditions at the site differing materially from those indicated in the Contract Documents. Engineer will promptly investigate those conditions and advise Owner in writing if further surveys or subsurface test are necessary. Promptly thereafter, Owner shall obtain the necessary additional surveys and tests and furnish copies to Engineer and Contractor. If Engineer finds that the results of such surveys or test indicate that there are subsurface or latent physical conditions which differ materially from those intended in the Contract Documents, and which could not reasonably have been anticipated by Contractor, a Change Order shall be issued incorporating the necessary revisions.

12. Reference Points

Owner shall provide engineering surveys for construction to establish reference points which in his judgment are necessary to enable Contractor to proceed with the work. Contractor shall be responsible for surveying and laying out the work (unless otherwise provided in the Special Conditions), and shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of Owner. He shall report to Engineer whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or location. Contractor shall replace and accurately relocate all reference points so lost, destroyed or moved.

13. Superintendence - Supervision

The Contractor shall keep on his work, during its progress, a competent Superintendent and any necessary assistants, all satisfactory to the Engineer. The Superintendent shall not be changed without written notice to the Owner and Engineer except under extraordinary circumstances. The Superintendent shall represent the Contractor in his absence and all directions given to him shall be as binding as if given to the Contractor.

The Contractor shall give efficient supervision to the Work, using his best skill and attention. He shall be solely responsible for the means, methods, techniques, sequences and procedures of construction, but he shall not be solely responsible for the negligence of others in the design or selection of a specific means, method, technique, sequence or procedure of construction which is indicated in and required by the Contract Documents. Contractor shall be responsible to see that the finished Work complies accurately with the Contract Documents.

The Contractor shall see that for his own Work and for the Work of each subcontractor, proper templates and patterns necessary for the coordination of the various parts of the Work are prepared, and shall furnish, or require subcontractors to fit together and execute fully their respective portions of the Work.

14. Materials, Appliances, Employees

The Contractor shall provide and pay for all materials, labor, water tools, appliances, fuel, heat, sanitary facilities, equipment, light, power, telephone, transportation and other facilities necessary for the execution, testing, initial operation and completion of the Work.

Approval of manufacturer's Shop Drawings of materials and equipment shall not mean final acceptance, but they shall be subject to inspection and test or delivery and installation. The Contractor shall repair, replace, or adjust any materials or equipment found defective or not operating properly, due to improper materials, workmanship, and adjustment on his part, during the correction period.

Materials and equipment shall be so stored as to insure the preservation of their quality and fitness for the work. Stored materials and equipment to be incorporated in the work shall be located so as to facilitate prompt inspection.

Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directly by the manufacturer.

The Contractor shall provide competent, suitably qualified personnel to survey and lay out the work and perform construction as required by the Contract Documents. The Contractor shall at all times enforce strict discipline and good order among his employees, and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him.

15. Substitute Materials or Equipment

Wherever the words "or equal", appear in the Specifications or on the Drawings, they shall be interpreted to mean an item of material or equipment equal in quality to that named and which is suited to the same use and capable of performing the same function as that named.

The burden of proof of equal quality or service shall be on the Contractor. Proof of inequality is not implied by the Specifications and is not a burden of the Engineer. His duty shall be to properly weigh the proven facts of equality in fairness to all parties involved.

Inclusion of a certain make or type of materials or equipment in Contractor's bid or estimate shall not obligate the Owner to accept such material or equipment if it does not meet the requirements of the Plans and Specifications.

If the Contract, Specifications, law, ordinance or applicable rules or regulations permit Contractor to furnish or use a substitute that is equal to any material or equipment specified, and if Contractor wishes to furnish or use a proposed substitute, he shall prior to 30 days before such substitute is required make written application to Engineer for approval of such a substitute certifying in writing that the proposed substitute will perform adequately the functions called for by the general design, be similar and of equal substance to that specified and be suited to the same use and capable of performing the same function as that specified; stating whether or not its incorporation in or use in connection with the project is subject to the payment of any license fee or royalty; and identifying all variations of the proposed substitute from that specified and indicating available maintenance service. No substitute shall be ordered or installed without the written approval of Engineer who will be the judge of equality and may require Contractor to furnish such other data about the proposed substitute as he considers pertinent. No substitute shall be ordered or installed without such performance guarantee and bonds as Owner may require which shall be furnished at Contractor's expense.

In case where one or more specified brands, makes or manufacturers are named and these names are not qualified by the "or equal" clause, it is intended that the Contractor be restricted to one of those named unless otherwise set out.

16. Subcontracts

Contractor shall not employ any Subcontractor or other person or organization (including those who are to furnish the principal items of materials or equipment), whether initially or as a substitute, against whom Owner or Engineer may have reasonable objection.

The Contractor will not be permitted to sublet any portion of his contract to any individual, co-partnership or corporation without the prior written consent of the Owner and the approval of the Engineer.

The Contractor shall not sublet more than fifty percent (50%) of the work without the written consent of the Owner and approval of the Engineer prior to the receipt of bids.

Contractor shall be fully responsible for all acts and omissions of his Subcontractor and of persons and organizations directly or indirectly employed by them and of persons and organizations for whose acts any of them may be liable to the same extent that he is responsible for the acts and omissions of persons directly employed by him. Nothing in the Contract Documents shall create contractual relationship between Owner or Engineer and any Subcontractor or other person or organization having a direct contract with Contractor, nor shall it create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any Subcontractor or other persons or organization, except as may otherwise be required by law. Owner or Engineer may furnish to any Subcontractor or other person or organization, to the extent practicable, evidence of amounts paid to Contractor on account of specific Work done in accordance with the schedule of values.

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

Contractor agrees to bind specifically every Subcontractor to the applicable terms and conditions of the Contract Documents for the benefit of Owner.

All work performed for Contractor by a Subcontractor shall be pursuant to an appropriate agreement between Contractor and the Subcontractor which shall contain provisions that waive all rights the contracting parties may have against one another for damages caused by fire or other perils covered by insurance provided in accordance with Article 7, except such rights as they may have to the proceeds of such insurance held by Owner as trustee.

17. Patent Fees and Royalties

Contractor shall pay all license fees and royalties and assume all costs incidental to the use in the performance of 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. Contractor shall indemnify and hold harmless Owner and Engineer and anyone directly or indirectly employed by either of them from and against all claims, damages, losses and expenses (including attorney's fees) arising out of any infringement of patent rights or copyrights incidental 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, and shall defend all such claims in connection with any alleged infringement of such rights.

18. Permits, Laws and Regulations

Contractor shall obtain and pay for all construction permits and licenses and shall pay all governmental charges and inspection fees necessary for the prosecution of the Work, which are applicable at the time of

his bid. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall also pay all public utility charges.

Contractor shall give all notices and comply with all laws, ordinances, rules and regulations applicable to the Work. If Contractor observes that the specifications or drawings are at variance therewith, he shall give the Engineer prompt written notice thereof, and any necessary changes shall be adjusted by an appropriate modification. If Contractor performs any Work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to Engineer, he shall bear all costs arising therefrom; however, it shall not be his primary responsibility to make certain that the Specifications and Drawings are in accordance with such laws, ordinances, rules and regulations.

19. Taxes

Contractor shall pay all sales, consumer use and other similar taxes required to be paid by him in accordance with the law of the place where the Work is to be performed.

20. Safety and Protection

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

- a. All employees on the Work and other persons who may be affected thereby.
- b. All the Work and all materials or equipment to be incorporated therein, whether in storage on or off the site.
- c. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

The Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. He shall erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for its safety and protection. He shall notify owners of adjacent utilities when prosecution of the work may affect them. All damage, injury or loss to any property caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor or anyone directly or indirectly employed by any of them 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 Owner or Engineer or anyone employed by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor. Contractor's duties and responsibilities for the safety and 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 that the Work is acceptable.

Contractor shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This person shall be Contractor's Superintendent unless otherwise designated in writing by Contractor to Owner

In emergencies affecting the safety of persons or the Work or property at the site or adjacent thereto, Contractor, without special instruction or authorization from Engineer or Owner, is obligated to act, at his discretion, to prevent threatened damage, injury or loss. He shall give Engineer prompt written notice of injury or loss. He shall give Engineer prompt written notice of any significant changes in the Work or deviations from the Contract Documents caused thereby, and Change Order shall thereupon be issued covering the changes and deviations involved. If Contractor believes that additional Work done by him in an emergency which arose from causes beyond his control entitles him to an increase in the Contract

Price or an extension of the Contract Time, he may make a claim therefor as provided in these Specifications.

21. Shop Drawings and Samples

After checking and verifying all field measurements, the Contractor shall submit with such promptness as to cause no delay in the Work two (2) copies of all Shop Drawings and schedules required for the Work, and the Engineer will pass upon them with reasonable promptness, making necessary corrections. The Contractor shall then revise the drawings as required by the Engineer and file with him five (5) corrected copies for final approval (or one (1) reproducible copy).

Drawings shall have been checked by and stamped with the approval of Contractor and identified as Engineer may require. The data shown on the Shop Drawings will be complete with respect to dimensions, design criteria, materials of construction and the like to enable Engineer to review the information as required.

The Contractor shall also submit to Engineer for approval with such promptness as to cause no delay in work, all samples required by the Contract Documents. All samples will have been checked by and stamped with the approval of Contractor, identified clearly as to material, manufacturer, any pertinent catalog numbers and the use for which intended.

At the time of each submission, Contractor shall in writing call Engineer's attention to any deviations that the Shop Drawings or sample may have from the requirement of the Contract Documents.

The Engineer will review and approve with reasonable promptness Shop Drawings and samples, but his review and approval shall be only for conformance with the design concept of the project and for compliance with the information given in the Contract Documents. The approval of a separate item as such will not indicate approval of the assembly in which the item functions. Contractor shall make any corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and resubmit new samples until approved. Contractor shall direct specific attention in writing or on resubmitted Shop Drawings to revisions other than the corrections called for by Engineer on previous submissions. Contractor's stamp of approval on any Shop Drawing or sample shall constitute a representation to Owner and Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or he assumes full responsibility for doing so, and that he has reviewed or coordinated each Shop Drawing or sample with therequirements of the Work and the Contract Documents.

Where a Shop Drawing or sample submission is required by the Specifications, no related Work shall be commenced until the submission has been approved by Engineer. A copy of each approved Shop Drawing and each approved sample shall be kept in good order by Contractor at the site and shall be available to Engineer.

The following items of Work and other such items as required shall have Shop Drawings submitted:

- a. All concrete reinforcement, water stops, pre cast concrete and location of construction joints.
- b. Structural steel, miscellaneous metal and fencing.
- c. Windows and doors.
- d. Piping layouts, including small piping layouts.
- e. Mechanical equipment.
- f. Pumps and related equipment, including pump control equipment.

- g. Building service equipment.
- h. Control and instrumentation, metering equipment.
- i. Electrical equipment and wiring diagrams.
- j. Plumbing, heating, ventilating and air conditioning equipment.

No fabrication, erection, installation or construction shall commence until drawings and details have been approved by the Engineer.

Engineer's approval of Shop Drawings or samples shall not relieve the Contractor from his responsibility for any deviations from the requirements of the Contract Documents unless Contractor has in writing called Engineer's attention to such deviation at the time of submission and Engineer has given written approval to the specific deviation, nor shall any approval by Engineer relieve Contractor from responsibility for errors or omissions in the Shop Drawings.

22. Record Drawings

The Contractor shall keep an accurate record of the location, size, and material for all piping, both interior and exterior, concealed and exposed; size and routing of conduits, size and location of pull boxes and number and size of conductors installed therein; and changes in equipment dimensions, structural openings, foundations and any other variations between the Work actually provided and that shown on the Contract Drawings. The representation of such variations shall conform to standard drafting practices and shall include such supplementary notes, legends and details as may be necessary for legibility and clear portrayal of the as-built construction. Upon completion, the Contractor shall have these drawings and records certified as to their completeness and correctness by the Resident Inspector and deliver them to the Engineer for incorporation into the tracings. Final As-Built alignment, invert elevations and locations including the location of service connections for water and sewer lines are to be supplied by the Contractor.

As-Built information shall be provided monthly to the Engineer and submitted with the partial pay request.

23. Use of Premises

The Contractor shall confine his apparatus, the storage of materials and the operation of his workmen to limits indicated by law, ordinances, permits or direction of the resident Engineer and shall not unreasonably encumber the premises with his materials.

The Contractor shall not load or permit any part of any structure to be loaded with weights that will endanger the structure, nor shall he subject any part of the Work to stresses or pressures that will endanger it.

The Contractor shall enforce all applicable regulations and any additional requirements of the Owner regarding signs, advertisements, fires and smoking.

24. Cleaning

Contractor shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work, and at the completion of the Work he shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, construction equipment and machinery, and surplus materials, and shall leave the site clean and ready for occupancy by Owner. Contractor shall restore to their original condition those portions of the site not designated for alteration by the Contract Documents.

25. Work By Others

The Owner reserves the right to perform additional work related to the project by himself or to let other contracts in connection with the Work. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work, and shall properly connect and coordinate his work with theirs.

If any part of the Contractor's Work depends on proper execution or results upon the Work of any other Contractor, the Contractor shall inspect and promptly report to the Engineer any defects in such Work that render it unsuitable for such proper execution and results. His failure to inspect and report shall constitute an acceptance of the other Contractor's Work as fit and proper for the reception of his Work, except as to defect which may develop in the other Contractor's Work after the execution of his Work.

To ensure the proper execution of this subsequent Work, the Contractor shall measure Work already in place and shall at once report to the Engineer any discrepancy between the executed Work and the Drawings.

Whenever Work being done by the Owner's forces or by other Contractors is contiguous to Work covered by this Contract, the respective rights of the various interest involved shall be established by the Engineer, to secure the completion of the various portion of the Work in general harmony.

The Contractor shall do all cutting, fitting and patching of his Work that may be required to make its several parts come together properly and fit it to receive or be received by 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 of the other Contractors whose Work will be affected.

If the performance of additional Work by other Contractors or Owner is not noted in the Contract Documents prior to the execution of the contract, written notice thereof shall be given to Contractor prior to starting any such additional Work. If Contractor believes that the performance of such additional Work by Owner or others involves him in additional expense or entitles him to an extension of the Contract Time, he may make a claim thereof as provided in these Specifications.

26. Engineer's Status During Construction

The Engineer will be the Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of the Engineer as Owner's representative during construction as defined in these General Conditions shall not be extended without written consent of the Owner and the Engineer.

The Engineer will make periodic visits to the site to observe the progress and quality of the executed Work and to determine, in general, if the Work is proceeding in accordance with the Contract Documents. He will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. His efforts will be directed toward providing assurance for Owner that the completed project will conform to the requirements as an experienced and qualified design professional, he will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defects and deficiencies in the Work of Contractors.

The Engineer will issue with reasonable promptness such written clarifications or interpretations of the Contract Documents (in the form of Drawings or otherwise) as he may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents. If Contractor believes that a written clarification and interpretation entitles him to an increase in the Contract Price, he may make claim therefore, as provided in these Specifications.

The Engineer will have authority to disapprove or reject Work which is "defective" (which term is hereinafter used to describe Work that is unsatisfactory, faulty or defective, or does not conform to the requirements of the Contract Documents or does not meet the requirements of any inspection, test or approval referred to in these Specifications or has been damaged prior to approval of final payment.) He will also have authority to require special inspection or testing of the Work as provided in these specifications whether or not the Work is fabricated, installed or completed.

The Engineer is responsible for review and approval of Shop Drawings and samples in accordance with Article 21 of these General Conditions.

The Engineer has responsibilities for preparation of Change Orders for execution by the Owner in accordance with Article 29 of these General Conditions.

In accordance with Article 27 of these General Conditions, the Engineer shall decide claims of the Owner or Contractors and interpret the Contract Documents.

The Engineer shall faithfully discharge his responsibilities with regard to Applications for Payment as described in Articles 42, 43, 44 and 46 of these General Conditions.

If Owner and Engineer agree, the Engineer will furnish a Resident Project Representative and/or inspector to assist the Engineer in carrying out his responsibilities at the site. The duties, responsibilities and authority of any such representative shall be as set forth in Article 28 of these General Conditions.

Neither Engineer's authority to act under this Article 26 or elsewhere in the Contract Documents nor any decision made by him in good faith either to exercise or not exercise such authority shall give rise to any duty or responsibility of Engineer to Contractor, any Subcontractor, any material man, fabricator, supplier, or any of their agents or employees or any other person performing any of the work.

The Engineer will not be responsible for Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, and he will not be responsible for Contractor's failure to perform the work in accordance with the Contract Documents.

The Engineer will not be responsible for the acts or omissions of Contractor, or any Subcontractors, or any of his or their agents or employees, or any other persons at the site or otherwise performing any of the work.

27. Engineer's Decision on Disagreements

Engineer will be the interpreter of the requirements of the Contract Documents and the judge of the performance thereunder. In his capacity as interpreter and judge, he will exercise his best efforts to insure faithful performance by both Owner and Contractor. He will not show partiality to either and will not be liable for the result of any interpretation or decision rendered in good faith. Claims, disputes and other matters relating to the execution and progress of the work or the interpretation of or performance under the Contract Documents shall be referred to Engineer for decision; which he will render in writing within a reasonable time.

Either Owner or Contractor may request arbitration with respect to any such claim, dispute or other matter that has been referred to Engineer, except any which have been waived by the making or acceptance of final payment as provided in Article 46, such arbitration to be in accordance with Article 50. However, no request for arbitration of any such claim, dispute or other matter shall be made until the earlier of (a) the date on which Engineer has rendered his decision, or (b) the tenth day after parties have presented their evidence to Engineer if he has not rendered his written decision before that date. No request for arbitration shall be made later than thirty days after the date on which Engineer rendered his written decision in respect of the claim, dispute or other matter as to which arbitration is sought; and the failure to request arbitration within said thirty days' period shall result in Engineer's decision being final and binding upon Owner and Contractor. If Engineer renders a decision after arbitration proceedings have been

initiated, such decision may be entered as evidence but shall not supersede the arbitration proceedings, except where the decision is acceptable to the parties concerned.

28. Status of Engineer's Project Representative

Resident Project Representative is Engineer's Agent and shall act as directed by and under the supervision of Engineer. He shall confer with Engineer regarding his actions. His dealings in matters pertaining to the on-site work will in general be only with Engineer and Contractor. His dealings with Subcontractors will only be through or with the full knowledge of Contractor or his Superintendent. He shall generally communicate with Owner only through or as directed by Engineer.

Resident Project Representative shall:

- a. Schedules: Review the progress schedule, schedule of Shop Drawing submissions, schedule of values and other schedules prepared by Contractor and consult with Engineer concerning their acceptability.
- b. Conferences: Attend pre construction conferences. Arrange a schedule of progress meetings and other job conferences as required in consultation with Engineer and notify in advance those expected to attend. Attend meetings, and maintain and circulate copies of minutes thereof.
- c. Liaison:
 1. Serve as Engineer's liaison with Contractor working principally through Contractor's Superintendent and assist him in understanding the intent of the Contract Documents. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-site operations.
 2. As requested by Engineer, assist in obtaining from Owner additional details or information, when required at the job site for proper execution of the work.
 3. In the interest of preserving the proper channels of communication, advise Engineer of any direct communication between Owner and Contractor.
- d. Shop Drawings and Samples:
 1. Receive and record date of receipt of Shop Drawings and samples which have been approved by Engineer.
 2. Receive samples which are furnished at the site by Contractor for Engineer's approval, and notify Engineer of their availability for examination.
 3. Advise Engineer and Contractor or his Superintendent immediately of the commencement of any Work requiring a Shop Drawing or sample submission if the submission has not been approved by Engineer.
- e. Review of Work, Rejection of Defective Work, Inspections and Tests:
 1. Conduct on-site observations of the Work in progress to assist Engineer in determining that the project is proceeding in accordance with the Contract Documents and that completed Work will conform to the Contract Documents.
 2. Report to Engineer whenever he believes that any Work is unsatisfactory, faulty or defective or does not conform to the Contract Documents, or has been damaged, or does not meet the requirements of any inspections, tests or approvals required to be made;

and advise Engineer when he believes Work should be corrected or rejected or should be uncovered for observation, or requires special testing or inspection.

3. Verify that tests, equipment and system's startups and operating and maintenance instructions are conducted as required by the Contract Documents and in presence of the required personnel, and that Contractor maintains adequate records thereof; observe, record and report to Engineer appropriate details relative to the test procedures and startups.
 4. Accompany Owner and visiting inspectors representing public or other agencies having jurisdiction over the Project, record the outcome of these inspections and report to Engineer.
- f. Interpretation of Contract Documents: Transmit to Contractor clarification and interpretation of the Contract Documents as issued by Engineer.
- g. Modifications: Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report them with recommendations to Engineer.
- h. Records:
1. Maintain at the job site orderly files for correspondence, reports of job conferences, Shop Drawings and sample submissions, reproductions of original Contract Documents including all addenda, change orders, field orders, additional Drawings issued subsequent to the execution of the Contract, Engineer's clarifications and interpretations of the Contract Documents, progress reports and other project-related documents.
 2. Keep a diary or log book, recording hours on the job site, weather conditions, data relative to questions of extras or deductions, list of principal visitors, daily activities, decisions, observations in general and specific observations in more detail as in the case of observing test procedures. Send Copies to Engineer.
 3. Record names, address and telephone numbers of all Contractors, Subcontractors and major suppliers of equipment and materials.
 4. Advise Engineer whenever Contractor is not currently maintaining an up-to-date copy of Record Drawings at the site.
- i. Reports:
1. Furnish Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the approved progress schedule, schedule of Shop Drawing submissions and other schedules.
 2. Consult with Engineer in advance of scheduled major tests, inspections or start of important phases of the Work.
- j. Payment Requisitions: Review Applications for Payment with Contractor for compliance with the established procedure for their submission and forward them with recommendations to Engineer, noting particularly their relation to the schedule of values, Work completed and materials and equipment delivered at the site.
- k. Guarantees, Certificates, Maintenance and Operation Manuals: During the course of the Work verify that guarantees, certificates, maintenance and operation manuals and other data required to be assembled and furnished by Contractor are applicable to the items actually installed and

deliver these data to Engineer for his review and forwarding to Owner prior to final acceptance of the Project.

I. Completion:

1. Before Engineer issues a Certificate of Substantial Completion, submit to Contractor a list of observed items requiring correction.
2. Conduct final inspection in the company of Engineer, Owner and Contractor and prepare a final list of items to be corrected.
3. Verify that all items on final list have been corrected and make recommendations to Engineer concerning acceptance.

Except upon written instructions of Engineer, Resident Project Representative:

- a. Shall not authorize any deviation from the Contract Documents or approve any substitute materials or equipment.
- b. Shall not undertake any of the responsibilities of Contractor, Subcontractor or Contractor's Superintendent.
- c. Shall not expedite Work for the Contractor.
- d. Shall not advise on or issue directions relative to any aspect of the means, methods, techniques, sequences or procedures of construction unless such is specifically called for in the Contract Documents.
- e. Shall not advise on or issue directions as to safety precautions and programs in connection with the Work.
- f. Shall not authorize Owner to occupy the Project in whole or in part.
- g. Shall not participate in specialized field or laboratory tests or inspections conducted by others.
- h. Shall not assist Contractor in maintaining up-to-date copy of Record Drawings.

29. Changes in the Work

Without invalidating the Agreement, Owner may, at any time or from time to time, order additions, deletions or revisions in the Work; these will be authorized by Change Orders. Upon receipt of a Change Order, Contractor shall proceed with the Work involved. All such Work shall be executed under the applicable conditions of the Contract Documents. If any Change Order causes an increase or decrease in the Contract Price or an extension or shortening of the Contract Time, an equitable adjustment will be made as provided in Article 30 on the basis of a claim made by either party.

Engineer may authorize minor changes or alterations in the Work not involving extra cost and not inconsistent with the overall intent of the Contract Documents. These may be accomplished by a Field Order. If Contractor believes that any minor change or alteration authorized by Engineer entitles him to an increase in the Contract Price, he may make a claim therefore, as provided in Article 30.

Additional work performed by Contractor without authorization of a Change Order will not entitle him to an increase in the Contract Sum or an extension of the Contract Time, except in the case of an emergency as provided in Article 20.

Owner shall execute appropriate Change Orders prepared by Engineer covering changes in the Work to be performed, work performed in an emergency and any other claim of the Contractor for a change in the Contract Time or the Contract Sum which is approved by the Engineer.

It is the Contractor's responsibility to notify his surety of any changes affecting the general scope of the Work or change in the Contract Sum and the amount of the applicable bonds shall be adjusted accordingly. Contractor shall furnish proof of such adjustment to Owner.

30. Changes of Contract Price

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

The Contract Price may only be changed by a Change Order. Any claim for an increase in the Contract Price shall be based on written notice delivered to Owner and Engineer within fifteen days of the occurrence of the event giving rise to the claim. Notice of the amount of the claim with supporting data shall be delivered within forty-seven days of such occurrence unless Engineer allows an additional period of time to ascertain accurate cost data. All claims for adjustment in the Contract Price shall be determined by Engineer if Owner and Contractor cannot otherwise agree on the amount involved. Any change in the Contract Price resulting from any such claim shall be incorporated in a Change Order.

The value of any Work covered by a Change Order shall be determined in one or more of the following ways:

- a. By estimate and mutual acceptance in a lump sum.
- b. By unit prices named in the Contract or subsequently agreed upon.
- c. On the basis of the cost of the Work plus a Contractor's fee for overhead and profit as provided in this Article.

In Case "c", the Contractor shall keep and present in such form as the Engineer may direct, a correct account of all items comprising the net cost of such work, together with vouchers. The determination of the Engineer shall be final upon all questions of the amount and cost of extra work and changes in the work.

The term Cost of the Work means the sum of all costs necessarily incurred and paid by the Contractor in the proper performance of the Work. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items and shall not include any of the costs itemized in paragraph 30.6.

30.1 Payroll cost for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to salaries and wages plus the cost of fringe benefits which shall include social security contributions, unemployment, excise and payroll taxes, workmen's compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. Such employees shall include superintendents and foreman at the site. The expenses of performing work after regular working hours, on Sunday or legal holidays shall be included in the above to the extent authorized by Owner.

30.2 Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and manufacturer's field service required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and

refunds, and all returns from sale of surplus materials and equipment shall accrue to Owner and Contractor shall make provisions so that they may be obtained.

30.3 Payments made by Contractor to the Subcontractors for work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from Subcontractors acceptable to him and shall deliver such bids to Owner who will then determine with the advice of Engineer, which bids will be accepted. If a subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work, plus a Fee, the Cost of the Work shall be determined in accordance with paragraphs 30.4 and 30.5. All subcontracts shall be subject to the other provisions of the Contract Documents insofar as applicable.

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

30.5 Supplemental costs including the following:

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

Costs, 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 workmen, 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.

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 (shall not exceed 100 miles), loading, unloading, installation, dismantling and removing thereof ; all in accordance with terms of said rental agreements. The rental of any such equipment, machinery or parts shall cease when the use thereof is no longer necessary for the Work.

Sales, use or similar taxes related to the Work, and for which Contractor is liable, imposed by any governmental authority.

Deposits lost for causes other than Contractor's negligence, royalty payments and fees for permits and licenses.

Losses, damages and expenses, not compensated by insurance or otherwise, sustained by Contractor in connection with the execution of, and to, the Work, provided they have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's Fee. If, however, any such loss or damage requires reconstruction and Contractor is placed in charge thereof, he shall be paid for his services a fee proportionate to that stated in paragraph 30.6.

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

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

Cost of premiums for bonds and insurance which Owner is required to pay.

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

Payroll costs and other compensation of Contractor's officers, executives, principals (of partnership and sole proprietorships), general managers, engineers, architects, estimators, lawyers, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks and other personnel employed by

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Contractor whether at the site or in his principal or a branch office for general administration of the work and not specifically included in the schedule referred to in subparagraph 30.1 -- all of which are to be considered administrative costs covered by the Contractor's Fee.

Expenses of Contractor's principal and branch offices other than his office at the site.

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

Cost of premiums for all bonds and for all insurance policies whether or not Contractor is required by the Contract Documents to purchase and maintain the same (except as otherwise provided in subparagraph 30.5).

Cost 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.

Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraphs 30.1 - 30.5.

30.7 The Contractor's Fee which shall be allowed to Contractor for his overhead and profit shall be determined as follows:

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

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

- a. For costs incurred under paragraph 30.1 and 30.2, the Contractor's Fee shall be ten (10%) percent.
- b. For costs incurred under paragraph 30.3, the Contractor's Fee shall be five (5%) percent; and if a subcontract is on the basis of Cost Plus a Fee, the maximum allowable to the subcontractor as a fee for overhead and profit shall be ten (10%) percent.
- c. No fee shall be payable on the basis of costs itemized under paragraph 30.4, 30.5 and 30.6.

The amount of credit to be allowed by Contractor to Owner for any such change which results in a new decrease in cost will be the amount of the actual net decrease. When both additions and credits are involved in any one change, the combined overhead and profit shall be figured on the basis of the net increase, if any.

Whenever the cost of any work is to be determined pursuant to Article 30, Contractor will submit in form prescribed by the Engineer an itemized cost breakdown together with supporting data.

In all cases where Extra Work or Changes are covered by unit prices set forth in the Contract, the value of such Extra Work or Changes shall be determined only upon the basis of such unit prices.

Pending final determination of value, payments on accounts of Extra Work or Changes shall be made only upon the estimate of the Engineer.

30.8 All Change Orders to the construction contract (if required) must be negotiated pursuant to 40 CFR 35.938.5.

31. Cash Allowance

The Contractor shall include in the contract sum all allowances named in the Contract Documents and shall cause the Work so covered to be done by such Contractors and for such sums as the Engineer may direct, the contract sum being adjusted in conformity therewith. The Contractor declares that the contract sum includes such sums for expenses and profit on account of cash allowance as he deems proper. No demand for expense or profit other than those included in the contract sum shall be allowed.

32. Delays and Extension of Time

The Contract Time may only be changed by a Change Order. Any claim for an extension in the Contract Time shall be based on written notice delivered to Owner and Engineer within fifteen (15) days of the occurrence of the event giving rise to the claim. Notice of the extent of the claim with supporting data shall be delivered within forty-five (45) days of such occurrence unless Engineer allows an additional period of time to ascertain more accurate data. All claims for adjustment in the Contract Time shall be determined by Engineer if Owner and Contractor cannot otherwise agree. Any change in the Contract Time resulting from any such claim shall be incorporated in a Change Order.

The Contract Time will be extended in an amount equal to time lost due to delays beyond the control of Contractor if he makes a claim therefore as provided in this Article. Such delays shall include, but not be restricted to, acts or neglect by any separate Contractor employed by Owner, fires, floods, labor disputes, epidemics, abnormal weather conditions, or acts of God.

All time limits stated in the Contract Documents are of the essence of the Agreement. The provisions of this Article shall not exclude recovery for damages (including compensation for additional professional services) for delay by either party.

33. Warranty and Guarantee

Contractor warrants and guarantees to Owner and Engineer that all materials and equipment will be new unless otherwise specified and that all work will be of good quality and free from faults or defects and in accordance with the requirements of the Contract Documents and of any inspections, tests or approval referred to in Article 34. All unsatisfactory Work, all faulty or defective Work, and all Work not conforming to the requirements of the Contract Documents at the time of acceptance thereof or of such inspection, tests or approvals, shall be considered defective. Prompt notice of all defects shall be given to Contractor. All defective Work, whether or not in place, may be rejected, corrected or accepted as provided in these Contract Documents.

34. Tests and Inspections

If the Contract Documents, Laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any Work to specifically be inspected, tested, or approved by some public body, Contractor shall assume full responsibility therefor, pay all costs in connection therewith and furnish Engineer the required certificates of inspection, testing or approval. All other inspections, tests and approvals required by the Contract Documents shall be performed by organizations acceptable to Owner and Contractor and the costs thereof shall be borne by Owner unless otherwise specified.

The Contractor shall give Engineer timely notice of readiness of the Work for all inspections, tests or approvals. If such Work required so to be inspected, tested or approved is covered without written approval of Engineer, it must, if requested by Engineer, be uncovered for observation, and such uncovering shall be at Contractor's expense unless Contractor has given Engineer timely notice of his intention to cover such Work and Engineer has not acted with reasonable promptness in response to such notice.

Neither observations by Engineer nor inspections, tests or approvals by persons other than Contractor shall relieve Contractor from his obligations to perform the Work in accordance with the requirements of the Contract Documents.

35. Access to Work

Engineer and his representatives and other representatives of Owner will at reasonable times have access to the work. Contractor shall provide proper and safe facilities for such access and observation of the Work and also for any inspection or testing thereof by others.

36. Uncovering Work

If any Work should be covered contrary to the written request of the Engineer, it must, if required by the Engineer be uncovered for examination and replace at the Contractor's expense.

If any Work has been covered which Engineer has not specifically requested to observe prior to its being covered, or if Engineer considers it necessary or advisable that covered Work be 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. If it is found that such Work is defective, Contractor shall bear all the expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction, including compensation for additional professional services, and an appropriate deductive Change Order shall be issued. If, however, such Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction if he makes a claim therefore as provided in these Specifications.

37. Stopping the Work

If the Work is defective, or Contractor fails to supply sufficient skilled workmen or suitable materials or equipment, or if Contractor fails to make prompt payments to Subcontractors or for labor, materials or equipment, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor or any other party.

38. Correction of Work Before Final Payment

If required by Engineer prior to approval of final payment, Contractor shall promptly, without cost to Owner and as specified by Engineer, either correct any defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by Engineer, remove it from the site and replace it with non-defective Work. If Contractor does not correct such defective Work or remove and replace such rejected Work within a reasonable time, all as specified in a written notice from Engineer, Owner may have the deficiency corrected or the rejected Work removed and replaced. All direct or indirect costs of such correction or removal and replacement, including compensation for additional professional services, shall be paid by Contractor and an appropriate deductive Change Order shall be issued. Contractor shall also bear the expense of making good all Work of others destroyed or damaged by his correction, removal or replacement of his defective Work.

39. One Year Correction Period

If, after the approval of final payment and prior to the expiration of one year after the date of substantial completion or such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents, any Work is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions, either correct such defective Work, or, if it has been rejected by Owner, remove it from the site and replace it with non-defective Work. If Contractor does not promptly comply with the terms of such instructions, Owner may

have the defective Work corrected or the rejected Work removed and replaced, and all direct and indirect costs of such removal and replacement, including compensation for additional professional services, shall be paid by Contractor.

40. Acceptance of Defective Work

If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to approval of final payment, also Engineer) prefers to accept it, he may do so. In such case, if acceptance occurs prior to approval of final payment, a Change Order shall be issued incorporating the necessary revisions in the Contract Documents, including appropriate reduction in the Contract Price; or, if the acceptance amount shall be approval of final payment, an appropriate amount shall be paid by Contractor to Owner.

41. Neglected Work By Contractor

If Contractor should fail to prosecute the work in accordance with the Contract Documents, including any requirements of the progress schedule, Owner, after seven (7) days' written notice to Contractor may, without prejudice to any other remedy he may have, make good such deficiencies and the cost thereof (including compensation for additional professional services) shall be charged against Contractor if Engineer approved such action, in which case a Change Order shall be issued incorporating an appropriate reduction in the Contract Price. If the payments then or thereafter due Contractor are not sufficient to cover such amount, Contractor shall pay the difference to Owner.

42. Application for Payment

At least ten days prior to submitting the first Application for a progress payment, Contractor shall submit a progress schedule, a final schedule of Shop Drawing submission and a schedule of values of the Work. These schedules shall be satisfactory in form and substance to Engineer. The schedule of values shall include quantities and unit prices aggregating the Contract Price, and shall subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Upon approval of the schedules of values by Engineer, it shall be incorporated into the form of Application for Payment furnished by Engineer.

At least ten days before each progress payment falls due (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 data and schedules as Engineer may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by such data, satisfactory to Owner, as will establish Owner's title to the material and equipment and protect his interest therein, including applicable insurance. Each subsequent Application for Payment shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied to discharge in full all of Contractor's obligations reflected in prior Applications for Payment.

Retainage shall be an amount equal to 10% of the Work completed until 50% of the Work has been completed. At 50% completion, further partial payments shall be made in full to the Contractor and no additional amounts may be retained unless the Engineer certifies that the job is not proceeding satisfactorily, but amounts previously retained shall not be paid to the Contractor. At 50% completion or any time thereafter when the progress of the Work is not satisfactory, additional amounts may be retained but in no event shall the total retainage be more than 10% of the value of the work completed. Upon substantial completion of the work, any amount retained may be paid to the Contractor. When the Work has been substantially completed except for Work which cannot be completed because of weather conditions, lack of materials or other reasons which in the judgment of the Owner are valid reasons for non-completion, the Owner may make additional payments, retaining at all times an amount sufficient to cover the estimated cost of the Work still to be completed.

Contractor warrants and guarantees that title to all Work, materials and equipment covered by any Application of Payment, whether incorporated in the Project or not, will pass to Owner at the time of payment free and clear of all liens, claims, security interests and encumbrances (hereafter in these General Conditions referred to as "Liens").

43. Approval of Payments

Engineer will, within ten days after receipt of each Application for Payment, either indicate in writing his approval of payment and present the Application to Owner, or return the Application to Contractor indicating in writing his reasons for refusing to approve payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application. Owner shall, within thirty days of presentation to him of an approved Application for Payment, pay Contractor the amount approved by Engineer.

Engineer's approval of any payment requested in an Application for Payment will constitute a representation by him to Owner, based on Engineer's on-site observations of the Work in progress as an experienced and qualified design professional and on his review of the Application for Payment and the accompanying data and schedules that the Work has progressed to the point indicated; that, to the best of his knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning Project upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents and any qualifications stated in his approval); and that Contractor is entitled to payment of the amount approved. However, by approving any such payment Engineer will not thereby be deemed to have represented that he made exhaustive or continuous on-site inspections to check the quality or the quantity of the Work, or that he has reviewed the means, methods, techniques, sequences, and procedures of construction, or that he has made any examination to ascertain how or for what purpose Contractor has used the moneys paid or to be paid to him on account of the Contract Price, or that title to any Work, materials or equipment has passed to Owner free and clear of any Liens.

Engineer's approval of final payment will constitute an additional representation by him to Owner that the conditions precedent to Contractor's being entitled to final payment as set forth in Article 46 has been fulfilled.

Engineer may refuse to approve the whole or any part of any payment if, in his opinion, it would be incorrect to make such representation to Owner. He may also refuse to approve any such payment, or, because of subsequently discovered evidence or the results of subsequent inspections or tests, nullify any such payment previously approved, to such extent as may be necessary in his opinion to protect Owner from loss because:

- a. The Work is defective, or completed Work has been damaged requiring correction or replacement.
- b. Claims or Liens have been filed or there is reasonable cause to believe such may be filed.
- c. The Contract Price has been reduced because of Modifications.
- d. Owner has been required to correct defective Work or complete the Work in accordance with Article 41.
- e. Unsatisfactory prosecution of the Work, including failure to furnish acceptable submittals or to clean up.

When the above grounds are removed, payment shall be made for amounts withheld because of them.

44. Substantial Completion

Prior to final payment, Contractor may, in writing to Owner and Engineer, certify that the entire Project is substantially complete and request that the Engineer issue a certificate of Substantial Completion. Within a reasonable time thereafter, Owner, Contractor and Engineer shall make an inspection of the Project to determine the status of completion. If Engineer does not consider the Project substantially complete, he will notify Contractor in writing giving his reasons therefore. If Engineer considers the Project substantially complete, he will prepare and deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion and the responsibilities between Owner and Contractor for maintenance, heat and utilities. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment, and the certificate shall fix the time within which such items shall be completed or corrected, said time to be within the Contract Time. Owner shall have seven (7) days after receipt of the tentative certificate during which he may make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the project is not substantially complete, he will within fourteen days (14) days after submission of the tentative certificate to Owner notify Contractor in writing, stating his reasons therefore. If, after consideration of Owner's objections, Engineer considers the project substantially complete, he will within said fourteen 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 he believes justified after consideration of the objections from Owner.

The Owner may reduce the retainage to five (5%) percent of the total Contract Price after substantial completion. Owner shall have the right to exclude Contractor from the Project after the date of Substantial Completion, but Owner shall allow Contractor reasonable access to complete or correct items on the tentative list.

45. Partial Utilization

Prior to final payment, Owner may request Contractor in writing to permit him to use a specified part of the Project which he believes he may use without significant interference with construction of other parts of the Project. If Contractor agrees, he will certify to Owner and Engineer that said part of the Project is substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Project. Within a reasonable time thereafter Owner, Contractor and Engineer shall make an inspection of that part of the Project to determine its status of completion. If Engineer does not consider that it is substantially complete, he will notify Owner and Contractor in writing giving his reasons therefore. If Engineer considers that part of the Project to be substantially complete, he will execute and deliver to Owner and Contractor a certificate to that effect, fixing the date of Substantial Completion as to that part of the Project, attaching thereto a tentative list of items to be completed or corrected before final payment and fixing the responsibility between Owner and Contractor for maintenance, heat and utilities as to that part of the Project. Owner shall have the right to exclude Contractor from any part of the Project which Engineer has so certified to be substantially complete, but Owner shall allow Contractor reasonable access to complete or correct items on the tentative list.

Insurance carrier shall be informed by the Contractor of occupancy and adjustments made so that coverage of construction will not be invalidated.

46. Final Payment

Upon written notice from Contractor that the Project is complete, Engineer will make a final inspection with Owner 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 remedy such deficiencies.

After Contractor has completed all such corrections to the satisfaction of Engineer and delivered all maintenance and operating instructions, schedules, guarantees, Bonds, certificates of inspection and other documents -- all as required by the Contract Documents, he may make Application for final Payment

following the procedure for progress payments. The final Application for Payment shall be accompanied by such date and scheduling as Engineer may reasonably require, together with complete and legally effective releases or waivers (satisfactory to Owner) of all Liens arising out of the Contract Documents and the labor and services performed and the material and equipment furnished hereunder. In lieu thereof and as approved by Owner, Contractor may furnish receipts or releases in full, an affidavit of Contractor that the releases and receipts include all labor, services, material and equipment for which a Lien could be filled, and that all payrolls, material and equipment bills, and other indebtedness connected with the work for which Owner or his property might in any way be responsible, have been paid or otherwise satisfied; and consent of the Surety, if any, to final payment. If any Subcontractor, material man, fabricator or supplier fails to furnish a release or receipt in full, Contractor may furnish a Bond or other collateral satisfactory to Owner to indemnify him against any Lien.

If, on the basis of his observation and review of the Work during construction, his final inspection and his review of the final Application for Payment -- all required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor has fulfilled all of his obligations under the Contract Documents, he will, within ten (10) days after receipt of the final Application for Payment, indicate in writing his approval of payment and present the Application to Owner for payment. Thereupon Engineer will give written notice to Owner and Contractor that the Work is acceptable. Otherwise, he will return the Application to Contractor, indicating in writing his reasons for refusing to approve final payment, in which case Contractor shall make the necessary corrections and resubmit the Application. Owner shall, within ten (10) days of presentation to him of an approved final Application for Payment, pay Contractor the amount approved by Engineer.

If after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of Contractor and Engineer so confirms, Owner shall, upon certification by Engineer and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work is not fully completed or corrected and is less than the retainage stipulated in the Agreement, and if Bonds have been furnished, 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 the Contractor to the Engineer prior to certification of 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 making and acceptance of final payment shall constitute:

- a. a waiver of all claims by Owner against Contractor other than those arising from unsettled Liens, from defective Work appearing after final inspection or from failure to comply with the requirements of the Contract Documents or the terms of any special guarantees specified therein, and
- b. a waiver of all claims by Contractor against Owner other than those previously made in writing and still unsettled.

Contractor's obligation to perform the Work and complete the Project in accordance with the Contract Documents shall be absolute. Neither approval of any progress or final payment by Engineer, nor the issuance of a certificate of Substantial Completion, nor any payment by Owner to Contractor under the Contract Documents, nor any use or occupancy of the Project or any part thereof by Owner, nor any act of acceptance by Owner nor any failure to do so, nor any correction of defective Work by Owner shall constitute an acceptance of Work not in accordance with the Contract Documents.

47. Owner's Right to Suspend Work

Owner may, at any time and without cause, suspend the Work or any portion thereof for a period of not more than ninety (90) days by notice in writing to Contractor and Engineer which shall fix the date on which Work shall be resumed. Contractor shall resume the Work on the date so fixed. Contractor will be

allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension if he makes a claim therefore as provided in these Contract Documents.

48. Owner's Right to Terminate Contract

If the Contractor should be adjudged a bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency, or if he should persistently or repeatedly refuse or should fail, except in cases for which extension of time is provided, to supply enough properly skilled workmen or proper material, or if he should fail to make prompt payment to subcontractors or for material or labor, or persistently disregard laws, ordinances or the instruction of the Engineer, or otherwise be guilty of a substantial violation of any provision of the Contract, then the Owner, upon the certificate of the Engineer that sufficient cause exists to justify such action, may without prejudice to any other right or remedy and after giving the Contractor and his Surety a minimum of seven (7) days from delivery of a written notice, take possession of the premises and of all materials, tools and appliances thereof and finish the Work by whatever method he may deem expedient. In such case the Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price shall exceed the expense of finishing the Work including compensation for additional managerial and administrative services, such excess shall be paid to the Contractor. If any such expense shall exceed such unpaid balance, the Contractor shall pay the difference to the Owner.

The expense incurred by the Owner as herein provided, and the damage incurred through the Contractor's default, shall be certified by the Engineer and incorporated in a Change Order.

Where the Contractor's services have been so terminated by the Owner, said termination shall not affect any right of the Owner against the Contractor then existing or which may thereafter accrue. Any retention or payment of moneys by the Owner due the Contractor will not release the Contractor from compliance with the Contract Documents.

After ten (10) days from delivery of a written notice to the Contractor and the Engineer, the Owner may, without cause and without prejudice to any other right or remedy, elect to abandon the Project and terminate the Contract. In such case, the Contractor shall be paid for all Work executed and any expense sustained plus reasonable profit.

49. Contractor's Right to Stop Work or Terminate

If, through no act or fault of Contractor the Work is suspended for a period of more than ninety (90) days by Owner or under an order of court or other public authority, or Engineer fails to act on any Application for Payment within thirty (30) days after it is submitted, or Owner fails to pay Contractor any sum approved by Engineer or awarded by arbitrators within thirty (30) days of its approval and presentation, then Contractor may, upon fifteen (15) days' written notice to Owner and Engineer, terminate the Agreement and recover from Owner payment for all Work executed and any expense sustained plus a reasonable profit. In addition, and in lieu of terminating the Agreement, if Engineer has failed to act on an Application for Payment or Owner has failed to make any payment as aforesaid, Contractor may upon fifteen (15) days' notice to Owner and Engineer stop the Work until he has been paid all amounts then due.

50. Arbitration by Mutual Consent

All claims, disputes and other matters in question arising out of, or relating to, this Agreement or the breach thereof except for claims which have been waived by the making or acceptance of final payment, may be decided by arbitration if the parties mutually agree. Any agreement to arbitrate shall be specifically enforceable under the prevailing arbitration law. The award rendered by the arbitrators shall be final, and judgment may be entered upon it in any court having jurisdiction thereof.

Notice of the request for arbitration shall be filed in writing with the other party to the Agreement and a copy shall be filed with Engineer. Request for arbitration shall in no event be made on any claim, dispute or other matter in question which would be barred by the applicable statute of limitations.

The Contractor will carry on the Work and maintain the progress schedule during any arbitration proceedings, unless otherwise mutually agreed in writing.

51. Computation of Time

When any period of time is referred to in the Contract Documents by days, it shall 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 shall be omitted from the computation.

52. Assignments

Neither the Contractor nor the Owner shall sell, transfer, assign or otherwise dispose of the Contract or any portion thereof, or of his right, title of interest herein, or his obligations thereunder, without written consent of the other party.

53. Ownership of Drawings

All Drawings, Specifications and copies thereof furnished by the Engineer are the property of the Engineer. They are not to be used on other work and, with the exception of the signed Contract set, are to be returned to the Engineer or his representative upon request, at the completion of the Work.

54. Compliance With Prevailing Wage Law (**Not Applicable**)

Full compliance by the Contractor and any Subcontractor as to their duties prescribed by the applicable State or Federal Minimum Wage Laws is required in the performance of Work under this Contract.

The Contractor will be required to accept liability for payment of all payroll taxes or deductions required by local and federal law, including old age pension, social security or annuities. Workmen's Compensation Insurance shall be carried to the full amounts as required by local statutes.

Incorporated within the Labor Regulations and Wage Rates is a classified list of labor positions used in this work. Opposite the positions are shown the general prevailing hourly rates of wages as ascertained for this contract.

In case it shall become necessary for the Contractor or any Subcontractor to employ on the work under this contract any person in a trade or occupation (except executive, administrative or supervisory workers) for which no wage rates are specified herein, the Contractor shall immediately notify the Engineer who will promptly thereafter furnish the Contractor with the general prevailing rates. The rates thus furnished shall be applicable for such trade or occupation from the time of initial employment of the person or persons affected and during the continuance of such employment.

The Contractor and any Subcontractor shall post and keep posted in a conspicuous place at the site of the Work a copy of the prevailing rates of wages and work hours for each classification of laborers employed in the performance of this Contract.

55. Measurement and Computation of Quantities

Computation of quantities that will be the basis for payment estimates, both monthly and final, will be made by the Engineer. In general, all payment-estimates will be checked and approved by a representative of the funding agency before payment.

No extra measurements of any kind, unless specially noted shall be allowed in measuring the Work under these Specifications; but the length, area solid contents or number only shall be considered as the basis for payment as hereinafter specified.

Where the computation of areas or volumes by exact geometric methods is unduly laborious or refined, the planimeter shall be held an instrument of precision and may be used in the determination of quantities upon which payments are based.

The measurements of the Engineer as to the amount of Work done shall be final and conclusive. Payments shall be made upon the Work done within the lines prescribed by the Drawings or Specifications and in accordance with the unit prices for the items under which the Work is done.

56. Project Signs

The Contractor shall erect a project sign at a prominent location on the Project. The sign shall be four feet by eight feet, two colors and shall contain the name of the Project, the Owner, the Engineer, and the Contractor. The lettering shall be approved by the Engineer prior to making the signs.

End of Section

Construction Sign

PROJECT: Slade WWTP Aerated Equalization Basin

Owner: Powell's Valley Water District
Clay City, KY

Engineer: MSE of Kentucky, Inc.
Lexington, KY

859-223-5694

Contractor:



SECTION 00800 - SPECIAL CONDITIONS

1. Description of the Work and Designation of the Owner

These specifications and accompanying plans describe the work to be done and the materials to be furnished for the construction of Slade WWTP Equalization Basin for the Powell's Valley Water District.

All references to the Owner in these specifications, Contract Documents and plans shall mean the Powell's Valley Water District.

2. Available Funds

The attention of all bidders is directed to the fact that the funds will be made available for the award of the contract from the Owner.

3. Time of Completion and Liquidated Damages

The time allowed for completion of the contract is 180 calendar days. The time allowed for completion shall begin at midnight, local time, on the date which the Owner shall instruct the Contractor, in writing, to start work, but not later than 10 days after Notice to Proceed.

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

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Precip.	7	7	9	8	8	8	8	7	6	5	6	7
Freeze	10	6	1								1	5

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

It is understood that time is the essence of this contract and that the Owner will sustain damages, monetary and otherwise, in the event of delay in completion of the work hereby contracted.

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

The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the extreme difficulty in fixing and ascertaining the actual damages the Owner would in such

event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be retained from time to time by the Owner from current periodical estimates.

Liquidated damages are fixed at \$1,000 per day for each calendar day of overrun beyond the date set for completion or authorized extension thereof for the contract.

4. Insurance

Insurance is to be furnished by the Contractor for the benefit of the Owner, Contractor and subcontractors as their interests may appear. The contractor shall procure and maintain the following insurance in addition to the insurance required by law:

- (a) Commercial General Liability-Occurrence form-not less than \$2,000,000 General Aggregate, \$2,000,000 Products & Completed Aggregate, \$1,000,000 Personal and Advertising, \$1,000,000 each occurrence.
- (b) Automobile Liability - \$1,000,000 per accident
- (c) Employers Liability:
 - (1) \$100,000 Each Accident Bodily Liability
 - (2) \$500,000 Policy Limit Bodily Injury by Disease
 - (3) \$100,000 Each Employee Bodily Injury by Disease
- (d) The insurance required above must be evidenced by a Certificate of Insurance and this Certificate of Insurance must contain one of the following statements:
 - (1) "policy contains no deductible clauses".
 - (2) "policy contains _____ (amount) deductible property damage clause but company will pay claim and collect the deductible from the insured."
- (e) Kentucky Workmen's Compensation Insurance. The contractor shall furnish evidence of coverage of all his employees or give evidence of self-insurance by submitting a copy of a certificate issued by the Workmen's Compensation Board.

The cost of insurance is incidental to all contract items. All subcontractors must meet the same minimum insurance requirements.

All policies shall provide for a minimum of fifteen (15) days written cancellation notice with notice to be given both to the Owner and the Engineer. The Owner and Engineer shall be included as additional insured parties.

5. Performance and Payment Bond

The Contractor shall furnish separate performance and payment bonds issued by an approved bonding company (in accordance with the General Conditions) in an amount at least equal to one hundred (100%) percent of the contract price, as security for the faithful performance of this contract and for the payment of persons performing labor and furnishing materials in connection with this contract. These bonds shall be executed by a company authorized to do business in the State of Kentucky and shall be signed or countersigned by a Kentucky resident agent. Bonds shall remain in effect for one year after date of final acceptance of the work.

6. Additional Bonds and Insurance

Prior to delivery of the executed Agreement by the Owner to the Contractor, the Owner may require the Contractor to furnish such other Bonds and such additional insurance, in such forms and with such sureties or insurers as the Owner may require. If such other Bonds or such other insurance are specified by written instructions given prior to opening of the bids, the premium shall be paid by the Contractor; if subsequent thereto, they shall be paid by the Owner (except as otherwise provided for bonding of substitute materials or equipment).

7. Sequence of Work

Contractor shall apply their forces as necessary to complete the project within the allowed time. Contractor may also order all materials immediately upon award of contract. Contractor shall construct new drying beds and all associated piping for its operation immediately.

Contractor shall apply their forces as necessary to complete the project within the allowed time. Contractor may order all materials immediately upon award of contract.

8. Site Dimensions

All Contractors furnishing materials and equipment for this contract shall obtain exact dimensions at the site. Scale or figure dimensions on the drawings and details show the correct size under ideal conditions and shall not, under any circumstances, be so construed as to relieve the Contractor from responsibility for taking measurements at the site and furnishing materials or equipment of the correct size.

9. Damage to Equipment Stored and/or In Place Prior to Initial Operations

Any equipment damaged or which has been subjected to possible damage by reason of inundation, improper storage and/or protection during the construction period of a project, shall be replaced with new equipment, or with the approval of the Engineer, be returned to the manufacturer of the equipment, or his authorized repair agency, for inspection and repair; provided, however, that such repair after inspection will place the equipment in new condition and restore the manufacturer's guarantee the same as for new equipment.

10. Equipment Rental - Charges for Extra Work

Equipment rental charges by the Contractor for rented equipment units used on "Extra Work" or "Changes in Work" as may be ordered and authorized by the Owner shall not exceed those charges listed in the latest edition of the "Green Book," compiled and distributed by Associated Equipment Distributors, 615 West 22nd Street, Oak Brook, Illinois 60523.

11. Salvaged Materials and Equipment

All materials and/or equipment to be removed from existing structures and not specifically specified to be reused shall remain the property of the Owner. Such materials and/or equipment shall be stored on site by the Contractor as directed by the Owner.

12. Sanitary Facilities

Each Contractor shall construct and maintain, in a sanitary condition, sanitary facilities for his employees and also employees of his subcontractors. At completion of the contract work, these sanitary facilities shall be properly disposed of.

13. Utilities

Obtaining of all utilities for construction, including power and water, shall be the responsibility of the Contractor and he shall bear the cost of all utilities used for construction. Cost of all connections and facilities for use of utilities shall be borne by the Contractor.

14. Cash Allowances

No cash allowances are included in this project. However, the Contractor is required to make labor and material allowances for unforeseen repairs, to the existing improvements as described in these specifications.

15. Nondiscrimination in Employment

During the performance of this contract, the Contractor shall not discriminate against any employee or applicant for employment because of race, creed, color or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, creed, color or national origin.

16. Minimum Wage Rates

If available, the prevailing minimum wage rates are contained in these specifications. However, applicable wage rates may be provided at any time before bids are received. In that event the wage rates will be provided by addendum to these specifications. Currently, State or Federal prevailing wages do **not** apply to this project.

The Contractor will be required to pay not less than the higher of the State or Federal minimum wage rate for each job classification as and if set forth in Part V of these specification or in an addendum to the specifications. The stipulated wage rates represent prevailing minimum rates of pay allowable as determined by the appropriate governing agency and shall not be construed to mean that the Contractor may not have to pay higher rates to secure labor. No contract adjustment is permissible should this condition become applicable.

17. Property Protection

Care is to be exercised by the Contractor in all phases of construction to prevent damage and injury to the Owner's or other property.

In connection with work performed on "private property" (property other than that belonging to the Owner), the Contractor shall confine his equipment and stored materials to lands and rights-of-way provided for the project by the Owner and shall take every precaution to avoid damage to the private property owner's buildings, grounds and facilities.

Fences, hedges, shrubs, etc., within the construction limits shall be carefully removed, preserved and replaced when the back filling has been completed. If sod is damaged or not handled properly, it shall be replaced with new sod equal to existing sod at the Contractor's expense. Grassed areas, other than lawns, shall be graded, fertilized and seeded when construction is completed. When construction is completed the private property owner's facilities and grounds shall be restored to as good or better condition than found as quickly as possible at the Contractor's expense.

When directed by the Engineer, large trees or other facilities that cannot be replaced or preserved shall be removed by the Contractor. The Owner will assume responsibility for settling with the property owner for such loss. The Contractor shall be solely and entirely responsible for any damage to all other trees or facilities.

The Contractor, in the use of easements and rights-of-way, will comply with any and all agreements between the Owner and the property owner.

Carelessness on the part of the Contractor or his employees in leaving gates open, parking cars, trucks or vehicles in such a way as to interfere with farming operations will not be tolerated. Contractor shall use existing roads to transport pipe, materials and workmen to and from the job.

Foundations, adjacent to where an excavation is to be made below the bottom of the foundation, shall be supported by shoring, bracing and underpinning as long as the excavation shall remain open and the Contractor shall be held strictly responsible for any damage to said foundation.

Highway rights-of-way, railroad rights-of-way, public parks, school yards and other such properties shall be considered "private properties" for the purpose of this section.

18. Rock Excavation

It is specifically noted that separate payment for solid rock excavation will not be made under this contract, all excavation being considered "unclassified."

19. Extra Fill Material

Extra fill material required to complete the finished grading to the line and grade shown on the plans shall be obtained by the Contractor at no extra cost to the Owner above that included in the unit price bid.

20. Layout of the Work

The layout of the work shall be the responsibility of the Contractor and shall be subject to checking by the Engineer. All instruments, stakes, batter boards, barricades, traffic signs, flags and other materials necessary and personnel needed for establishing and marking lines, grades and structure location during construction, shall be furnished and paid for by the Contractor. The Contractor's personnel engaged in the layout work described herein and any aides used shall be fully capable of performing the duties set out herein.

21. Conflict With or Damage to Existing Utilities and Facilities

Insofar as location data is available to the Engineers, existing underground utilities (such as water lines, sewer lines, gas lines, telephone conduits, etc.) are accurately located on the drawings. Due, however, to the approximate nature of much of this data, the location of any particular facility can not be certified to be correct. In general, locations and elevations shown are approximate only.

Repair to existing utilities and facilities damaged by the Contractor's construction forces shall be considered as a part of the Contract covered only by the price bid for the new construction. The only exceptions to this provision, wherein extra compensation will be authorized, are relocation of an existing facility due to direct conflict with the new pipeline, and relocation (outside of limits of maximum allowable trench widths) of an existing facility presently located within the bounds of maximum allowable trench width, where necessitated for assurance against future damage due to settlement or to permit reasonable access to the new work.

Before proceeding with the work, the Contractor shall confer with all public or private companies, agencies, or departments that own and operate utilities in the vicinity of the construction work to verify the location of and possible interference with, the existing utilities that are shown on the Plans, arrange for necessary suspension of service and make arrangements to locate and avoid interference with all utilities (including house connections) that are not shown on the Plans.

Where the existing utilities must be disturbed during construction under this contract, their operation and function shall be maintained by the Contractor to such a degree that service to customers will be interrupted for minimum time periods only. Such disturbances and any maintenance use of these lines shall constitute no cost to the Owner. The Owner shall be notified

of interruptions in sufficient time to prepare for them and shall agree to the hour, date and duration of them before they are undertaken.

Should shutdowns in service be in excess of the time of duration agreed upon and such excessive shutdown time be due to the Contractor's negligence, faulty work and/or inability to perform, then and in that event, the Contractor shall be held liable to the Owner, by reason of such excessive shutdown periods.

When existing utilities or appurtenant structures, either underground or above ground, are encountered, they shall not be displaced or disturbed unless necessary and in such case shall be replaced in as good or better condition that found, as quickly as possible. Temporary relocation and replacement of all utilities and appurtenant structures to accommodate the construction work shall be at the Contractor's expense and permanent relocation of such facilities as described herein to accommodate the construction work shall be at the Owner's expense, unless such temporary or permanent relocation and replacement is by statute or agreement the responsibility of the Owner. It is expected that the Contractor will be diligent in his efforts and use every possible means to locate existing utilities.

Payment for necessary disconnection and reconnection of utility services shall be included as a part of the Contractor's bid and no extra compensation will be made for same.

The Contractor shall at all times maintain on hand an adequate supply of repair materials and tools with which to make repair to damaged water, gas and sewer lines. Should the Contractor inadvertently damage existing utilities, he shall make immediate repair thereto and in no event shall he leave the site before such repair has been made and proven to be successful. Repair to damaged utilities must meet the requirements of the agency in charge of that particular utility.

The intent of this article is to assure compensation to the Contractor for changes in existing utilities reasonably necessary and at the same time, to protect the Owner against excessive damage due to carelessness of the Contractor's construction force.

22. Personal Liability of Public Officials

In carrying out any of the provisions of the Contract or in exercising any power or authority granted to them thereby, there shall be no personal liability upon the Engineer, or its authorized agents or employees, or upon any other officer or employee of the Owner, it being understood that in such matters they act as the agent and representative of that Owner.

23. Blasting

All blasting operations shall be conducted in strict accordance with Kentucky Revised Statutes 351.320 to 351.340 and the rules and regulations promulgated under KRS 351.320 to 351.340, effective October 6, 1972, which shall be deemed to be included in these Specifications the same as though herein written out in full. The Contractor shall also comply with applicable municipal ordinances, Federal safety regulations and Section 9 of the Manual of Accident Prevention in Construction published by the Associated General Contractor's of America, Inc. All explosives

shall be stored in conformity with said ordinances, laws and safety regulations. No blasting shall be done within five feet of any water mains, except with light charges of explosives. Any damage done by blasting is the responsibility of the Contractor and shall be promptly and satisfactorily repaired by him.

To implement these requirements and unless otherwise required by ordinance or law, each excavation crew shall be provided with two metal boxes equipped with suitable locks. One of these boxes shall be for storing explosives and one for caps. The boxes shall always be locked except when in actual use. They shall be painted a bright color and stenciled with appropriate warning signs. At night explosives and caps shall be stored in separate magazines.

All shots shall be covered with heavy timber, steel or rope blasting mats to prevent flying material. Unless otherwise specified or directed, delay caps shall be used to reduce earth vibration and noise. In sparsely populated areas, the Engineer may permit the Contractor to use regular type caps.

The Contractor shall keep a blasting log and, for each blast, shall record the date, time of blast, number of holes, type of explosive, number of delays, amount of charge per delay, stemming and number and type of caps. An inventory of all explosives handled and stored shall also be kept. Blasting operations shall be covered by comprehensive general liability insurance or separate public liability insurance to cover blasting as set forth in the General Conditions.

24. Control of Erosion

The Contractor shall be responsible for control of siltation and erosion from the project work. Control shall include all necessary ditching, check dams, mulching, etc. to prevent deposition of materials in roadside ditches. The Owner shall incur no extra costs from such work.

25. Occupational Safety and Health

It shall be the Contractor's responsibility to be informed of and comply with all Kentucky Department of Labor, Division of Occupational Safety and Health requirements for this type of construction. He shall also comply with all reporting requirements of the Occupational Safety and Health Law. The Contractor shall provide adequate protection against accidents due to special hazards caused by blasting, deep trenches, excavations, heavy equipment or vehicle operation, electrical work, work in dangerous atmospheres, work above the ground, traffic control, work with augering and drilling equipment and any other construction work which he might undertake as a part of this project.

The Contractor shall provide safety controls for protection of the life and health of employees. He will utilize precautionary methods for the prevention of damage to property, materials, supplies and equipment and for avoidance of work interruptions in the performance of this contract. In order to provide such safety controls aforesaid, the Contractor shall comply with all pertinent provisions of the Kentucky Safety Standards of the Division of Occupational Safety, Department of Labor, that are in effect at the time this contract is entered into and during the period in which the contract is to be performed. The Contractor shall also take or cause to be

taken such additional measures as the Division of Occupational Safety may determine to be reasonably necessary for the purpose.

The Contractor shall maintain an accurate record of, and shall report to the Division of Occupational Safety in the manner and on the forms prescribed by the Division; exposure date and all accidents resulting in death, traumatic injury, occupational disease and/or damage to property, materials, supplies and equipment incident to work performed under this contract.

The Division of Occupational Safety will notify the Contractor through the Owner of any noncompliance with the foregoing provisions and the action to be taken. The Contractor shall, after receipt of such notice, immediately correct conditions. Such notice when delivered to the Contractor or his representative at the site of the work, shall be deemed sufficient for the purpose.

If the Contractor fails or refuses to comply promptly, the Owner may issue an order stopping all or part of the work until satisfactory or corrective action has been taken. Failure or refusal to comply with the order will be grounds for stopping all payments due under the contract to the Contractor. No part of the time lost due to any such stop order shall be made the subject of claim or extension of time or for excess cost or damages to the Contractor.

Compliance with the provisions of the foregoing sections by subcontractors will be the responsibility of the prime Contractor.

The Contractor shall provide necessary first aid facilities and employees trained to provide first aid as required by the Occupational Safety and Health Law. In addition to the reporting requirements of other agencies, the Contractor must report promptly in writing to the Engineer all accidents whatsoever arising out of, or in connection with, the performance of the work, whether on or adjacent to the site, which caused death, personal injury, or property damages, giving full details and statements of witnesses. In addition, if death or serious injuries or serious damages are caused, such shall be reported to both the Engineer and the Owner.

26. Construction Warning Signs

The Contractor shall provide construction warning signs for each location where he is working in the highway right-of-way. Safety rules, including size, type and placement of construction signs, shall be equal to those required by the Kentucky Department of Highways.

27. Pipeline Right-of-way

The Owner will attempt to obtain all pipeline right-of-way before construction is begun. However, the Contractor must be prepared to work in right-of-way which have been acquired and shall not be entitled to a time extension due to delay over lack of particular right-of-way unless he has been provided no other place to work.

28. Responsibility for Trench Settlement

Where the pipelines installed under this contract are located within existing or proposed street right-of-way the Contractor shall be responsible for any settlement of the street surfacing, curbs, or sidewalks caused by the pipeline construction, that occurs within one year after the final acceptance of this contract. Repair of any damage caused by settlement shall meet the approval of the Owner.

29. Permission to Use Property Other Than That Provided by Owner

Should the Contractor desire or elect to use, pass over and/or encroach on private property title or right-of-way for a specific purpose, he shall obtain such rights and permission at his own expense and risk.

30. Resolving Conflicts in Contract Documents

Anything called for in the specifications and not shown on the drawings or shown on the drawings and not called for in the specifications shall be included in the Contractor's work, the same as if included in both. Where the details and general drawings do not agree, the Contractor shall notify the Engineer at least five (5) days before the date of the receipt of bids and the Engineer will have the Owner issue an addendum to all Contractors as to which of the two methods of construction shall be followed. Failure to make this determination shall make the Contractor subject to furnishing either method as may be later called for by the Engineer. In case of discrepancies between the various parts of the plans and the specifications, the detailed drawings shall take precedence over the general layouts or elevations and the written specifications shall take precedence over all other documents.

Figure dimensions on the drawings shall govern over scale dimensions. Work, materials or equipment described in words which so applied have a well-known technical or trade meaning shall be deemed to refer to such recognized standards.

In resolving conflicts, errors and discrepancies in the Contract Documents, the documents shall be given precedence in the following order: Agreement, Modifications, Addenda, Funding Agency Specifications or Contract Documents, Special Conditions, Special Provisions, Supplementary General Conditions, Information for Bidders, General Conditions, Technical Specifications and Drawings.

31. Access to the Work

The Engineer and the Owner shall have access to the work wherever it is in preparation or progress, and the Contractor shall provide proper facilities for such access and inspection.

32. Lubrication

The Contractor shall make suitable provision for the proper lubrication of all equipment furnished under this Contract. Accessible grease fittings shall be provided where required. A supply of oil, grease and other lubricants of proper quality, as recommended by the manufacturer

of the equipment, shall be furnished. Lubricants shall be furnished in their original, unopened containers, in sufficient quantity for initial fillings and for at least one (1) year of operation.

33. Labor Regulations

All public works projects bid and constructed in the State of Kentucky are subject to the provisions of Chapter 337 of the Kentucky Revised Statutes entitled Wages and Hours. In addition, if the project to which these specifications apply is funded in whole or in part by a Federal grant program whereby the U.S. Department of Labor is required to prescribe predetermined prevailing minimum wages, compliance with the applicable Federal labor regulations is also required.

All Contractors and subcontractors on the work will be required to comply with all applicable provisions of State and Federal regulations as outlined in the Supplemental General Conditions.

34. Preconstruction Conference

A preconstruction conference may be held prior to issuance of notice to proceed. The Contractor shall be represented by at least one (1) principal of the firm and the job superintendent. The Contractor shall at that time present the construction schedule, progress payment format and estimates, any available subcontractor approval requirements, required insurance and any other documents deemed necessary.

35. Record Drawings

The Contractor shall keep an accurate record of the location, size and material for all piping and changes in dimensions, and any other variations between the work actually provided and that shown on the Contract Drawings. The representation of such variations shall conform to standard drafting practice and shall include such supplementary notes, legends and details as may be necessary for legibility and clear portrayal of the construction. This requirement shall not be deleted regardless of the record keeping practices of the Engineer or the Owner.

36. EEO Requirements

Discrimination (because of race, religion, color, national origin, sex orientation, gender identity, age, or disability) is prohibited. During the performance of this contract, the Contractor agrees as follows:

a. The Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, national origin, sex, sexual orientation, gender identity, or age. The Contractor further agrees to comply with the provisions of the Americans with Disabilities Act (ADA), Public Law 101-336, and applicable federal regulations relating thereto prohibiting discrimination against otherwise qualified disabled individuals under any program or activity. The Contractor agrees to provide, upon request, needed reasonable accommodations. The Contractor will take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, religion, color, national origin, sex,

sexual orientation, gender identity, age or disability. Such action shall include, but not be limited to the following; employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination, rates or pay or other forms of compensations; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this non-discrimination clause.

b. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor; state that all qualified applicants will receive consideration for employment without regard to race, religion, color, national origin, sex, sexual orientation, gender identity, age or disability.

c. The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice advising the said labor union or workers' representative of the Contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment. The Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance.

d. The Contractor will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and by the rules, regulations and orders of the Secretary of Labor

e. The Contractor will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, as amended, and permit access to his books, records and accounts b the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations and orders.

f. In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations or orders, tis contract may be cancelled, terminated or suspended in whole or in part and the Contractor may be declared ineligible for further government contracts or federally-assisted construction contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, as amended, and such other sanctions may be imposed and remedies invoked as provided in or as otherwise provided by law.

g. The Contractor will include the provisions of paragraph (1) through (7) of section 202 of Executive Order 11246 in every subcontract or purchase order unless exempted by rules, regulations or orders of Secretary of Labor, issued pursuant to section 204 of Executive Order No. 11246 of September 24, 1965, as amended, so that such provisions will be binding upon each sub-contractor or vendor. The Contractor will take action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions including sanctions of noncompliance.

End of Section

SECTION 01005 - ADMINISTRATIVE PROVISIONS

PART 1. GENERAL

1.1 Requirements Included

- A. Title of Work, and Type of Contract.
- B. Work Sequence.
- C. Applications for Payment
- D. Coordination.
- E. Field Engineering.
- F. Reference Standards.

1.2 Work Covered by Contract Documents

- A. Work of this Contract is comprised of Build Ready Site Preparation for Lot 12 in the Greer Industrial Park.

1.3 Contract Method

Construct the Work under a single unit price contract.

1.4 Work Sequence

- A. Coordinate construction schedule and operations with Engineer.

1.5 Applications for Payment

- A. Submit five copies of each application under procedures of Section 01300 on Application for Payment form supplied by the Engineer.
- B. Content and Format: That specified for Schedule of Values in Section 01300.

1.6 Coordination

- A. Coordinate work of the various Sections of Specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items installed later.
- B. Verify characteristics of elements of interrelated operating equipment are compatible; coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

1.7 Field Engineering

- A. Provide field engineering services; establish grades, lines, and levels, by use of recognized engineering survey practices.
- B. Control datum for survey is shown on Drawings. Locate and protect control and reference points.

1.8 Reference Standards

- A. For products specified by association or trade standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. The date of the standard is that in effect as of the Bid date except when a specific date is specified.
- C. Obtain copies of standards when required by Contract Documents. Maintain copy at jobsite during progress of the specific work.

PART 2. PRODUCTS

Not Used

PART 3. EXECUTION

Not Used

End of Section

SECTION 01200 - PROJECT MEETINGS

PART 1. GENERAL

1.1 Requirements Included

- A. Contractor participation in pre-construction conferences, progress meetings, pre-final inspection and final inspection.
- B. Contractor administration of pre-installation conferences and pre-final inspection.

1.2 Related Requirements

- A. Section 01300 - Submittals: Progress Schedules.
- B. Section 01300 - Submittals: Shop drawings, product data, and samples.
- C. Section 01400 - Quality Control.
- D. Section 01700 - Contract Close-out: Project record documents.
- E. Section 01700 - Contract Close-out: Operation and maintenance data.

1.3 Pre-construction Conferences

- A. Engineer will administer pre-construction conference for execution of Owner-Contractor Agreement and exchange of preliminary submittals.

1.4 Progress Meetings

- A. Attend progress meetings.
- B. Review of Work progress, status of progress schedule and adjustments thereto, delivery schedules, submittals, maintenance of quality standards, pending changes and substitutions, and other items affecting progress of Work.

1.5 Pre-installation Conferences

- A. When required in individual specification Section, convene a pre-installation conference prior to commencing work of the Section.
- B. Require attendance of entities directly affecting, or affected by, work of the Section.
- C. Review conditions of installation, preparation and installation procedures, and coordination with related work.

1.6 Pre-final Inspection

- A. When work is substantially complete, convene a pre-final inspection.
- B. Require attendance of Owner, Engineer and funding agency officials.
- C. Review installation, cleanup and operation of work.
- D. Review record drawings, operation and maintenance materials, and other close-out documents.

1.7 Final Inspection

- A. When punch list work is complete, attend a final inspection.
- B. Review completion of punch list items.

PART 2. PRODUCTS

Not Used

PART 3. EXECUTION

Not Used

End of Section

SECTION 01300 - SUBMITTALS

PART 1. GENERAL

1.1 Requirements Included

- A. Procedures.
- B. Construction Progress Schedules.
- C. Shop Drawings.
- D. Product Data.
- E. Manufacturer's Instructions.
- F. Manufacturer's Certificates.
- G. Record Drawings.

1.2 Related Requirements

- A. Section 01005 - Administrative Provisions: Applications for Payment.
- B. Section 01400 - Quality Control: Testing laboratory reports.
- C. Section 01400 - Quality Control: Manufacturers' field service reports.
- D. Section 01700 - Contract Close-out: Close-out submittals.

1.3 Procedures

- A. Deliver submittals to Engineer at address listed on cover of Project Manual.
- B. Identify Project, Contractor, major supplier; identify pertinent Drawing sheet and detail number, and Specification Section number, as appropriate. Identify deviations from Contract Documents. Provide space for Contractor and Engineer review stamps.
- C. Submit initial progress schedule in duplicate within 15 days after date established in Notice to Proceed. After review by Engineer revise and resubmit as required. Submit revised schedule with each second Application for Payment, reflecting changes since previous submittal.
- D. Comply with progress schedule for submittals related to Work progress. Coordinate submittal of related items.
- E. After Engineer review of submittal, revise and resubmit as required, identifying changes made since previous submittal.
- F. Distribute copies of reviewed submittals to concerned persons. Instruct recipients to promptly report any inability to comply with provisions.

1.4 Construction Progress Schedules

- A. Submit horizontal bar chart or network analysis system using the critical path method, showing complete sequence of construction by activity, identifying work of separate stages and other logically grouped activities. Show projected percentage of completion for each item of Work as of time of each Application for Progress Payment.
- B. Show submittal dates required for shop drawings, product data, and samples, and product delivery dates.

1.5 Shop Drawings

A. Submit the number of copies which Contractor requires, plus two copies which will be retained by Engineer.

1.6 Product Data

A. Mark each copy to identify applicable products, models, options, and other data; supplement manufacturers' standard data to provide information unique to the Work.

B. Submit the number of copies which Contractor requires, plus two copies which will be retained by Engineer.

1.7 Manufacturer's Instruction

A. When required in individual Specification Section, submit manufacturer's printed instructions for delivery, storage, assembly, installation, startup, operation, maintenance, adjusting, and finishing, in quantities specified for product data.

1.8 Record Drawings

A. Maintain accurate records of any variations between the work actually provided and that shown on the Contract Drawings. The representation of such variations shall conform to standard drafting practice and shall include such supplementary notes, legends and details as may be necessary for legibility and clear portrayal of the construction.

B. Submit one copy of all such records to the Engineer.

PART 2. PRODUCTS

Not Used

PART 3. EXECUTION

Not Used

End of Section

SECTION 01400 - QUALITY CONTROL

PART 1. GENERAL

1.1 Requirements Included

- A. General Quality Control.
- B. Workmanship.
- C. Manufacturer's Instructions.
- D. Manufacturer's Certificates.
- E. Manufacturers' Field Services.

1.2 Related Requirements

- A. Document 00700 - General Conditions: Inspection and testing required by governing authorities.
- B. Section 01005 - Administrative Provisions: Applicability of specified reference standards.
- C. Section 01300 - Submittals: Submittal of Manufacturer's Instructions.

1.3 Quality Control, General

- A. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

1.4 Workmanship

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

1.5 Manufacturer's Instructions

- A. Comply with instructions in full detail, including each step in sequence. Should instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

1.6 Manufacturer's Certificates

- A. When required by individual Specifications Section, submit manufacturer's certificate, in duplicate, that products meet or exceed specified requirements.

1.7 Manufacturer's Field Services

- A. When specified in respective Specification Sections, require supplier or manufacturer to provide qualified personnel to observe field conditions, conditions of surfaces and installation, quality of workmanship, startup of equipment, test, adjust and balance of equipment as applicable, and to make appropriate recommendations.
- B. Representative shall submit written report to Engineer listing observations and recommendations.

PART 2. PRODUCTS

Not Used

PART 3. EXECUTION

Not Used

End of Section

SECTION 01420 - INSPECTION OF THE WORK

PART 1. GENERAL

1.1 The Engineer's Duties

It is not the Engineer's function to supervise or direct the manner in which the work under this Contract is carried on or conducted.

The Engineer is not responsible for construction means, methods, techniques, sequences, or procedures, nor for safety precautions and programs in connection with the work.

The Engineer will not be responsible for the Contractor's failure to carry out the work in accordance with the Contract Documents.

1.2 The Contractor's Duties

The Contractor shall perform no work in the absence of the Engineer or his assistants, without prior approval.

The Contractor shall use no material of any kind until it has been inspected and accepted by the Engineer.

The Contractor agrees that any method or procedure, which in the opinion of the Engineer does not achieve the required results or quality of the work specified, shall be discontinued immediately upon the order of the Engineer.

The Contractor shall remedy all materials or workmanship found at any time to be defective or not of the quality required by the Plans and Specifications, regardless of previous inspection of the materials and workmanship.

The Engineer's inspection does not relieve the Contractor from any obligation to perform the work specified, strictly in accordance with the Drawings and Specifications. Any work not so constructed shall be removed and made good by the Contractor free of all expense to the Owner.

Upon completion, the Contractor shall have Record Drawings and certified as to their completeness and correctness by the Resident Inspector and delivered to the Engineer for incorporation in the Drawings.

At Contract close-out, deliver Record Documents to the Engineer for the Owner.

Accompany submittal with transmittal letter in duplicate, containing:

Date. Project title and number. Contractor's name and address. Title and number of each Record Document. Signature of the Contractor or his authorized representative.

PART 2. PRODUCTS

Not Used.

PART 3. EXECUTION

Not Used.

End of Section

SECTION 01500 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1. GENERAL

1.1 Requirements Included

- A. Barriers
- B. Protection of Installed Work.
- C. Security.
- D. Water Control.
- E. Cleaning During Construction.
- F. Project Identification.

1.2 Related Requirements

- A. Section 01005 - Administrative Provisions: Work sequence. Contractor use of premises.
- B. Section 01700 - Contract Close-out: Final cleaning.

1.3 Barriers

- A. Provide as required to prevent public entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide barricades and covered walkways as required by governing authorities for public rights-of-way and for public access to existing building or site.

1.4 Protection of Installed Work

- A. Provide temporary protection for installed products. Control traffic in immediate area to minimize damage.
- B. Where applicable, follow project traffic control plan as required by state or local authorities having jurisdiction over roads or streets. Provide required signage, markings, cones, barriers, flaggers or other controls as may be required by the jurisdictional agency.

1.5 Cleaning During Construction

- A. Control accumulation of waste materials and rubbish; periodically dispose of off-site.

1.6 Project Identification

- A. Provide Project identification sign of wood frame and exterior grade plywood construction, painted with required design and colors. List title of Project, names of Owner, Engineer, Contractor.
- B. Erect on site at location established by Engineer.

1.7 Removal

- A. Remove temporary materials, equipment, services, and construction prior to Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary facilities.

PART 2. PRODUCTS

SECTION 01500 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

Not Used

PART 3. EXECUTION

Not Used

End of Section

SECTION 01700 - CONTRACT CLOSE-OUT

PART 1. GENERAL

1.1 Requirements Included

- A. Close-out Procedures.
- B. Project Record Documents.
- C. Operation and Maintenance Data.
- D. Warranties and Bonds.
- E. Spare Parts and Maintenance Materials.

1.2 Related Requirements

- A. Document 00700 - General Conditions: Fiscal provisions, legal submittals, and other administrative requirements.
- B. Section 01500 - Construction Facilities and Temporary Controls: Cleaning during construction.

1.3 Close-out Procedures

- A. Comply with procedures stated in General Conditions of the Contract for issuance of Certificate of Substantial Completion.
- B. When Contractor considers Work has reached final completion, submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection.
- C. In addition to submittals required by the conditions of the Contract, provide submittals required by governing authorities, and submit a final statement of accounting giving total adjusted Contract Sum, previous payments, and sum remaining due.
- D. Engineer will issue a final Change Order reflecting approved adjustments to Contract Sum not previously made by Change Order.

1.4 Project Record Documents

- A. Store documents separate from those used for construction.
- B. Keep documents current; do not permanently conceal any work until required information has been recorded.
- C. At Contract close-out, submit documents with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor.

1.5 Operation and Maintenance Data

- A. Provide data for pump stations.
- B. Submit two sets prior to final inspection, bound in 8-1/2 x 11 inch (216 x 279 mm) three-ring side binders with durable plastic covers.

1.6 Warranties and Bonds

A. Provide duplicate, notarized copies. Execute Contractor's submittals and assemble documents executed by subcontractors, suppliers, and manufacturers. Provide table of contents and assemble in binder with durable plastic cover.

B. Submit material prior to final application for payment. For equipment put into use with Owner's permission during construction, submit within 10 days after first operation. For items of Work delayed materially beyond Date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.7 Spare Parts and Maintenance Materials

A. Provide products, spare parts, and maintenance materials in quantities specified in each Section, in addition to that used for construction of Work. Coordinate with Owner, deliver to project site and obtain receipt prior to final payment.

PART 2. PRODUCTS

Not Used

PART 3. EXECUTION

Not Used

End of Section

SECTION 01720 - PROJECT RECORD DOCUMENTS

PART 1. GENERAL

1.1 Work Included

The Contractor shall maintain at the site for the Owner one record copy of:

- A. Drawings.
- B. Specifications.
- C. Addenda.
- D. Change orders and other modifications to the Contract.
- E. Engineer field orders or written instructions.
- F. Approved shop drawings, product data and samples.
- G. Field test records.

1.2 Related Requirements

- A. Section 01200 - Project Meetings
- B. Section 01340 - Shop Drawings, Product Data and Samples
- C. Section 01500 - Construction Facilities and Temporary Controls

1.3 Recording

- A. Each document shall be labeled "PROJECT RECORD" in large printed letters.
- B. Record information shall be kept current with construction progress.

1.4 Submittals

- A. Sketches showing the "Record" information shall be provided monthly to the Engineer and submitted with the partial pay request. Copies of quality control test results notes shall be supplied weekly and all test results shall be submitted with close-out documents.
- B. Upon completion, the Contractor shall have Record Drawings and certified as to their completeness and correctness by the Resident Inspector and delivered to the Engineer for incorporation in the Drawings.
- C. At Contract close-out, the Contractor shall deliver Record Documents to the Engineer for the Owner.
- D. The Contractor shall accompany the submittal with a transmittal letter containing:
 - 1. Date.
 - 2. Project title and number.
 - 3. Contractor's name and address.
 - 4. Title and number of each Record Document.
 - 5. Signature of the Contractor or his authorized representative.

PART 2. PRODUCTS

Not Used.

PART 3. EXECUTION

Not Used.

End of Section

SECTION 02100 - EROSION CONTROL

PART 1. GENERAL

1.1 Work Included

Submit KPDES Notice of Intent (NOI) and all follow-up information. Take responsibility for locating, furnishing, installing, and maintaining temporary sediment and erosion control best management practices for earth disturbing activity areas and developing a Best Management Practices (BMP) Plan using good engineering practices as required by the Kentucky Pollutant Discharge Eliminating System (KPDES) Permit. Make and record inspections of BMPs and areas as required by the KPDES Permit. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other Federal, State or Local agencies, adhere to the more restrictive laws, rules, or regulations. A template for the Contractor's use in preparing the BMP Plan is supplied in these documents.

1.2 Related Work

- A. Section 02110 - Site Clearing
- B. Section 02200 - Earth and Rock Work
- C. Section 02936 - Seeding

PART 2. PRODUCTS

Not used

PART 3. EXECUTION

As the permittee, submit the KPDES Notice of Intent (NOI) form to the Division of Water. Additionally, delegate in writing to Manager, KPDES Branch, who will have signature authority for reports. Provide the Engineer a copy of the NOI and a BMP Plan to represent and warrant compliance with the Kentucky Division of Water (KDOW) KPDES Permit, related rules, and specifications prior to starting work.

Locate, furnish, install, and maintain temporary sediment and erosion control best management practices (BMP) to represent and warrant compliance with the Clean Water Act, (33 USC Section 1251 et seq.), the 404 permit, the 401 Water Quality Certification, local government agency requirements, and other related rules and permits until the project has a formal release issued.

Provide the Engineer a copy of all weekly and rainfall event inspections as they are completed. Ensure all reports are signed by the delegated authority. Keep a current BMP Plan and all inspection records available for public inspection as required by the KPDES Permit.

These provisions survive the completion and/or termination of the contract. The following provisions must be followed:

1. Take full responsibility and make all corrections when a governmental agency or a local governmental authority finds a violation of the above noted requirements; that the BMPs are incomplete; that the BMP Plan is incomplete; or that the implementation of the BMP Plan is not being performed correctly or completely.

2. Make payment to the Owner for the full amount, within 10 Calendar Days of notification, when a governmental agency or a local governmental authority furnishes an assessment, damage judgment or finding, fine, penalty, or expense for a violation of the above noted requirements; the BMPs being incomplete; or the BMP Plan being incomplete or its implementation not being performed correctly or completely. The Owner may withhold the amount of money requested for the above from the next pay estimate and deliver that sum to the governmental agency or local governmental authority issuing the assessment, damage judgment or finding, fine, penalty or expense.

3. Indemnify and hold harmless the Department, and reimburse the Department for any assessments, damage judgment or finding, fine, penalty, or expense as a result of the failure of performing this portion of the Contract. The Owner may withhold the amount of any assessments, damage judgments or finding, fine, penalty or expense from the next pay estimate.

4. The Owner will find the Contract in default if a governmental agency or a local governmental authority furnishes a stop work order for any of the following: a violation of the above noted requirements, that the BMPs are incomplete, that the BMP Plan is incomplete, that the implementation of the BMP Plan is not being performed correctly or completely.

5. When the Owner or any government regulatory agency finds a violation of the above noted requirements, or that the BMPs are incomplete, or that the "BMP Plan is incomplete or that the implementation of the BMP Plan is not being performed correctly or completely, correct and mitigate the conditions within 48 hours of notification by the Owner or regulatory agency. Failure to correct non-compliant site conditions will result in the Owner applying a penalty of \$500 per day until corrective actions are completed.

Upon completion of the project, provide the Engineer with a copy of the submitted KPDES Notice of Termination (NOT) form. Retain all records for 2 years.

6. Maintenance of all BMPs at the site will be handled by a Contractor's employee or sub-contractor, who has been trained on construction site BMPs at workshops sponsored by the KY DOW and the Kentucky Erosion Protection and Sediment Control (KEPSC) Program. Other workers on-site will be trained in BMP installation, maintenance, and good housekeeping by this employee or sub-contractor.

These are the inspection and maintenance practices that will be used to maintain erosion and sediment controls:

- Areas at final grade will be seeded and mulched within 14 days.
- All measures will be maintained in good working order; if a repair is necessary, it will be initiated within 24 hours of being reported. This information will be logged on the SWPPP/BMP Plan.
- Silt fences will be inspected for bypassing, overtopping, undercutting, depth of sediment, tears, and to ensure attachment to secure posts. Bypasses will be repaired immediately.
- Built-up sediment will be removed from behind the silt fence before it has reached halfway up the height of the fence.
- The inlet sediment protection devices will be inspected for depth of sediment, and built-up sediment will be removed when it impairs flow into the inlet and at the end of the job.
- Diversion dikes and berms will be inspected and any breaches promptly repaired. Areas that are eroding or scouring will be repaired and re-seeded / mulched as needed.
- Temporary and permanent seeding and mulching will be inspected for bare spots, washouts, and healthy growth. Bare or eroded areas will be repaired as needed.

7. Inspection Procedures (Stormwater, Erosion, and Sediment Control Inspection Practices). Inspection of all BMPs at the site will be handled by the Contractor's qualified employee or sub-contractor, who has been trained on inspecting construction site BMPs at workshops sponsored by the KY DOW and the Kentucky Erosion Protection and Sediment Control (KEPSC) Program.

- All erosion prevention and sediment control measures will be inspected at least once each week and following any rain of one-half inch or more.
- The Contractor's erosion control inspector will train three other people who will be responsible for assisting in the inspections and installing, maintaining, and repairing the controls on the site.
- Inspection reports will be written, signed, dated, and kept on file for two years.

End of Section

SECTION 02110 - SITE CLEARING

PART 1. GENERAL

1.1 Work Included

- A. Furnish all labor and equipment required and perform all clearing, grubbing and stripping of topsoil complete as shown on the Drawings and as specified herein.
- B. Protect existing improvements and vegetation indicated to remain.
- C. Arrange and pay for disconnecting, removing, capping, and plugging utility services. Notify affected utility companies in advance and obtain approval before starting this work. Identify service lines and capping locations on Project Record Documents.

1.2 Related Work

- A. Section 02200 - Earthwork.
- B. Section 02935 - Seeding

1.3 Submittals

None required for this section.

PART 2. PRODUCTS

Not used

PART 3. EXECUTION

3.1 Protection

- A. Protect existing improvements, bench marks, monuments and other reference points.
- B. Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning of bark, piling construction materials or excavated materials within drip line, excess traffic or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to remain.

3.2 Site Clearing

- A. Remove trees, shrubs, grass and other vegetation, improvements, or obstructions, including walks, curbs, and paving, interfering with installation of new construction. All stumps, roots, and root clusters shall be grubbed out to a depth of at least two feet below subgrade elevation.
- B. Strip topsoil to whatever depths encountered in a manner to prevent mixing with subsoil or other material.

3.3 Removal

- A. Remove waste materials and unsuitable topsoil from site.

End of Section

SECTION 02200 - EARTH AND ROCK WORK

PART 1. GENERAL

1.1 Work Included

A. This section includes all labor, materials, equipment, and related items to complete all earth and rock work.

B. The extent of earth and rock work is shown on drawings.

- Top soil stripping is included as part of this work.
- Proof rolling is included as part of this work.
- All excavation (including rock excavation), filling and grading is included as part of this work.

1.2 Related Work Specified Elsewhere

A. Section 02100 - Erosion Control

B. Section 02110 - Site Clearing

C. Section 02936 - Seeding

1.3 Excavation Classification

A. All mass, structural, and trench excavation shall be considered unclassified. No adjustments will be allowed to the contract price for rock encountered during mass or structural excavation.

1.4 Quality Assurance

A. Codes and Standards: Perform earth and rock work in compliance with applicable requirements of governing authorities having jurisdiction. Applicable references include the following:

- ASTM D422 Particle Size Analysis of Soils.
- ASTM D423 Test for Liquid Limit of Soils.
- ASTM D424 Test for Plastic Limit and Plasticity Index of Soils.
- ASTM D698 Laboratory Compaction Characteristics of Soil Using Standard Effort
- ASTM D3017 Moisture content of Soil Aggregates in Place by Nuclear Methods (Shallow Depth).

B. Testing and Inspection Service: The Contractor will employ a testing laboratory to perform soil testing and inspection services for quality control testing during earth and rock work operations. Testing laboratory employed is to observe, test and report to the Engineer that the compaction requirements specified herein have been obtained.

1.5 Submittals

A. Test Reports-Excavating: Coordinate and schedule in a timely manner the following quality related items. The following reports shall be submitted directly to the Engineer from the testing services, with copy to the Contractor:

- Test reports on borrow material.
- Field density test reports of sufficient number to verify compaction of structural fill.
- One optimum moisture-density curve for each type of soil encountered. Determine particle size, liquid limit, plastic limit, plasticity index and maximum density of each type of soil.
- Observe proof-rolling.

1.6 Job Conditions

A. **Site Information.** Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that the Owner will not be responsible for interpretations or conclusions drawn by the Contractor. The data is made available for the convenience of the Contractor and is not guaranteed to represent all condition that may be encountered. No claim for extra compensation, or for extension of time, will be allowed on account of subsurface conditions inconsistent with the data shown. Additional test borings and other site examination and exploratory operations may be made by Contractor at no cost to Owner. Notify Owner prior to making any subsurface exploration.

B. **Groundwater.** Groundwater may be encountered during the excavation. Control the ground water to a level at least three feet below the top of the subgrade.

C. **Explosives.** Blasting shall only be conducted by licensed blasters and shall be in accordance with state and local requirements, and after conducting a thorough pre-blast survey.

D. **Protection of Persons and Property.** Barricade open excavations occurring as part of this work and post with warning lights.

E. **Bench Marks and Monuments.** Maintain carefully all bench marks, monuments and other reference points. If disturbed or destroyed, replace as directed at no cost to the owner.

F. **Notify the Engineer 48 hours prior to the beginning of any excavation work.**

PART 2. PRODUCTS

2.1 Materials

A. Definitions:

- **Satisfactory soil:** Materials complying with Unified Soil Classification System (USCS), ASTM D 2487-93, soil classification group ML, CL or CL-ML and CH soil with plasticity index of less than 35. Testing of borrow materials shall include the following:
 - Moisture-Density Relationship (ASTM D 698)
 - Particle Size Analysis (ASTM D 1140 and ASTM D 422)
 - Liquid Limit, Plastic Limit, Plasticity Index (ASTM D 4318)
 - Visual Inspection by a Geotechnical Engineer (ASTM D 2488)
- **Unsatisfactory soil:** Materials as defined in USCS soil classification groups OL, CH with plasticity index of 35 or more, MH and OH; also, peat and other highly organic soils.
- **Subbase Material:** Satisfactory soil (as described above, or naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand.

PART 3. EXECUTION

3.1 Excavation

A. **Excavation** consists of removal and disposal of material encountered when establishing required finish grade elevations. For the purpose of this contract, mass, structural and trench excavation of all materials shall be considered unclassified. Adjustments for rock or similar materials will not be considered.

B. Unauthorized excavation. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer.

- Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense.
- Backfill and compact unauthorized excavations, as specified for authorized excavations of same classification, unless otherwise directed by Engineer.

C. Additional Excavation. When excavation has reached required subgrade elevations, notify Engineer who will make an inspection of conditions.

- If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by Engineer.
- Removal of unsuitable bearing material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.

D. Stability of Excavations. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restriction or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

E. Shoring and Bracing. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross-braces, in good serviceable condition.

- Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
- Maintain shoring and bracing in excavations, regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

F. Dewatering. Prevent surface water and subsurface or ground water from flowing into excavations and flooding project site and surrounding area.

- Do not allow water to accumulate in excavations. Remove water to prevent softening of excavation bottoms and soil changes detrimental to stability of subgrades. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
- Convey water removed from excavations and rain water to collecting or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches. Site grading should be maintained during construction so that positive drainage of the site is promoted at all times.

G. Material Storage. Stockpile satisfactory excavated materials, where directed by Engineer, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

- Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
- Dispose of excess soil material and waste materials as herein specified.

H. Cold Weather Protection. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F (1 degree C).

I. Proofrolling. After excavation and before any fill placement, entire subgrade shall be proof-rolled with two coverages of a loaded dump truck or scraper. Areas found to be soft or pumping by the testing/inspection agency shall have the soft soil removed and replaced with structural fill and compacted as outlined herein.

3.2 Compaction

A. General. Control soil compaction during construction, providing minimum percentage of density specified for each area classification.

B. Lift Thickness. The maximum final compacted thickness of each lift of soil material shall be six inches.

C. Percentage of Maximum Density Requirements. Compact soil to not less than 95 percent of their Standard Proctor maximum dry density (ASTM D 698).

D. Moisture Control. Maintain soil moisture at minus one to plus three percent of optimum moisture content: Where soil must be moisture conditioned before compaction, uniformly apply water to prevent free water from appearing on surface during or subsequent to compaction operations. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by dicing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3.3 Backfill and Fill

A. General. Place acceptable soil material in layers to required subgrade elevations.

B. Backfill excavations as promptly as work permits, but not until acceptance of construction below finish grade and removal of trash and debris.

C. Ground Surface Preparation. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

D. Placement and Compaction. Place backfill and fill materials in layers to provide lift thickness.

3.4 Grading

Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

3.5 Field Quality Control

A. Quality Control Testing During Construction. Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed. It shall be the Contractor's responsibility to notify the testing agency at least 24 hours prior to beginning any work which requires testing.

B. If in opinion of Engineer, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense to the Owner.

3.6 Maintenance

A. Protection of Graded Areas. Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Repair and reestablish grades in settled, eroded and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas. Where completed compacted areas are disturbed by subsequent construction operations or weather, scarify surface, reshape and compact to required density prior to further construction.

C. Settling. Where settling is measurable or observable at excavated areas during general project warranty period, add backfill material, compact, and replace surface treatment. Restore appearance, quality and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

D. Desiccation. Where desiccation cracks are observable, remove and replace soil to restore appearance, quality and condition of surface.

3.7 Disposal of Excess and Waste Materials

Removal to Designated Areas On Owner's Property. Transport acceptable excess excavated material to designated soil storage areas on Owner's property. Stockpile soil or spread as directed by Engineer.

End of Section

SECTION 02512 - CRUSHED STONE PAVING

PART 1. GENERAL

1.1 Work Included

Furnish all material, labor and equipment and construct all crushed stone pavement.

1.2 Related Work

A. Section 02200 - Earthwork.

PART 2. PRODUCTS

2.1 Crushed Stone

A. Coarse Aggregate. Aggregate retained on a No. 4 sieve shall be crushed stone meeting applicable quality requirements of Kentucky Department of Highways Specifications, shall be produced from an approved quarry, and shall be capable of withstanding the effects of handling, spreading and compaction without appreciable degradation.

B. Fine Aggregate. The material passing the No. 4 sieve shall consist of particles from the operation of crushing coarse aggregate at the approved source. Its minus No. 40 sieve size fraction shall not have a liquid limit greater than 30 or a plasticity index greater than 4.

C. Gradation Requirements for Subbase.

<u>Sieve Size</u>	<u>Percent Passing</u>
2 1/2 inch	100
2 inch	95-100
1 inch	35-70
1/2 inch	10-30
No. 4	0-5

D. Gradation Requirements for Surfacing Aggregate.

<u>Sieve Size</u>	<u>Percent Passing</u>
1 1/2 inch	100
3/4 inch	75-100
No. 4	35-65
No. 30	12-65
No. 200	6-15

PART 3. EXECUTION

3.1 Preparation of Subgrade

A. Clearing and grubbing, rough grading, and all utility work shall be complete prior to final grading in preparation for placing the base.

B. All utility trenches shall be back filled and thoroughly tamped to minimize settlements.

C. Grading shall be sufficient to ensure good drainage and prevent ponding.

D. The subgrade shall be checked to ensure that it is true to grade, free from ruts, and uniformly firm.

SECTION 02512 - CRUSHED STONE PAVING

E. Where required, coarse graded crushed stone shall be incorporated into the top soil layer at specified rate, and recompactd

3.2 Constructing the Crushed Stone Base

A. The crushed stone base material shall be proportioned and mixed in a pugmill and delivered to the site at a moisture content suitable for immediate compaction.

B. Mechanical spreaders designed to lay the base material true to line and grade shall be used. Loose stone layer depths shall not exceed 9 inches.

C. The base material shall be compacted with vibratory rollers immediately upon completion of the spreading operation. Crushed stone shall be compacted at optimum moisture content (plus or minus 1 1/2 percent) as determined by ASTM D 1557 100 percent of maximum density as determined by ASTM D 1557, Method D.

End of Section

SECTION 02600 - WATER DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.01 Work Included

The work called for by this section includes furnishing all labor, materials and equipment to install the water lines, valves and blow-offs as shown on the plans and as specified herein.

1.02 Delivery and Storage

Notify the Engineer when pipe will be received on the job so that proper arrangements may be made for inspecting the unloading operations and examining the pipe materials.

PART 2 - PRODUCTS

2.01 Polyvinyl Chloride Pipe and Fittings

- A. Pipe. PVC pipe shall meet ASTM Specifications D-1784 for material and D-2241 for pipe, latest revisions. Pipe shall also meet all applicable provisions of the Product Standards and shall bear the National Sanitation Foundation (NSF) seal of approval in compliance with NSF Standard No. 14. PVC pipe having a maximum hydrostatic working pressure of 160 psi (SDR26), 200 psi (SDR21), 250 psi (SDR17), or 315 psi (SDR13.5) shall be used as required.

The workmanship, pipe dimensions and tolerances, outside diameters, wall thickness, eccentricity, sustained pressures (ASTM D-1598), burst pressures (ASTM D-1599), flattening, extrusion quality (ASTM D-2152), marking and all other requirements of the Product Standard PS 22-70 shall be conformed with in all respects.

Pipe shall be furnished in 20 foot or 40 foot lengths. The pipe may be double plain end or with bell on one end. Male ends of pipe must be beveled on the outside. Pipe shall have a ring painted around the male end or ends in such a manner as to allow field checking of setting depth of pipe in the socket.

Pipe shall be joined with slip-type joints with rubber gaskets. Pipes with bells shall have all part of the bell, including the gasket groove, made from the same extruded piece, integral with the pipe, and shall be thickened to meet standard dimension ratios of wall thickness to outside diameter. The gasket groove shall be constructed such that gasket rollout will not occur. Rubber gasket shall conform to ASTM 1869. Joint lubricant shall be of a type recommended by the manufacturer for their pipe. Lubricant shall be water soluble, non-toxic and have no objectionable properties.

- B. Fittings. Cast or ductile iron mechanical joint or push-on type fittings with appropriate adapters shall be used with PVC pipe. All such fittings shall be approved by the pipe manufacturer. Fittings shall comply with AWWA C-110 or C-111 and shall be manufactured for the size and pressure class of the line on which they are used. Use of transition gaskets will not be allowed unless specifically approved by the pipe

manufacturer.

2.02 Municipal Polyvinyl Chloride (MPVC) Pressure Pipe

- A. Pipe. MPVC pipe shall meet the requirements of AWWA C-900 or C-905, latest revision, and shall be furnished in cast-iron pipe equivalent outside diameters with rubber-gasketed separate couplings.

MPVC pipe and couplings shall be made from Class 12454-A or Class 12454-B virgin compounds as defined in ASTM D-1784. The standard code designation shall be PVC 1120. The PVC compounds shall be tested and certified as suitable for potable water products by the NSF Testing Laboratory and shall carry the NSF approval marking.

Solvent-cement couplings or joints shall not be used. PVC joints using elastomeric gaskets shall be tested as assembled joints and shall meet the laboratory performance requirements specified in ASTM D-3139.

Pipe and couplings shall be marked with nominal size and OD base, material code designation (PVC 1120), dimension ratio number, AWWA pressure class, AWWA designation number (C900 or C905), manufacturers name or trade-mark and production record code; and seal of the NSF Laboratory.

Pipe shall be joined with slip-type joints with rubber gaskets in accordance with manufacturer's instruction.

- B. Fittings. Fittings for municipal PVC shall be cast-iron or ductile iron only. Either push-on or mechanical joints may be used. Fittings shall be manufactured for the size and pressure class of the line on which they are used and shall comply with AWWA C-110 or C-111.

2.03 Cast Iron Pipe

Gray cast iron pipe shall be designed in accordance with AWWA H1, and for pressures and conditions as stated in these specifications. The specific wall thickness will be determined for the given internal and external loading requirements in accordance with AWWA H1. The class of pipe required will be shown on the plans and/or bid documents. The net weight, class or nominal thickness and sampling period shall be marked on each pipe.

All cast iron pipe for water service shall be bituminous coated outside and cement lined with seal coat on the inside. Cement mortar lining and bituminous seal coat inside shall conform to AWWA C-104.

Cast iron mechanical, rubber ring slip and flanged joints shall conform to AWWA C-110 for centrifugally cast iron water pipe. Mechanical joints shall also conform in all respects to AWWA C-111. Fittings shall be manufactured for the size and pressure class of the pipeline in which they are to be used. Fittings shall be bituminous coated outside and lined on the inside same as the line on which they are installed.

All cast iron flanged pipe shall have flanges faced and drilled, 125 pound in accordance with AWWA C-110 unless otherwise specified. Flanges may be cast integrally with the pipe or they may be screwed on specially designed long hub flanges, refaced across both face of flange and end of pipe.

Flanged pipe shall be in accordance with AWWA C-106 specifications, latest revisions. Where plain ends of flanged and plain end pipe fit into mechanical joint bells, centrifugally cast pipe shall be used. Flanged pipe for water service shall be cement lined and bituminous coated the same as written herein for bell-joint pipe.

Flexible couplings for flanged pipe shall be a mechanical joint cast to a special flanged joint using a neoprene O-ring in place of the usual 1/16 inch rubber ring gasket. The mechanical bell and special flanged joint piece shall be of high grade gray cast iron in accordance with AWWA C-100. Mechanical joint follower flange shall be of ductile iron ASTM A399 or malleable iron ASTM A47, Grade 35018 or 32510, latest revision, with high strength/weight ratio design.

Bolts shall be fine grained high tensile malleable iron with malleable iron hexagon nut. Stainless steel nuts shall be used in vaults and wet wells.

2.04 Ductile Iron Pipe

Ductile iron pipe shall be designed in accordance with AWWA 113 and for pressures and conditions as stated in these specifications or called for on the plans or bid documents. Ductile cast iron pipe shall conform to AWWA C-151. The net weight, class or nominal thickness and sampling period shall be marked on each pipe.

Mechanical joints are to be furnished according to AWWA Specifications C-111. All pipe joints must be furnished complete with all accessories. Mechanical joint bolts and nuts shall be of alloy cast iron or alloy steel (Corten type such as U.S. Alloy) or equal. Rubber gaskets shall be made of plain first grade rubber, free of imperfections and porosity. Hardness shall be 70 to 75 durometer. Rubber ring slip joints shall be equal to AWWA C-111.

All pipe for water service shall be bituminous coated outside and cement lined with seal coat on the inside per the above specifications. Cement mortar lining and bituminous seal coat inside shall conform to AWWA C-104.

Cast iron mechanical, rubber ring slip and flanged joints shall conform to AWWA C-110 for centrifugally cast iron water pipe. Mechanical joints shall also conform in all respects to AWWA C-111. Fittings shall be manufactured for the size and pressure class of the pipeline in which they are to be used. Fittings shall be bituminous coated outside and lined on the inside same as the line on which they are installed.

All cast iron flanged pipe shall have flanges faced and drilled, 125 pound in accordance with AWWA C-110 unless otherwise specified. Flanges may be cast integrally with the pipe or they may be screwed on specially designed long hub flanges, refaced across both face of flange and end of pipe. Flanged pipe shall be in accordance with AWWA C-106, and be the class called for on the plans or bid forms. Where plain ends of flanged and plain end pipe fit into mechanical joint bells, centrifugally cast pipe shall be used. Flanged pipe for water service shall be cement lined and bituminous coated the same as written herein for bell-joint pipe.

Flexible couplings for flanged pipe shall be a mechanical joint cast to a special flanged joint using a neoprene O-ring in place of the usual 1/16 inch rubber ring gasket. The mechanical bell and special flanged joint piece shall be of high grade gray cast iron in accordance with AWWA C-100. Mechanical joint follower flange shall be of ductile iron ASTM A399 or malleable iron ASTM A47, Grade 35018 or 32510, latest revision, with high strength/weight ratio design.

Bolts shall be fine grained high tensile malleable iron with malleable iron hexagon nut. Stainless steel nuts shall be used in vaults and wet wells.

2.05 River Crossing Pipe

River crossing pipe shall meet all provisions of ASA Specifications A-21.6. Pipe bells and glands shall be 70-50-05 ductile iron with suitable rubber sealing gaskets.

2.06 Gate Valves

- A. Underground. All underground gate valves shall be of the resilient seat type, iron body, non-rising stem, fully bronze mounted, asphalt varnish coated outside and suitable for working water pressures of 200 PSI. 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-509. 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. 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 shall be resilient seat type, iron body, flanged, fully bronze mounted with O-ring seals, asphalt varnish or epoxy coated outside and suitable for working water pressures of 200 PSI. 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-509. Unless otherwise shown on the plans, all housed gate valves shall be outside stem and yoke - handwheel operated.

Valve stand handwheels and handwheels on extended stems, shall have the same minimum diameters as those shown for handwheels directly on valves. Extension stems for O, S & Y valves shall be non-rising, with clamp to valve handwheel and hollow shaft for rising stem of valve, with adjustable cast iron guides per each ten (10) feet of extensions 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 extensions stem connections shall be stainless steel.

2.07 Check Valves

Check valves shall be swing gate type. All check valves shall be standard iron body with passage of full pipe area when swing gate is open. The valve shall be of the outside lever weight-operating

type with an adjustable closure rate. The valve must be tight seating 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.

2.08 Butterfly Valves

- A. Dezurik, Figure No. 632-LD, Dresser, Keystone, or approved equal, lug style, semi-steel body, bronzed discs with stainless steel shafts, bronze bushings and infinite position adjustment lever on valves 4" and smaller and enclosed handwheel actuators on all valves 6" and larger. Valves for buried service shall use stainless steel bolts and 2 inch square nut actuator (Dezurik Figure No. 309 or 615) actuator shall be for buried/submerged service.

2.09 Pressure Reducing Valves

Pressure reducing valves shall be hydraulically operated of the self-contained differential piston type. The valve body shall be cast iron of the globe or angle type. The valve is to be bronze fitted with renewable lining and seating components. The valve shall be pilot controlled and diaphragm operated. The valve shall be air and water cushioned to prevent hammer or shock. Bronze castings shall conform to ASTM B-62 and the cast iron body and lid shall conform to ASTM A-126, Class B.

2.10 Air Release Valves

- A. Automatic Air Release Valves. A valve designed to automatically allow exhaust of small pockets of air from the water main while in use shall be installed where shown on the plans or where directed by the Engineer. The air release valve shall have a 3/4" iron pipe thread inlet, cast iron body construction, bronze trim, with all internal parts of stainless steel or bronze. The valve shall have an orifice size of 5/64" or greater. Valves shall be suitable for a working water pressure of 200 PSI. The air release valve shall be mounted on 3/4", Schedule 80, galvanized steel riser pipe. The riser pipe shall be connected to the water main by use of a service clamp and a corporation stop as shown in the standard details. The riser shall also have a 3/4", bronze gate valve with a tee-handle, solid wedge type, inside I.P. threads, suitable for a 200 PSI working water pressure. Equipment shall be as manufactured by Mueller, Ford, Crane, Valve and Primer or approved equal.
- B. Manually Operated Air Release Valves. A manually operated valve designed to allow for exhausting small pockets of air from the water main while in use shall be installed where shown on the plans or where directed by the Engineer.

The assembly consists of yoke or coppersetter of the type used for service meter installation. The setter shall be constructed from brass or copper materials in accordance

with AWWA C-800. The setter shall have 5/8" angle meter stops or ball valves on both ends and shall be connected to the water main by use of polyethelene service tubing, two service clamps and two corporation stops as shown in the standard details.

2.11 Valve Boxes

All valves (gate, air release, check, etc.) installed underground shall be installed in a vertical position in an approved valve box.

Gate valve boxes shall be of a cast iron, two or three-piece, slip-type consisting of a base, a center section and a top section with a covered marked "WATER". Where valve box is constructed in a paved area, the box shall be a screw type box. The entire assembly shall be adjustable for elevation and shall be set vertically and be properly adjusted so that the cover will be flush with the finished grade.

Air release valves will be installed in the same type of box as is used for meters. As described in these specifications the box may be cast iron, concrete, or concrete pipe. The box must allow for adequate cover over the pipe at the installation.

Check valves installed underground will be installed in the meter box type installation using concrete pipe and a meter box cover. The installation will utilize a suitable pipe diameter to accommodate the valve and accessories in accordance with the standard details. The box must allow for adequate cover over the pipe at the installation.

2.12 Blow-off Assemblies

The blowoff pipe from the main to the flush valve shall be of the same material as the main and connected to the main by means of a tee. Do not use a corporation stop for this connection. The gate valve for the blow-off connection shall be a bronze gate valve with tee-handle, solid wedge type, inside I.P. threads. All pipe beyond the gate valve shall be galvanized iron pipe, Schedule 80, with Class 300 malleable iron fittings. Contractor shall install a length of hose in each valve box as shown in the Standard Details. The valve enclosure shall be constructed of an 18-inch diameter by 30-inch depth concrete or vitrified clay pipe or cylinder. The cover shall be of cast iron construction, 4 inches deep with a non-recessed lid, with cast letters "WATER" and a pentagon lock nut.

2.13 Fire Hydrants

All fire hydrants shall be of the compression type, with cast iron body, fully bronze-mounted, suitable for working pressure of 200 pounds per square inch and shall be in accordance with AWWA C-502. Hydrants shall have two 2-1/2" hose connections and a 4-1/2" steamer connection with National Standard threads.

Hydrants shall be constructed in a manner permitting withdrawal of internal working parts without disturbing barrel or casing. Hydrants shall have dry-top design and non-rising stem and be frost-proof. Valve, when shut, shall be reasonably tight if upper portion of barrel should be

broken off. Waterway of hydrants shall be not less than 6" throughout and valve opening shall be at least 5 1/4" in diameter. There shall be no chattering under any conditions of operation. Each hydrant shall be tested to a hydrostatic pressure of 300 PSI with valve in both opened and closed position. The direction of opening shall be cast in the head of the hydrant. Hydrants shall be painted with one coat of red lead and two finishing coats of Koppers Ponkote Enamel for hydrants or approved equal, color to be selected by Engineer.

Hydrants shall have mechanical connection directly to lines. Valves supplied with hydrants shall have mechanical joints and may be connected directly to hydrant or may be on hydrant service as shown in the Standard Details. One operating and spanner wrench shall be furnished with each hydrant with a maximum of three provided on any one project. Extensions for extra depth shall be included in the cost of hydrants. One disassembly wrench shall be supplied for the project. Concrete thrust blocking, hydrant bedding and main line tee as shown in the Standard Details are to be included in the unit price for hydrant installation.

Hydrants shall be set so that outlets are not less than 15 inches above the ground, plumb and at a distance of 18 inches from the outside of the curb. If no curb exists, hydrant is to be set four feet from the property line or as shown on the plans.

PART 3 - EXECUTION

3.01 Installation of Water Lines

- 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. 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 water line materials and protective coatings and linings. Scratching of the exterior surface of the pipe will be cause for rejection of the pipe.

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 installed, 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 left temporarily at any other time.

- B. Cast or Ductile Iron Pipe. Cast or ductile iron bolted joint, rubber ring slip joint, and ball and socket river crossing pipe shall first be thoroughly cleaned at joints, then joined according to manufacturer's instructions.

All pipes must be forced and held together, or "homed" at the joints, before sealing or

bolting. Pipe must be aligned as each joint is placed, so as to present as nearly true, straight lines and grades as is practical, and all curves and changes in grades must be laid in such a manner that the maximum deflection is not exceeded at any joint.

When using pipe with push-on joints, care must be exercised to make certain that the correct gasket is being used for the type of joint installed and that the gasket faces the proper direction. Before inserting the gasket, the groove and bell socket should be carefully cleaned of all dirt. If sand or dirt is permitted to remain in the groove, leaks may occur. Lubricant must be applied to bell socket, gasket and plain-end of pipe as required by manufacturer. Plain-end must be beveled before joint is made. Deflection required at the joint shall be obtained after the joint is made.

- C. PVC and MPVC Pipe. Where good bedding conditions are attained, PVC pipe smaller than four inches may be assembled outside the trench in longer sections (as conditions allow) and then lowered into the trench. At any time when improper bedding is discovered or the pipe is severely deflected the pipe will be removed from the trench and the condition corrected. Pipe in sizes four inch and above may be assembled outside the trench but must be lowered into the trench as each joint is assembled. Regardless of installation methods of couplings must be inspected after laying in trench for proper insertion and alignment. Field cuts and bevels will be allowed in accordance with the manufacturer's instructions for these operations.

Municipal PVC pipe of all sizes must be assembled in the trench in strict accordance with the manufacturer's requirements.

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. Thrust blocks shall 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 in accordance with the following pipe materials and under normal stable earth trenching conditions:

Pipe	Bedding
PVC (4 inches and smaller), copper, galvanized	earth trench bottom (leveled)
PVC (above 4 inches)	compacted earth backfill
C.I. and D.I. (less than 4 inches)	compacted earth backfill
C.I. and D.I. (4 inches diameter and above)	compacted crushed stone backfill

- B. Special Pipe Foundation. When directed 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 on a shelf, 2 feet above and 2 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 uncovered and encased with concrete per the standard encasement detail.
- 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, 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 two feet above the sewer line, encase the water line five feet in each direction from the crossing.

3.05 Tie-ins to Existing Pipelines

This work shall consist of connecting new water pipes to the existing system where shown on the plans and shall include the necessary fittings, tapping sleeves, valves and necessary equipment and material required to complete the connection.

Knowledge of pipe sizes in the existing system may not be accurate, therefore, it is recommended that the Contractor check outside diameters of existing pipe and types of pipe prior to ordering the required accessories. No additional payment will be allowed for machining pipe and/or accessories when the proper size is not ordered.

Neither the Owner nor the Engineer can guarantee the location of the existing lines. The Contractor shall verify the location of all existing water mains and valves pertaining to the proposed improvements before excavation is started.

Before shutting down an existing water main or branch main for a proposed connection, prior approval for a specific time and time interval shall be obtained from the Owner. At no time shall an existing main be shut without the Owner's knowledge and permission.

Excavation to existing water mains shall be carefully made, care being exercised not to damage the pipe. The excavation shall not be of excessive size or depth beneath the pipe. The sides of the excavation shall be as nearly vertical as possible.

The Contractor shall be responsible for any damage to the existing system and any such damage shall be repaired at the Contractor's expense.

3.06 Pipe Entering Structures

Cast iron, steel, or PVC pressure pipe, 4-inch diameter or larger, entering structure below original earth level, unsupported by original earth for a distance of more than six (6) feet, shall be supported by Class E concrete, where depth of such support does not exceed three (3) inches in accordance with the Standard Details. All other pressure pipe entering buildings or basins below original earth level, which have more than 3 feet span between wall and original earth and having a cover of more than 24 inches of earth, or under roadway, shall be supported as shown on Standard Detail drawings, in order to prevent breakage from settlement of backfill about the structure. Concrete and reinforcing steel for such supports are to be included in the unit price of work to which it is subsidiary, and not as extra concrete. Pipe entering structures shall have flexible joint within 16 inches of exterior of structure.

3.07 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 Engineer shall be given a minimum of twenty four hours for inspection before backfilling. 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. For PVC only the backfill shall be select material and may be walked-in. 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.

3.08 Pavement Replacement

Where conditions permit, pavement shall not be placed until 30 days have passed since placing backfill. Crushed stone as specified for roads and parking areas and sidewalks or their bases shall be placed and compacted to the top of trench. Backfill shall be maintained easily passable to traffic at original ground level, until acceptance of project or replacement of paving or sidewalks.

3.09 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.

3.10 Hydrostatic Tests

The Contractor will be required to pressure test all pipelines and appurtenances with water at the 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 shall be applied for not less than four hours and all pipes, fittings, valves, hydrants and joints shall be carefully examined for defects or leakage. Any observed leakage shall be corrected.

Wherever practicable, corporations 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.

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.

The test shall be made between valves as far as practical in sections of pipe approximately 1,000 to 3,000 feet in length and shall, in general, be made within twelve working days of the completion of each section of line.

No pipe shall be accepted unless or until the leakage, determined by this test, is less than 5 U.S. gallons over 24 hours, per 1,000 feet, per inch nominal diameter of pipe.

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.

3.11 Disinfection

All water piping shall be thoroughly disinfected before being placed in service, by the use of chlorine or chlorine compounds in such amounts as to produce an initial concentration of at least 50 ppm and a residual of at least 25 ppm at the end of 24 hours, followed by thorough flushing. If for some reason, the initial disinfection fails to result in a 25 ppm residual, or the initial concentration does not achieve at least 50 ppm, the process shall be repeated until said 25 ppm residual is obtained after the 24 hour period. All disinfection shall be accomplished in a manner satisfactory to the Engineer and the Division of Water.

All valves in the lines including check and altitude valves shall be opened several times during the sterilization process.

3.12 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 restoration is complete and all equipment, excess material and temporary structures have been removed.

End of Section

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 and PVC 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 PVC 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 and PVC 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 Air Release Valves

A valve designed to allow release of air from the pump discharge shall be installed when required by the plans. The valve shall be cast iron, bronze-fitted, with stainless steel float. Valve shall be of the size shown on the plans and equipped with discharge pipe.

2.05 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.

2.06 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.

2.07 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.

2.08 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 l/r ratio 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.

2.09 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.

2.10 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.

2.11 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.

2.12 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 02732 - FORCE MAINS

PART 1. GENERAL

1.1 Work Included

The Contractor shall furnish all material, labor and equipment required to install the force mains as shown on the plans and as specified herein.

1.2 Submittals

Submit manufacturer's specifications for materials and installation instructions. Include test reports showing compliance with project requirements where test method is indicated.

1.3 Delivery and Storage

Notify the Engineer when pipe will be received on the job so that proper arrangements may be made for inspecting the unloading operations and examining the pipe materials.

PART 2. PRODUCTS

2.1 Polyvinyl Chloride Rigid Pipe and Fittings

A. Pipe. PVC pipe shall meet ASTM Specifications D-1784 for material and D-2241 for pipe, latest revisions. Pipe shall also meet all applicable provisions of the Product Standards and shall bear the National Sanitation Foundation (NSF) seal of approval in compliance with NSF Standard No. 14. PVC pipe having a maximum hydrostatic working pressure of 160 psi (SDR26), 200 psi (SDR21), 250 psi (SDR17), or 315 psi (SDR13.5) shall be used as required.

The workmanship, pipe dimensions and tolerances, outside diameters, wall thickness, eccentricity, sustained pressures (ASTM D-1598), burst pressures (ASTM D-1599), flattening, extrusion quality (ASTM D-2152), marking and all other requirements of the Product Standard PS 22-70 shall be conformed with in all respects.

Pipe shall be furnished in 20 foot or 40 foot lengths. The pipe may be double plain end or with bell on one end. Male ends of pipe must be beveled on the outside. Pipe shall have a ring painted around the male end or ends in such a manner as to allow field checking of setting depth of pipe in the socket.

Pipe shall be joined with slip-type joints with rubber gaskets. Pipes with bells shall have all part of the bell, including the gasket groove, made from the same extruded piece, integral with the pipe, and shall be thickened to meet standard dimension ratios of wall thickness to outside diameter. The gasket groove shall be constructed such that gasket rollout will not occur. Rubber gasket shall conform to ASTM 1869. Joint lubricant shall be of a type recommended by the manufacturer for their pipe. Lubricant shall be water soluble, non-toxic and shall have no objectionable properties.

B. Fittings. Cast or ductile iron mechanical joint or push-on type fittings with appropriate adapters shall be used with PVC pipe. All such fittings shall be approved by the pipe manufacturer. Fittings shall comply with AWWA C-110 or C-111 and shall be manufactured for the size and pressure class of the line on which they are used. Use of transition gaskets will not be allowed unless specifically approved by the pipe manufacturer.

2.2 Ductile Iron Sewer Pipe

Ductile iron sewer pipe installed underground shall be Class 50, tar coated outside and inside in accordance with AWWA specifications. The joints for ductile iron sewer pipes shall be of the push-on type and shall have an annular recess in the pipe to accommodate a single rubber gasket. Plain spigot ends shall be suitably beveled to permit easy entry into the bell. A gasket and annular recess of the socket shall be so designed and shaped that the gasket is located in place against displacement as the joint is assembled.

2.3 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.

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 at 73°F for low pressure 100 and 150 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.

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.

Polyethylene pipe lengths, fittings and flanged connections to be fused shall be of the same type, grade and class of polyethylene compound.

2.4 Plug Valves

Valves shall comply with AWWA C504 and C507. Valve body shall be stainless steel. Plugs shall be resilient faced with neoprene, suitable for use with sewage. Bearings shall be stainless steel. 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. Valves shall be DeZurik or approved equal.

2.5 Sewage Air Release Valves

Sewage air release valves shall be of the type that automatically releases air, gas or vapor under pressure during operation. Valves shall have 2" inlet and 1/2" outlet. Valves shall be Valmatic Model No. 48BWA with 3/16" orifice, or APCO Model No. 400 with backflushing attachments, or approved equal.

2.6 Valve Boxes

All valves (plug, air release, check, etc.) installed underground shall be installed in a vertical position in an approved valve box.

Plug valve boxes shall be of a cast iron, two or three-piece, slip-type consisting of a base, a center section and a top section with a cover marked "SEWER". Where valve box is constructed in a paved area, the box shall be a screw type box. The entire assembly shall be adjustable for elevation and shall be set vertically and be properly adjusted so that the cover will be flush with the finished grade.

Air release valves will be installed in the same type of box as is used for meters. As described in these specifications the box may be cast iron, concrete, or concrete pipe. The box must allow for adequate cover over the pipe at the installation.

Check valves installed underground will be installed in the meter box type installation using concrete pipe and a meter box cover. The installation will utilize a suitable pipe diameter to accommodate the valve and accessories in accordance with the standard details. The box must allow for adequate cover over the pipe at the installation.

PART 3. EXECUTION

3.1 Clearing

Clearing and grubbing includes the cutting and removal of trees, stumps, brush, roots, logs, fences and other loose or projecting material and natural obstructions which must be removed to properly prosecute the construction and operate the facilities upon completion of construction. Protect trees, ornamental shrubs, plantings, fences, walls, and other improvements from the construction activity.

3.2 Trenching

Open the trench far enough ahead to reveal any obstruction that may necessitate changing the line or grade of the pipe.

Trench shall provide six inches of clearance on each side and below all pipe and fittings to provide working space and to permit proper backfilling around the pipe.

3.3 Shoring, Sheet piling and Bracing of Excavation

Where unstable material is encountered, or where the depth of the excavation in earth exceeds five feet, support the sides of the trench or excavation by sheet piling, bracing, or shoring. The design and installation of all sheet piling, sheet piling, bracing or shoring shall be based on computations of pressure exerted by the materials to be retained. Proper shoring of excavations will be the responsibility of the Contractor. The Standards of the Federal Occupational Safety and Health Act and the Kentucky Department of Labor shall be followed.

3.4 Removal of Water

Provide adequate removal of all water and the prevention of surface water from entering the excavation. Maintain dry conditions within the excavations until the backfill is placed. All water pumped or drained from the excavation shall be disposed of in a suitable manner without damage to adjacent property or to other work under construction.

3.5 Bedding of Pipe

Prepare the bedding so that the entire load of the backfill on top of the pipe will be carried uniformly on the barrel of the pipe.

Trench bottoms shall be smooth and free of frozen material, dirt clods and stones over 1/2" diameter. A layer of soft backfill must be provided to ensure the pipe barrel is properly cushioned. Crushed stone, fine gravel, sand or compacted finely graded select earth shall be used to correct irregularities in the subgrade. Holes shall be excavated to prevent the bells from being supported on undisturbed earth.

If unstable material is encountered which may not provide a suitable foundation for the pipe, the unstable material will be removed and an adequate layer of encasement concrete or other special bedding shall be placed for the pipe foundation. Such "special pipe foundation" shall only be installed when directed by the Engineer in writing or on the plans.

3.6 Pavement Removal

Only one-half (1/2) of the street crossings or road crossings shall be excavated before placing temporary bridges over the side excavated, for the convenience of the traveling public. All backfilled ditches shall be maintained in such a manner that they will offer no hazard to the passage of traffic. The convenience of the traveling public and the property owners abutting the improvements shall be taken into consideration. All public or private drives shall be promptly backfilled or bridged. Pavement replacement shall be in accordance with these specifications.

3.7 Pipe Installation

All pipe must be tested for uniform diameter, straightness and defects. Pipe found defective, not meeting specifications, or improperly installed shall be rejected and replaced.

The interior of the pipe shall be cleaned of dirt, jointing materials, and other substances. When pipe installation is stopped for any reason, the exposed pipe end shall be closed to exclude earth and other material.

Joining of pipes and fittings shall be performed in accordance with the pipe manufacturer's recommendations as to equipment and technique.

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 and alignment. 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.

3.8 Thrust Blocking and Anchorage

All fittings, either vertical or horizontal, shall be braced or anchored against the tendency of movement with concrete thrust blocking, joint harness, or approved equivalent anchors to the satisfaction of the Engineer. Where joint harness is used, all component parts shall be stainless steel.

3.9 Water and Sewer Separation

Sewer lines must, if possible, be located a minimum lateral distance of 10 feet from existing water lines measured from outside diameters. Whenever this condition cannot be met, the sewer line must be located at least two feet below and two feet to the side of the water line. Wherever sewer lines and water lines cross the sewer line must be at least 24 inches below the water line.

3.10 Pressure Testing

Prior to the final inspection, the Contractor shall have taken the necessary steps to remove all dirt, debris and obstructions from the interior of all lines. The finished lines shall be pressure tested and comply with

the revisions listed herein, or similar requirements insuring equal or better results. Where leaks are visible or evident, the joints or pipes shall be remade and leakage minimized, regardless of total leakage as shown by test.

The force mains shall be tested at 100 PSI for 2 hours. The pumping equipment shall be detached during the test. An acceptable test shall be one in which the pressure holds during the test period as witnessed by the Engineer. Care shall be taken to ascertain that all air has been expelled from the lines prior to the test.

3.11 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 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 02936 - SEEDING

PART 1. GENERAL

1.1 Work Included

The work described herein shall consist of replacing the surface soil, furnishing and incorporating the materials, for all exposed earth areas.

1.2 Submittals

Submit certificates of analysis and weight for all fertilizers to the Engineer. All seed shall be delivered in separate bags or packages according to species. The tags from each package shall be delivered to the Engineer.

PART 2. PRODUCTS

2.1 Seed

Seed shall be certified seed to be the latest season's crop and shall be delivered in original sealed packages bearing the producer's guaranteed analysis for percentages of mixtures and pure live seed. Seed shall be labeled in conformance with U.S. Department of Agriculture rules and regulations under the Federal Seed Act and applicable state seed laws. Seed that has become wet, moldy, or otherwise damaged will not be acceptable.

Seed shall be of the following mixture:

Seed Type	Percentage
Kentucky 31 Fescue (<i>Festuca arundinacea</i>)	65
Creeping Red Fescue (<i>Festuca rubra</i>)	10
Red Top (<i>Argrostis alba</i>)	10
White Dutch Clover (<i>Trifolium repens</i>)	5
Ryegrass, perennial (<i>Colium perenne</i>)	10

2.2 pH Adjusters

Agricultural limestone shall have a minimum calcium carbonate equivalent of 90 percent and shall be ground to such a fineness that at least 90 percent will pass a 10-mesh sieve and at least 50 percent will pass a 60-mesh sieve. Agricultural ground limestone shall be from quarries approved by the Kentucky Department of Agriculture.

2.3 Fertilizer

Fertilizer shall be a commercial grade ammonium nitrate (33.5-0-0), monocalcium phosphate (0-46-0), and potassium chloride (0-0-60). Where fertilizer is furnished from bulk storage, the Contractor shall furnish a supplier's certification of analysis and weight.

2.4 Mulch

Mulch shall consist of wheat or rye straw. The mulch material shall be air dry, reasonable light in color, and shall not be musty, moldy, caked, and shall not contain noxious weeds.

2.5 Inoculants

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. A mixing medium, as recommended by the manufacturer, shall be used to bond the inoculant to the seed. Seed shall be sown within twenty four hours of treatment and shall not remain in a hydraulic seeder longer than four hours.

PART 3. EXECUTION

3.1 Delivery, Storage and Handling

Fertilizer and limestone shall be delivered to the site in the original, unopened containers bearing the manufacturer's guaranteed chemical analysis, name, trade name, trademark, and conformance to State and Federal laws. In lieu of containers, fertilizer and limestone may be furnished in bulk and a certificate indicating the above information shall accompany each delivery.

Seed, limestone and fertilizer shall be kept in dry storage away from contaminants, insects and rodents.

3.2 Preparation of Seed and Planting Beds

A. Tillage: Soil shall be tilled to a depth of at least 4 inches. Tillage shall be accomplished by plowing, disking, or harrowing during periods when beneficial results are likely to be obtained. Undulations or irregularities in the surface shall be leveled before the next specified operations.

B. Placing topsoil: Topsoil shall be spread evenly with a minimum thickness of 4 inches. Surface irregularities resulting from topsoiling or other operations shall be leveled. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry or excessively compacted.

C. Application of Soil Conditioners: Lime shall be applied by tillage at the rate of four tons per acre. Fertilizer shall be applied at the rate of 120 pounds per acre of each nutrient. Equivalent amounts are 353 pounds of ammonium nitrate (33.5-0-0), 261 pounds of monocalcium phosphate (0-46-0), and 200 pounds of potassium chloride (0-0-60). Lime and fertilizer rates may be adjusted with the approval of the Engineer based upon the results of soils testing of final cover material. All fertilizers, pH adjusters, and soil conditioners shall be incorporated into the soil to a depth of at least 2 inches.

3.3 Seeding

A. Seed shall be broadcast uniformly at the rate of 400 pounds per acre. The seed shall be covered to an average depth of 1/4 inch by means of spike-tooth harrow, cultipacker, or other approved device. Seed shall not be broadcast when winds are above 10 mph.

B. Immediately after seeding, the entire area shall be firmed with a roller not exceeding 90 pounds for each foot of roller width and the soil moistened to a depth of 6-8 inches. If seeding is performed with a cultipacker-type seeder or if seed is applied in combination with hydromulching, rolling will not be required.

3.4 Maintenance

Seeded areas shall be protected and maintained by watering and replanting as may be necessary to produce a uniform stand of grass. Maintenance shall continue until a dense, uniform turf is established composed of the grasses specified and until acceptance, and shall include repair of damage caused by erosion.

End of Section

SECTION 03100 - CONCRETE FORMWORK

PART 1. GENERAL

1.1 Work Included

Formwork shall be designed, constructed, erected and removed in accordance with ACI 347 and SP-4. Forms shall be wood, steel, or other approved material. Wood forms shall be tongue-and-groove lumber of uniform width and thickness, or plywood having a minimum of five plies, a minimum thickness of 9/16 inch and a type made especially for concrete forms. Steel forms shall be of a type acceptable to, and commonly used in the construction field. The type, shape, size, quality and strength of all material of which the forms are made shall be subject to the approval of the Engineer.

1.2 Design, Inspection and Approval of Form Work

The design and engineering of the form work, as well as the construction, shall be the responsibility of the Contractor. The Engineer's approval of form work design and/or drawings, as submitted or as corrected in no way shall relieve the Contractor of his responsibility for adequately construction and maintaining the forms so that they will function properly.

Forms, form joints, and reinforcing steel placement shall be checked by the Engineer before closing up the forms. Concrete shall not be place in any form until the placing of steel and erection of form work have been completed and approved by the Engineer. Immediately after completion of pouring, tops of all forms shall be adjusted to line and approved by the Engineer as to conformity with the tolerances specified herein.

PART 2. PRODUCTS

2.1 Forms for Exposed Concrete

A. Unlined. The contact surface of forms shall be constructed from 5/8 inch or 3/4 inch 5 ply structural plywood of concrete form grade. All concrete form plywood shall be designated by grade marking each panel. Full sized sheets of plywood must be used except where smaller pieces will cover an entire area. The edges of all plywood sheets shall be straightened on the bench to insure close fitting, tight joints. All vertical joints shall be backed solidly and the edges of abutting sheet shall be nailed to the same stud.

Contact surfaces of forms shall be in good condition. The Engineer has the right to reject forms which will not produce a smooth, uniform, concrete surface.

B. Lined. The backing for form lining shall be constructed of a good grade of form lumber that is solid, straight and free from defects that might impair its strength but need not be of the quality used for contact forms. Square-edged, sized lumber may be used for form boarding in place of shiplap or tongue-and-groove.

The boarding for lined forms may be horizontal or vertical, depending upon convenience. Form sheathing shall be securely nailed to the studs and the edges of the boards shall be in contact to prevent any bulging of the lining.

Plywood faced panel or patented forms in good condition, with tight fitting joints, such as steel-ply forms, can be substituted for lined forms if a smooth wall surface, as required by these specifications, can be obtained. Minor variations in concrete texture at form joints will be permitted.

Lining material shall be 1/4 inch structural plywood securely nailed to the form sheathing. All lining material shall be used in as wide pieces as possible Areas less than 4 feet in width shall be lined with a single width of plywood.

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Joints in lining and backing shall not occur at the same place and butting edges of adjacent sheets shall be nailed to the same board. The lining material shall be nailed to the backing beginning at center of the board and working toward the edges to prevent buckling. Lining material may be reused, if it is in satisfactory condition and is approved by the Engineer. Open joints which would permit leakage of grout shall be sufficient cause for rejection of forms. If, in the opinion of the Engineer, pointing of slightly open joints will prevent leakage, then such pointing shall be allowed.

In the case of line circular forms where the backing for form lining is constructed in chords of a circle, the form lining shall be adequately supported by variable thickness shim strips on at least 6 inch centers so that the liner forms a circular surface within tolerances specified herein.

2.2 Forms for Unexposed Concrete

Forms shall be constructed of a good grade of form lumber that is solid, straight and free from defects which might impair its strength, but need not be of the quality required for contact surfaces of forms for exposed concrete. Forms shall be of shiplap or T 7 G No. 2 wood sheathing, 3/4 inch plywood, 5/8 inch plywood or approved equal.

2.3 Form Ties

Form ties shall be as follows:

- (a) "Water-Seal" type of ties shall be used for water holding structures or structures subject to flooding.
- (b) Non-water holding structures, which are not subject to flooding, shall have ties approved by the Engineer.

Form ties shall have a minimum working strength when fully assembled of at least 3,000 pounds. Ties shall be so adjustable in length as to permit tightening of forms and of such type as to leave no metal closer than 1 inch from the surface and they shall not be fitted with any lugs, cones, washers, or other device to act as a spreader within the form or for any other purpose which will leave a hole larger than 7/8 inch in diameter of a depression back of the exposed surface of the concrete. Fill tie holes, after being thoroughly cleaned and dampened, with a nonmetallic nonshrinking grout. Wire ties shall not be permitted.

PART 3. EXECUTION

3.1 Construction

Forms shall be true to line and grade, mortar tight and sufficiently rigid to prevent objectionable deformation under load. Where forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the complete surface so as to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall be constructed such that keyways, waterstops, and dowels can be placed as shown in the plans.

The form surfaces shall be smooth, free from irregularities, depressions, sags, or holes when used for permanently exposed faces. Bolts and rods used for internal ties shall be so arranged that, when all forms are removed, all metal will not be less than one inch from any concrete surface. Wire ties will not be permitted. All forms shall be so constructed so that they can be removed without hammering or prying against the concrete. All exposed joints shall be chamfered and suitable molding shall be placed to bevel or round exposed edges or corners, unless otherwise directed by the Engineer.

Temporary openings shall be provided in the inside form of all wall forms and column forms to facilitate cleaning and inspection immediately before depositing concrete. When wood sheeting is used for the inside form, the bottom board shall be fitted and removed to provide a continuous clean out space and if plywood is used, the forms shall be started with a 6 inch wide piece for the same purpose. Washing out of

all forms and other concrete before pouring new materials must be done with water or air from hose under pressure. The hose must be provided with a suitable nozzle for this work. The intent of these specifications is to produce a perfectly watertight structure in all cases, without any subsequent repair work. Forms shall be so assembled that their removal will not damage the concrete.

Contact surfaces of forms shall be divided into two categories: forms for exposed concrete and forms for unexposed concrete. Exposed concrete shall mean concrete normally exposed to view and shall be considered extending 6 inches below planned regrade or water level. Exposed concrete shall exclude interior surfaces of covered water holding basins and unpainted, unfinished, interior surfaces of manholes and vaults. Unexposed concrete shall be concrete not normally exposed to view and shall include all concrete not included by exposed concrete, unless otherwise noted on the plan or in the specifications. Either unlined forms or lined forms (as hereinafter specified) shall be used for exposed concrete. A combination of lined forms for exposed concrete and unlined forms for unexposed concrete may be used in a structure where only a part of the structure is exposed. When this combination occurs, the Engineer will determine, upon request of the Contractor, if that portion of the structure which requires lined forms can be reduced in section to accommodate the liner without offsetting the liner backing from the sheathing used for the unexposed portion of the structure.

3.2 Construction Tolerance

The forms shall be constructed and rigidly braced in place within the following tolerances:

- (1) Variation from true alignment as shown on the drawings in the lines and surfaces of walls:

In 10 feet	1/4 inch
In 20 feet maximum	3/8 inch
In 40 feet or more	3/4 inch

- (2) Variation from the level or from the grades indicated on the drawings in floors or slabs:

In 10 feet	1/4 inch
In 20 feet maximum	3/8 inch
In 40 feet or more	3/4 inch

- (3) Variation in sizes and/or locations of floor and/or wall openings: 1/3 inch

- (4) Variation in thickness of slabs and walls and in cross-sectional dimensions of columns and beams:

Minus	1/4 inch
Plus	1/2 inch

- (5) Variation in plan dimension of footings:

Minus	1/2 inch
Plus	2 inches

3.3 Wetting and Oiling Forms

The inside surface of wood board forms shall be soaked with clean water and kept continuously wet for 12 hours before any concrete is placed. In case forms have been erected for some time and have become dry so that joints have opened, then the forms shall be thoroughly soaked at least twice each day for at least 3 days prior to placing concrete. If the forms cannot be tightened to the satisfaction of the Engineer, they shall be torn down and rebuilt. Plywood forms may be treated with a non staining form oil, mineral oil or lacquer. If oil is used, all excess oil shall be wiped off with rags to leave the surface of the forms just oily to the touch. In freezing weather, oil shall be used.

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3.4 Form Removal

Forms shall not be removed without approval of the Engineer. All form removal shall be accomplished in such a manner as to prevent injury to the concrete.

Forms shall not be removed sooner than the following minimum times after the concrete is placed. These periods represent cumulative number of days and fractions of days, not necessarily consecutive, during which the temperature of the air adjacent to the concrete is above 50°F.:

<u>Element</u>	<u>Time</u>
Beams, arches - supporting forms and shoring	14 days
Conduits, deck slabs - supporting (inside) forms and shoring	7 days
Conduits (outside forms), sides of beams, small structures	24 hours
Columns, walls, spillway risers - with side or vertical load	7 days
Columns, walls, spillway risers - with no side or vertical load	4 days
Concreting supporting more than 30 feet of wall in place above it.	7 days
Concrete supporting 20 to 30 feet of wall in place above it.	4 days

Age of stripped concrete shall be at least 7 days before any load other than the weight of the column or wall itself is applied.

When conditions on the job are such as to justify the requirements, forms will be required to remain in place for longer periods. Forms for beams, girders, and floor slab shall remain in place for at least seven days and shall only be removed when test cylinders used under the same condition as the members break with a compressive strength as required in these specifications.

End of Section

SECTION 03200 - CONCRETE REINFORCEMENT

PART 1. GENERAL

1.1 Work Included

The work covered by this specification consists of furnishing, cutting, bending and placing all steel reinforcement, including rods and fabric, as indicated on the drawings or otherwise required and in accordance with these specifications.

1.2 Submittals

Submit manufacturer's specifications for materials and installation instructions. Include test reports showing compliance with project requirements where test method is indicated.

1.3 Delivery and Storage

Notify the Engineer when materials will be received on the job so that proper arrangements may be made for inspecting the unloading operations and examining the materials.

PART 2. PRODUCTS

2.1 Bars

All bar reinforcement for reinforced concrete construction shall be Grade 60 new billet steel or rail steel reinforcement bars and conforming to ASTM A-615 and A-616. All bars shall be rolled so as to comply with the requirements of ASTM A-305.

2.2 Welded Wire Fabric

Welded wire fabric shall comply with the requirements of ASTM A-185.

2.3 Cold-Drawn Steel Wire

Cold-drawn steel wire shall comply with the requirements of ASTM A-82.

2.4 Black Annealed Wire

Black annealed wire shall be cold-drawn wire and shall have a tensile strength of not less than 40,000 pounds per square inch.

PART 3. EXECUTION

3.1 Bending

Reinforcing bars may be mill or field bent. All bends shall be made in compliance with the requirements of the American Concrete Institute Standard 315 and by approved machine methods except as noted otherwise on the drawings. All bends shall be made without heating. Bars with kinks, cracks or improper bends will be rejected.

3.2 Installation

All reinforcement shall be free from dirt, oil, grease, paint, mill scale, loose or thick rust, or other coating which might destroy or reduce its bonds with the concrete when the surrounding concrete is placed.

All reinforcement shall be placed in accordance with the drawings as furnished or approved by the Engineer and shall be held so securely in position by wiring and blocking from the forms and by wiring together at intersections that it will not be displaced during the placement of the concrete. Tack welding of bars will not be permitted.

The minimum cover for all main reinforcement shall conform to the dimensions shown on the drawings which will indicate the clear distance from the edge of the reinforcement to the concrete surface.

The following tolerances will be allowed in the placement of reinforcing bars as shown on the drawings:

(1) Variation in protective cover

1/4 inch for 2-inch cover
1/2 inch for 3-inch cover

(2) Variation of spacing

1/12 of indicated spacing

Any supplemental bar schedules, bar lists or bar-bending diagrams required to accomplish the fabrication and placement of reinforcement shall be provided by the Contractor. Prior to placement of reinforcement, the Contractor shall furnish three prints or copies of any such lists or diagrams to the Engineer. Acceptance of the reinforcement will not be based on approval of these lists or diagrams but will be based on inspection of the reinforcement after it has been placed.

All reinforcement for any pour shall be secured in place by use of metal or concrete supports, spacers, or ties, as approved by the Engineer, before the pour is started. The supports shall be used in such a manner that they will not be exposed or contribute in any way to the discoloration or deterioration of the concrete.

Steel in slabs poured on earth or compacted dense graded aggregate shall be supported by concrete masonry units on subgrade, and/or by approved metal supports with sand plates. Steel in slabs poured on solid rock shall be supported as for slabs on earth except that sand plates are not required.

All splices in reinforcement shall be as shown on the drawings or as directed by the Engineer. Unless otherwise specified on the drawings, splices shall overlap at least 32 times the diameter of the smaller bar in the splice, but not less than 12 inches. Splices shall overlap 40 diameters for hoop steel in circular walls. The lapped ends of bars shall be connected by lapping and tying as a single continuous bar to develop the strength of the bar.

Welded wire fabric shall be spliced using wire ties or standard clips in the following manner.

(1) Adjacent sections shall be spliced end to end by either:

- (a) Overlapping the two pieces of fabric one full mesh (measured from the ends of the longitudinal wires in one piece to the ends of the longitudinal wires in the other piece) and securing the two pieces together with wire ties placed at intervals of 18 inches; or,
- (b) Overlapping the two pieces of fabric so that the end crosswire of each piece comes in contact with the next-to-end crosswire of the other piece and securing the two pieces together only as required to keep the fabric in place and to prevent it from curing.

(2) Adjacent sections of fabric shall be spliced side to side by either:

- (a) Placing the two selvage wires (the longitudinal wires at the edge of the fabric) one along side and overlapping the other and securing the two pieces together with wire ties placed at intervals of 3 feet; or

- (b) Placing each selvaqe wire in the middle of the first mesh of the other section of fabric and securing it to the other section at intervals of 10 feet by means of wire ties placed on the selvaqe wires alternately at intervals of 5 feet.

3.3 Inspection

The Contractor shall secure from the manufacturer, and furnish in duplicate, certified copies of the mill test report for each delivery of bar reinforcing steel to the job. The bars shall be properly tagged so as to permit identification of the heat number shown on the mill test report for any and all steel delivered to the work.

3.4 Storage

Steel reinforcement shall be stored above the surface of the ground upon platforms, skids, or other supports and shall be protected, as far as practicable, from mechanical injury and surface deterioration caused by conditions producing rust.

3.5 Testing

When tests are required, reinforcement will be tested in accordance with the above ASTM Specifications for each class, except that tensile tests shall comply with the requirements of ASTM E-8.

End of Section

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1. GENERAL

1.1 Work Included

This specification covers the furnishing of all materials, equipment, and labor, and performing all operations specified herein, including the manufacturing, transporting, placing, finishing and curing of the concrete. The furnishing and placing of reinforced steel is covered in a separate technical specification.

1.2 Submittals

The Contractor shall be responsible for the design of the concrete mixtures and the quality of the concrete including ready-mix. Prior to any concrete placement, the Contractor shall furnish a statement to the Engineer giving the proportions by dry weight of cement and of fine and coarse aggregate that will be used in the manufacture of each class of concrete contained in the contract.

1.3 Delivery

Notify the Engineer 48 hours before concrete will be received on the job so that proper arrangements may be made for inspecting the materials and installation.

PART 2. PRODUCTS

2.1 Concrete

Concrete shall be composed of Portland cement, water, fine aggregate, coarse aggregate and required admixtures. The design of the concrete mixture will be based on the water-cement ratio necessary to secure a plastic workable mixture suitable for the specific conditions of placement and, when properly cured, a product having durability, impermeability and strength, but the maximum water-cement ratio should be 0.45. The concrete mixture shall be designed so that the concrete placed according to plans shall produce a minimum laboratory cylinder compressive strength equal to the required strength.

All concrete shall have a 28 day compressive strength of 4,000 psi. The minimum cement content shall be:

coarse aggregate number	lb. per yard
467 (1 1/2" max.)	517
57 (1" max.)	564

Slump, as determined in accordance with ASTM C143, shall be:

- 1 in. minimum
- 3 in. maximum for footings and substructure walls
- 4 in. maximum for slab, beams, reinforced walls and columns

Unless otherwise specified, the air content (by volume) of the concrete at the time of placement shall be:

Maximum Size Aggregate	Air Content (%)
Up to 1 inch	6 plus or minus 1
Over 1 inch to 1 1/2 inches	5 1/2 plus or minus 1

2.2 Cement

Portland cement shall meet the requirements of ASTM C-150 for the type of cement specified. Air entraining Portland cement shall meet the requirements of ASTM C-175 for the type of cement specified.

2.3 Aggregates

Aggregates shall conform to the provisions of ASTM C-136 and ASTM C-33. Sand shall consist of clean, well graded particles of hard, durable stone and shall contain limited amount of deleterious substances. It shall be equivalent to washed Ohio, Scioto, or Cumberland River sand.

Coarse aggregate shall be washed river gravel or crushed limestone of hard durable particles and shall contain limited amounts of deleterious substances. The maximum size of coarse aggregate will be limited to one and one-half inches.

2.4 Water

Water used in mixing concrete shall be fresh, clean and free from sewage, oil, acid, alkali, salts, or organic matter. The water used in mixing must be a minimum required for a plastic mix. No water will be permitted for purposes of hastening mixing and reducing tamping or vibration.

2.5 Admixtures

A. General. The use of calcium chloride or other accelerators or anti-freeze compounds will not be allowed.

B. Air-Entrainment. The air-entraining admixtures shall fully meet the requirements of ASTM C-260 and shall be subject to tests in accordance with ASTM C-233.

C. Water-Reducing Admixtures. ASTM C494, Type A.

D. High-Range Water-Reducing Admixture. ASTM C494, Type F or Type G.

E. Water-Reducing, Accelerating Admixture. ASTM C494, Type E.

F. Water-Reducing, Retarding Admixture. ASTM C494, Type D.

2.6 Waterstops

Use expanding hydrophilic waterstop as manufactured by Greenstreak, or equivalent. Use Hydrotite type CJ-0725-3K (0.28" x 0.98").

PART 3. EXECUTION

3.1 Batching and Mixing

A. Equipment. Mixing equipment shall be capable of combining the aggregate, cement and water into a uniform mixture and of discharging this mixture without segregation. Adequate facilities shall be provided for the accurate measurement of the materials entering the concrete.

Truck mixers shall be equipped with an accurate device for measuring the amount of water added. Truck mixers and agitator shall be operated within the limits of capacity and speed of rotation designated by the manufacturer of the equipment.

B. Mixing Time. Neither the speed nor the volume capacity of the mixer shall exceed those recommended by the manufacturer. Excessive overmixing, requiring additions of water to preserve the required consistency, will not be permitted. The mixing time for each batch after all solid materials are in the mixer drum, provided that all the mixing water shall be introduced before one-fourth of the mixing time has elapsed, shall be not less than two minutes for mixers having capacities up to two cubic yards. For mixers of larger capacities, this minimum shall be increased fifteen seconds for each cubic yard or fraction thereof of additional capacity.

When a truck mixer is used, each batch of concrete shall be mixed not less than fifty nor more than three hundred revolutions, at a mixing speed of not less than four rpm. after all materials are in the mixer drum. In all such cases, however, the concrete shall be delivered to the job site and discharged within 1-1/4 hours or before the drum has revolved 300 times, whichever comes first, after the mixing water has been added.

C. Consistency. The consistency of any concrete shall be such that it can be worked readily into the corners and angles of the forms and around reinforcement with the method of placing employed on the work, but without permitting the materials to segregate or excess free water to collect on the surface. Where vibrators are used, the Engineer may allow a slightly less slump than the specified minimum.

The quantity of mixing water shall not be changed without the consent of the Engineer.

D. Air-Entrained Concrete. Air-entrainment shall be accomplished by using an air-entrained Portland cement or by using an air-entraining admixture with normal Portland cement. Air-entraining admixtures shall be added in solutions to a portion of the mixing water by means of a mechanical batcher in a manner that will insure uniform distribution of the agent throughout the batch. The air content of freshly mixed air-entrained concrete shall be determined as a percentage of the volume of the concrete by following the methods specified in ASTM C-138, C-173, or C-231. Air content determination shall be made on samples of concrete during placement of the concrete in the forms.

When air-entrained concrete is specified, the amount of water and fine aggregate prescribed for normal concrete shall be reduced to compensate for the increased volume of air contained in the air-entrained concrete.

3.2 Testing

A. Slump Test. At least one slump test shall be made before first concrete pour, at the start of pouring any concrete and at each seven cubic yards deposited during one operation. These shall be made from same samples as those taken for cylinder tests and records of same kept therewith. Tests shall be made according to ASTM C-143 and as required under ASTM C-94 for ready-mixed concrete. The Contractor shall furnish the necessary equipment and labor for making slump tests.

B. Entrained Air Tests. The Contractor shall furnish and have on the job at all times, one LA-345 Chase Air Indicator Kit, one LA-340 Spare Chase Air Indicator and two quarts of isopropyl alcohol (rubbing alcohol) for the Engineer's use in making entrained air measurements.

The amount of measured entrained air shall be recorded by the Engineer. Mortar shall be sampled only from concrete taken directly from the mixer. At least one air measurement shall be made for each test cylinder taken.

C. Periodic Cylinder Tests. All cylinders shall be made per ASTM C-31 and tested per ASTM C-39. The Contractor shall furnish all labor and equipment for sampling and curing cylinders on the job site and transportation to the laboratory for testing.

At the start of concreting, three cylinders shall be made. One shall be tested at 7 days and two shall be tested at 28 days.

Throughout the remainder of the job, the Engineer shall direct when cylinders shall be taken and in what number they shall be taken. At each time when twenty or more cubic yards of concrete are placed during one operation and when the sum of smaller deposits of concrete equal thirty cubic yards since previous test and at any change in mix, three cylinders shall be made. One shall be tested at 7 days and two shall be tested at 28 days.

For a strength test, three test specimens will be made from a composite sample. The test result will be the average of the strength of the three specimens, except that, if one specimen in a test shows manifest evidence of improper sampling, molding, or testing, it shall be discarded and the remaining two strengths averaged. Should more than one specimen, representing a given test, show definite defects due to improper sampling, molding, or testing, the entire test shall be discarded.

The Engineer will ascertain and record the batch number for the concrete and the exact location in the work at which each batch represented by a strength test is deposited.

The Engineer shall have free entry to the plant and equipment furnishing concrete under the contract. Proper facilities shall be provided for the Engineer to inspect materials, equipment and process and to obtain samples of the concrete. All tests and inspections will be conducted so as not to interfere unnecessarily with the manufacture and delivery of the concrete.

If cylinders do not meet strength requirements, the Engineer can order shutdown on all concreting and redesign of concrete mix. The cost of mix redesign shall be paid for by the Contractor. The Engineer can also order additional tests, such as load tests, Swiss Hammer tests and/or core tests in the areas of the work represented by unacceptable cylinders. If areas of work are found to be under strength requirements, the Engineer can order the Contractor to strengthen or replace those areas at the expense of the Contractor.

When it is determined that such concrete shall be removed and replaced the Contractor shall be notified in writing, stating the extent of the replacement to be made.

3.3 Conveying

Concrete shall be conveyed from mixer to forms as rapidly as practicable, by methods which will prevent segregation or loss of ingredients. There shall be no vertical drop greater than five feet, except where suitable equipment is provided to prevent segregation.

Belt conveyers, chutes or other similar equipment in which the concrete is delivered to the structure in a thin, continuously exposed flow, will not be permitted, except for very limited or isolated sections of the work. Such equipment shall be arranged to prevent segregation.

Where wall forms exceed five feet in height, suitable measures, such as the use of tremie tubes, where practicable, or portholes, shall be provided in the forms to limit the vertical drop of the concrete to a maximum of five feet. Openings, when used, shall be spaced around the perimeter at five feet high. Openings shall be spaced around the perimeter of the formed area so that lateral flow of fresh concrete will be limited to three feet. Drop chutes which may be provided to convey the concrete through wall ports shall have an outside pocket under each form opening to stop the concrete and allow it to flow easily over into the form without separation.

3.4 Placing

A. General. No concrete shall be placed until the forms and subgrade are free of chips, dirt, sawdust, or other extraneous materials and the Engineer has given his approval of the subgrade, forms and reinforcing steel in place. No concrete shall be placed except in the presence of the Engineer and the Contractor shall give reasonable notice of his intention to place concrete.

Concrete shall be placed within one and one-quarter hours after the introduction of the water to the cement and aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, or where the temperature of the concrete is 85°F or above, the time shall be reduced to 45 minutes. Concrete shall be deposited as closely as possible to its final position in the forms so that flow within the mass and consequent segregation are reduced to a minimum. Vibrators may be used to aid in the placement of the concrete provided they are used under experience supervision and the forms designed to withstand their action. The duration of vibration shall be limited to that necessary to produce satisfactory consolidation without causing segregation. Vibration shall not be applied directly to the reinforcement steel or the forms nor to concrete which has hardened to the degree that it does not become plastic when vibrated.

When a vibrator is used, the Contractor shall also spade the concrete along form surfaces a sufficient amount to prevent excessive size or numbers of air-void pockets in the concrete surface, except where an approved absorptive form lining is used; in which case the spading specified above will not be permitted.

B. Lifts in Concrete. The permissible depth of concrete placed in each lift shall be as shown on the drawings or specified herein. All concrete shall be deposited in horizontal layers not exceeding twenty inches in thickness, unless otherwise authorized. The placement shall be carried on at such a rate that the formation of cold joints will be prevented. If a delay occurs in excess of a thirty minute interval between any two consecutive batches or loads, or in case of any delay between placing batches that allows previously placed concrete to take initial set, the Contractor shall discontinue the placing of concrete and make a construction joint before proceeding with the placing operations. He shall remove any portion of the previously placed concrete that is deemed necessary for the proper formation of the construction joint and no payment shall be made to the Contractor for the concrete removed. The thirty minute limitation, cited immediately above, may be extended in those cases where an approved type retarder is added to the concrete mixture to delay the set of the concrete.

Hoppers, chutes and pipes shall be used as necessary to prevent splashing of mortar on forms and reinforcing above the layer being placed.

C. Placing Temperature. When the atmospheric temperature may be expected to drop below 40°F at the time concrete is delivered to the work site, during placement or any time during the curing period, the following provisions also apply:

(1) The temperature of the concrete at the time of placing shall not be less than 50°F nor more than 90°F. The temperature of neither aggregates nor mixing water shall be more than 100°F just prior to mixing with the cement.

(2) When the daily minimum temperature is less than 40°F, concrete structures shall be insulated or housed and heated after placement. The temperature of the concrete and air adjacent to the concrete shall be maintained at not less than 50°F nor more than 90°F for the duration of the curing period.

(3) Methods of insulating, housing and heating the structure shall conform to "Recommended Practice for Cold Weather Concreting", ACI Standard 306.

(4) When dry heat is used to protect concrete, means of maintaining an ambient humidity of at least 40 percent shall be provided unless the concrete has been coated with curing compound or is covered tightly with an approved impervious material.

For obtaining the proper curing conditions for the concrete poured, steam heating equipment, oil-fired blowers (airplane heaters) located outside the enclosure and blowing hot air into the enclosure, or other similar equipment of a capacity sufficient to maintain the required minimum temperature all over, will be required. In conjunction with forced air heaters, means of supplying moisture to the area being cured will also be required. Oil or coke burning salamanders and other fuel-burning heaters produce carbon dioxide which combines with calcium hydroxide in fresh concrete to form a weak layer of calcium carbonate. When this occurs, the surface of the concrete floor will dust under traffic. For this reason, carbon dioxide

producing heaters shall not be used while placing concrete and for the first 24 to 36 hours of the curing period unless they are properly vented.

The Contractor must have a sufficient steam retaining canvas or other protective covering at the site to cover all sides and tops of forms to be poured and concrete to be cured, before pouring of concrete will be allowed. This covering must be placed over and around forms and concrete being cured in such a manner that circulation of curing air will prove effective to the tops of floors and to the outside, top and corners of concrete structures, as well as to their interiors. The Contractor may strip forms during curing period with covering removed, provided atmospheric temperatures are above specified curing temperatures, concrete surfaces are kept moist, and time and labor are available for recovering for lower night temperatures.

When climatic or other conditions are such that the temperature of the concrete may reasonably be expected to exceed 85°F at the time of delivery at the work site, during placement, or during the first 24 hours after placement, the following provisions also shall apply:

- (1) The Contractor shall maintain the temperature of the concrete below 85°F during mixing, conveying, and placing. Methods used shall conform to "Recommended Practice for Hot Weather Concreting," ACI Standard 605.
- (2) The concrete shall be placed in the work immediately after mixing. Truck mixing shall be delayed until only time enough remains to accomplish it before the concrete is placed.
- (3) Exposed concrete surfaces which tend to dry or set too rapidly shall be continuously moistened by means of fog sprays or otherwise protected from drying during the time between placement and finishing, and after finishing.
- (4) Finishing of slabs and other exposed surfaces shall be started as soon as the condition of the concrete allows and shall be completed without delay.
- (5) Concrete surfaces exposed to the air shall be covered as soon as the concrete has hardened sufficiently and shall be kept continuously wet for at least the first 24 hours of the curing period and for the entire curing period unless curing compound is applied.
- (6) Formed surfaces shall be kept completely and continuously wet for the duration of curing period (prior to, during and after form removal) or until curing compound is applied.
- (7) If moist curing is discontinued before the end of the curing period, white pigmented curing compound shall be applied immediately.

D. Concrete on Earth Foundations. Unless otherwise authorized all concrete shall be placed upon clean, damp surfaces free from frost, ice, or deleterious materials and standing or running water. Concrete shall not be placed in mud, dried porous earth or upon fill that has not been subject to approved rolling or tamping until optimum compaction has been obtained.

E. Vertical Joint Spacing. The layout of all monoliths shall be as shown on the drawings or as directed by the Engineer before construction is started.

F. Placing Concrete through Reinforcement. In dropping concrete through reinforcement, care shall be taken that no segregation of the coarse aggregate occurs.

3.5 Construction Joints

Construction joints shall be located as indicated on the contract drawings, or as approved by the Engineer. The surfaces of construction joints shall be clean when covered with fresh concrete. Cleaning shall consist of the removal of all laitance, loose or defective concrete and foreign material. Cleaning of the surface of construction joints shall be accomplished by the use of high velocity air-water jets, wet sandblasting, or

other effective means. Surfaces of construction joints that have been permitted to dry by reason of the succeeding lift or adjoining concrete not being placed within the specified post-curing period shall be moistened and kept continuously moist for at least forty-eight hours immediately prior to the placing of the succeeding lift of adjoining concrete. All pools of water shall be removed from the surfaces of construction joints before the new concrete is placed.

3.6 Finishing

A. Repair of Defects. Honeycombed areas and voids left by the removal of tie rods, ridges on all concrete surfaces permanently exposed to view or exposed to water on the finished structure, shall be repaired immediately after the removal of forms. Voids left by removal of tie rods shall be reamed and completely filled with dry-patching mortar.

Defective concrete shall be repaired by cutting out the unsatisfactory material and placing new concrete which shall be secured with keys, dovetails, or anchors. Defective areas shall be chipped away to a depth of not less than 1 inch with the edges perpendicular to the surface. The area to be patched and a space at least 6 inches wide entirely surrounding it shall be wetted to prevent absorption of water from the patching mortar. A grout of equal parts Portland cement and sand with sufficient water to produce a brushing consistency, shall then be well brushed into the surface, followed immediately by the patching mortar. The patch shall be made of the same material and of approximately the same proportions as used for the concrete except that the coarse aggregate shall be omitted. The mortar shall not be richer than 1 part cement to 3 parts sand. On exposed surfaces, white Portland cement shall be substituted for a part of the gray Portland cement to match the color of the surrounding concrete. The proportion of white and gray cements shall be determined by making a trial patch.

The amount of mixing water shall be as little as consistent with the requirements of handling and placing. The mortar shall be retempered without the addition of water by allowing it to stand for a period of 1 hour during which time it shall be mixed occasionally with a trowel to prevent setting.

The mortar shall be thoroughly compacted into place and screeded off so as to leave the patch slightly higher than the surrounding surface. It shall then be left undisturbed for a period of 1 to 2 hours to permit initial shrinkage before being finally finished. The patch shall be finished in such a manner as to match the adjoining surface.

Excessive rubbing of formed surfaces will not be permitted. All uniformed surfaces of concrete, exposed in the completed work, shall have a wood float finish without additional mortar.

B. Removal of Forms. In order that the rubbing required by these specifications shall be effective, nonsupporting forms may be stripped with 24 hours after concrete pouring is completed and initial rubbing required completed within 48 hours. If possible, patching and rubbing shall be done at the same time. This requirement regarding form removal is secondary to heating requirements and the specifications heretofore included regarding heating of concrete shall take precedence.

After the required curing time has elapsed, support forms may be removed to allow finishing. Finish shall be Type I, II, or III as required by the "Concrete Finishes" section. In general, surfaces that will show in the finished work will be rubbed down with a coarse carborundum stone. Floors and slabs shall be float finished as soon as possible after pouring unless otherwise specified. Cement or mortar coating will not be permitted. The Contractor should refer to the section on "Concrete Finishes" for complete finish requirements for all concrete units.

Rubbing is not required lower than 6 inches below water levels in basins, but all fins must be removed and holes patched. Exposed inside surfaces to be painted must be rubbed smooth.

The surfaces of exposed concrete roofs, walks and copings shall be finished with a wooden float and left with a gritty surface similar to that in general use for sidewalks. This finish and floating must be done at the

proper period in the setting of the concrete. These outside exposed surfaces of floors and roofs must be finished as one piece of work without a separate top coat.

Basin and channel floors shall be struck off smooth and finished with a steel float to produce a surface easily cleaned. The inside exposed floors must be finished with a steel float to even surfaces and present a neat, smooth and satisfactory appearance. Finish with bevel around all curbs and other openings. Floors must be finished to drain to floor traps and sump with slopes as shown on the plans. Floors at the walls must be level except where shown otherwise on the plans.

Surfaces of precast concrete members that are to be painted shall have all air holes and other imperfections filled and dressed to present surfaces comparable in smoothness and appearance to rubbed concrete as set forth above.

C. Watertightness. All concrete when finished must be watertight. Exposed concrete surfaces shall show no dampness when the interior of basins or exterior of pits have been filled with water for seven days. To obtain this result, the foregoing specifications must be rigidly followed. In case any leakage or dampness shows on the surface of any such walls after testing the time stated, then such defects must be remedied by the Contractor and work will not be accepted until this is done.

D. Openings for Pipes and Joints to Pipes. Pipes shall not be fixed in concrete wall or interior floor pours. Holes of a diameter 1 inch greater than the outside pipe diameter shall be formed accurately to pipe layout dimensions or shall be cored (10 inch diameter and under) in existing concrete slabs or walls. If cored, reinforcing shall be avoided.

When piping is placed, the annular ring around it shall be caulked from both sides with dry braided hemp (or unbraided where pipes do not center on grout closure is not necessary), to within 1 inch of wall surface or 2 inches if grout closure is necessary. Where exposed to view, inside basins, or where watertightness, airtightness, support or prevention of vibration is necessary, the remaining annular ring at the surface shall be troweled full with a nonshrink grout. Then the joint shall be raked back 1/2 inch from the surface and filled with a one to two mix grout of Portland Cement and sand. such joints shall be water and seepage tight.

Where malleable pipe (steel, wrought iron, or copper), a brittle pipe (hard rubber), rubber hose, or any pipe cut to fit on the job, passes through any concrete slab, floor or wall, a wrought or cast iron pipe nipple with about 1/2 inch greater diameter than the outside of the pipe shall be used as a sleeve and cast into the slab. In case of floors above ceilings, these sleeves shall extend 1/2 inch to 1 inch above floor surface, to prevent scouring water from running into them. If joint about pipe is required for watertightness or pipe support, the annular ring shall be caulked with dry, unbraided oakum to within 2 inches of surface. The ring at surface shall be filled with nonshrink grout, raked back 1/2 inch, and filled with 1/2 inch of Portland Cement grout as previously mentioned.

Where holes greater than 10 inch diameter have to be cut for pipe in existing concrete slabs or walls, the space about the pipe shall be formed to original surfaces and the pipe wrapped with 1/2 inch braided hemp. Where walls and space give sufficient room for safely using large aggregate, this may be added in a quantity equal to the sand specified. After removal of forms, the yarn shall be removed for a depth of 2 inches from water side and/or exposed surfaces and the space refilled to surface with a nonshrink grout. Then the joint shall be raked back 1/2 inch from the surface and filled with a one to two mix grout of Portland Cement and sand.

E. Floor Finishes. The finish of all floors and slabs shall be as described below, by types. Listed below are descriptions of the various type finishes.

(1) Type "A" Screeded. This finish shall be obtained by placing screeds at frequent intervals and striking off to the surface elevation required. Unless otherwise stipulated, this type of finish shall be used on slabs over which quarry tile, ceramic tile, terrazzo, bituminous mixtures, grout swept in by mechanism, or similar type wearing surface is subsequently to be applied.

(2) Type "B" Wood Floated. This type of integral finish shall be obtained by working a previously screeded surface with a wood float until the desired texture is reached. Unless otherwise stipulated, this type finish shall be used for exterior paved areas, sidewalks, ramps and steps. Care shall be taken to prevent the formation of laitance and excess water on the finished surface.

(3) Type "C" Steel Troweled. This type of integral floor finish shall be obtained by first screeding and then giving a preliminary wood float finish which shall be true, even and free from depressions.

After this operation, and when the concrete has hardened sufficiently to prevent excess fine materials from working to the surface, the surface shall be compacted and smoothed with not less than two thorough and complete steel troweling operations. The finish shall be brought to a smooth, dense surface, free from defects and blemishes. In areas that are to be covered with resilient flooring, one complete steel troweling operation will be sufficient.

(4) Type "D" Swept-in Grout Topping. This finish shall be applied to certain tank floors as specified. Grout topping shall be placed and spread on a previously screeded and hardened concrete slab. Before placing the grout, the surface shall be properly cleaned, washed and coated with a mixture of water and Portland Cement. The grout shall then be plowed and swept into neat conformance with the blades or farms of the apparatus by turning or rotating the previously positioned mechanical equipment. Special attention is to be paid to true grades, shapes and tolerances as specified by the manufacturer of the equipment. Before beginning this finish, the CONTRACTOR shall notify the ENGINEER and the equipment manufacturer of the details of the operation, and obtain approval and recommendations, respectively, before commencing work.

F. Non-floor Finishes. Type I - All holes left by removal of ends of ties, and all other holes, depressions or voids shall be filled solid with mortar after first being thoroughly wetted. Holes shall be filled with a small tool that will permit pack the hole solidly with mortar. Mortar shall consist of one part cement to three parts sand, and the amount of mixing water shall be as little as consistent with the requirement of handling and placing. Color of mortar shall match the adjacent wall surface.

Type II - After completing the Type I finish specified above, the Contractor shall also remove all fins, burrs and other projections left by the removed forms.

Type III - This finish shall be applied after the completion of the Type II finish. A smooth, uniform surface shall be obtained using the "carborundum-rub" finish which shall consist of the following procedure: Surfaces shall be rubbed with a carborundum stone to eliminate irregularities. Unless the nature of the irregularities require it, the general surface of the concrete shall not be cut into. Bulging or protruding areas, which result from slipping or deflecting forms shall be ground flush or chipped out and re-dressed as directed by the Engineer. Brush finishing or painting with grout or neat cement will not be permitted. Corners and edges shall be slightly rounded by the use of the carborundum stone. No rubbing shall be done before the concrete is seven days old or until the concrete is thoroughly hardened and the mortar used for patching is firmly set.

3.7 Curing and Protection

A. General. All concrete shall be cured for a period of not less than seven consecutive days by an approved method, or combination of methods. The curing process shall be done so as to prevent loss of moisture from the concrete for the duration of the entire curing period. Unhardened concrete shall be protected from heavy rains and flowing water. All concrete shall be adequately protected from damage.

B. Moist Curing. Concrete shall be moist cured by maintaining all surfaces continuously (not periodically) wet for the duration of the entire curing period. Water for curing shall be clean and free from any elements which will cause staining or discoloration of the concrete. Where forms of wood are used and left in place during curing, the wood shall be kept wet at all time.

C. Membrane Curing. At the option of the Contractor and when approved by the Engineer, the concrete may be cured with an approved curing compound of the surface membrane type in lieu of moist curing with water provided a permanent stain is not produced and provided the concrete surface is not to receive rubbed finish, terrazzo, tile, paint, chemical hardening, grout, cement patch, or concrete topping. The curing compound shall be applied to formed surfaces immediately after the forms have been removed and the surfaces cleaned of any loose sand, mortar and debris. The surface to receive the compound shall be moistened thoroughly with water and the compound applied as soon as the moisture film has disappeared but when the surface is still damp. On unformed surfaces, the compound shall be applied immediately after the surface loses its free water and has a dull appearance.

The curing compound shall be applied in a two coat continuous operation by approved spraying equipment and at a coverage of not more than two hundred square feet per gallon for both coats. The second coat shall be applied to overlap the first coat in a direction at approximately right angles to the direction of the first application. Concrete surfaces which are subjected to heavy rainfall within three hours after the curing compound has been applied shall be resprayed by the method and at the coverage herein specified. All concrete surfaces on which curing compound has been applied shall be adequately protected for the duration of the entire curing period from any damage that would disrupt the continuity of the curing membrane.

The curing compound shall conform to Type 2 or Type 3 of ASTM C-309.

All curing compound shall be delivered to the site of the work in the original sealed container bearing the name of the manufacturer, the brand name and the manufacturer's batch number. The compound shall be approved prior to use. The compound shall be stored so as to prevent damage to the containers and water-emulsion types shall be protected from freezing.

D. Cold Weather. The air and forms in contact with the concrete shall be maintained at temperatures above forty degrees for at least seven days and at a temperature above freezing for at least 21 days. Concrete, permitted to be cured with curing compounds, shall be provided the same protection against freezing and low temperatures as provided herein. No fire or excessive heat shall be permitted near or in direct contact with concrete at any time.

3.8 Embedded Items

A. General. Before placing concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings or required by the Engineer. All embedded items shall be clean and free of oil and other foreign matter such as loose coatings of rust, paint and scale. Any air lines, water lines, wall sleeves, or other materials embedded in structures shall conform to the above requirements and, upon completion of their use, shall be backfilled with concrete or grout as directed by the Engineer.

B. Pipe Embedded in Concrete. Where pipe is partially or wholly encased in concrete, care shall be taken that the pipe is firmly and securely held in place so that the alignment and grade of the pipe is not disturbed while the concrete is placed around the pipe.

End of Section

SECTION 03371 - GROUT

PART 1 - GENERAL

- A. The general provision of the Contract, including General and Supplementary Conditions and Requirements, apply to the work specified in this section.

PART 2 - RELATED WORK SPECIFIED ELSEWHERE

- A. Structural steel base plates, anchoring devices and leveling shims: Section 5A.

PART 3 - DELIVERY AND STORAGE

- A. Prevent damage to or contamination of non-shrink grouting materials during delivery, handling and storage.
- B. Store all non-shrink grouting materials in undamaged condition with seals and labels intact as packaged by the manufacturer.
- C. Non-shrink grout - SonogROUT - Sonneborn - Contech by Sonneborn Building Products Division or approved equal to be used under bearing plates or for grouting rebar dowels into existing walls.

PART 4 - MATERIALS

- A. Non-shrink grout conforming to the following requirements:
 - 1. Manufactured under rigid quality control specifically for grout used in transferring heavy loads.
 - 2. Contain metallic and non-metallic aggregates especially graded to minimize bleeding.
 - 3. Contain metallic aggregate that is ductile and capable of withstanding impact without fracturing.
 - 4. Have an initial setting time of approximately one hour at 70 degrees F.
 - 5. Produce no settlement or drying shrinkage at 3 days or thereafter.
 - 6. Have higher strength at all ages than plain cement grout of the same flowability.
 - 7. Resist attack by oil and water and have lower absorption than plain cement grout of the same flowability.
- B. Portland Cement: ASTM C 150-72, Type 1.
- C. Sand: ASTM C 33-71a, Fine Aggregate.
- D. Pea Gravel: ASTM C 33-71a. Coarse aggregate, graded so that at least 90 percent passes 3/8-inch sieve and 90 percent is retained by a number 4 sieve.

PART 5 - MIXES

- A. For less than 2-inch clearance, or where size or shape of space makes grouting difficult, grout mix shall consist of grout material and water.
- B. For greater than 2-inch clearances where coarse aggregate will not obstruct free passage of the grout, extend grout by adding 50 pounds of pea gravel per 100 pounds of grout material.
- C. Use the minimum amount of water necessary to produce a flowable grout without causing either segregation or bleeding.

- D. Portland cement mortar for raked-out edges of non-shrink grout: 1 part Portland cement, 2 parts sand and 0.50 parts water by weight.

PART 6 - MIXING

- A. Mix non-shrink grouting materials and water in a mechanical mixer for no less than 3 minutes.
- B. Mix grout as close to the work areas as possible and transport the mixture quickly and in a manner that does not permit segregation of materials.
- C. After the grout has been mixed, do not add more water for any reason.

PART 7 - PROCEDURES

- A. Installation methods and procedures shall be approved by the Engineer's representative before work is begun.

PART 8 - SURFACE PREPARATION

- A. Remove all defective concrete, laitance, dirt, oil, grease, and other foreign material from concrete surfaces by bush-hammering, chipping, or other similar means, until a sound, clean concrete surface is achieved.
- B. Lightly roughen the concrete, but not enough to interfere with the proper placement of grout.
- C. Cover concrete area with waterproof membrane until ready to grout.
- D. Remove foreign materials from all steel surfaces in contact with grout.
- E. Align, level, and maintain final positioning of all components to be grouted.
- F. Take special precautions during extreme weather conditions according to the manufacturer's written instructions.
- G. Immediately before grouting, remove waterproof membranes and clean any contaminated surfaces.
- H. Saturate all concrete surfaces with clean water; remove excess water and leave none standing.

PART 9 - PLACING

- A. Place non-shrink grouting material quickly and continuously by the most practical means permissible; pouring, pumping, or under gravity pressure.
- B. Do not use either pneumatic-pressure or dry packing methods without written permission of the Architect.
- C. Apply grout from one side only to avoid entrapping air.
- D. Final installation shall be thoroughly compacted and free from air pockets.
- E. Do not vibrate the placed grout mixture, or allow it to be placed if the area is being vibrated by nearby equipment.
- F. Do not remove leveling shims for at least 48 hours after grout has been placed.
- G. After shims have been removed, fill voids with plain cement-sand grout.

- H. After the non-shrink grout has reached initial set, rake out all exposed edges approximately 1-inch into the grouted area and point with portland cement mortar.

PART 10 - CURING

- A. Cure grout for 3 days after placing by keeping wet and covering with curing paper or by another approved method.

End of Section

SECTION 04100 - MORTAR

PART 1 - SCOPE

A. This Section includes all labor, materials, equipment, and related items required for the work of mortar as shown on the Drawings and specified herein. The work includes but is not necessarily limited to the following:

1. Furnishing of all mortars required for the work of unit masonry.

B. This Section does not include the following related items:

1. Concrete or grout required for the filling of hollow masonry units, grouting door frames, etc.
2. Unit masonry work.

PART 2 - PRODUCT HANDLING

A. All materials shall be delivered, stored, and handled in a manner to prevent damage by breakage, water, or moisture, or the inclusion of foreign particles. Packaged materials shall be delivered in unbroken packages with the manufacturer's name, brand, and applicable data plainly marked thereon. No materials shall be dumped or stored on the ground. Bulk materials shall be stored on a clean surface or platform as required and shall be protected from deterioration and foreign matter.

B. All tools and equipment shall be delivered, protected, and handled in a manner to prevent any damage which may make them defective for the purpose for which they are intended.

PART 3 - MATERIALS

A. General. One manufacturer's brand and/or source of supply shall be utilized for each material specified hereinafter in order to maintain uniformity of mortars prepared under work of this section.

B. Portland cement shall conform to ASTM C150, Type I or III.

C. Masonry cement shall conform to ASTM C91.

D. Hydrated lime shall conform to ASTM C207.

E. Aggregate shall be natural river sand conforming to ASTM C144, shall be clean, sharp, well graded, and free from injurious amounts of dust, lumps, shale, alkalis, surface coating, and organic matter.

F. Water shall be clean and free from deleterious quantities of acid, alkali, oils, salts, and organic matter.

G. **Admixtures.** The use of admixtures in mortar shall not be permitted unless approved in writing by the Architect. If an admixture is approved, it shall be used throughout whatever segment of the work for which it is proposed.

H. **Antifreeze Compounds.** Antifreeze liquids, salts, and other substances shall not be used in order to lower the freezing point of mortar.

PART 4 - MIXES

A. Mortar shall be freshly prepared and uniformly mixed in proportions by volume conforming to ASTM C270, Type N, 750 p.s.i. or Type S, 1,800 p.s.i. at 28 days as specified.

B. Mortar for use in all applications shall be mixed as follows. Proportions of mortar by volume shall conform to the following table, with the aggregate measured in a damp, loose, condition.

Mortar Type	Portland Cement	Masonry Cement	Hydrated Lime or Lime Putty	Aggregate
N	None	1 (Type II)	None	(Not less than 2¼ nor more than 3 times the sum of the cements and lime used)
N	1	None	Over ½ to 1¼	
S	½	1 (Type II)	None	

C. The weights per cubic foot of materials in mortar are considered to be as follows:

Material	Weight/Cubic Foot
Portland Cement	94 lbs.
Masonry Cement	Weight printed on bag
Hydrated Lime	40 lbs
Sand, damp and loose	80 lbs.

PART 5 - MIXING

A. Measurement by volume shall be manufacturer's packages or other containers of known capacity or by approved batching device so that specified proportions shall be consistently maintained. Material that has partially set shall not be re-tempered or used; frozen, caked, or lumpy material shall not be used. Mix mortar with proper amount of water, for a minimum of 5 minutes to desired consistency, and uniform color is obtained in electric batch mixer.

B. **Mortar Flow.** Mortar of the materials and proportions used in the construction shall have a flow after section for one (1) minute of not less than 70 percent of that immediately before suction. The flow shall

be determined by the method of the Water Retention Test of the Standard Specifications for Masonry Cement, ASTM C91.

C. Mortar Consistency. The mortar shall be of as wet a consistency as can be conveniently handled, and it shall be re-tempered frequently if necessary. Mortar which has greatly stiffened or in which the cement material has started to set shall not be used.

End of Section

SECTION 04200 - UNIT MASONRY

PART 1 - GENERAL

A. This Section includes all labor, materials, equipment, and related items required for the work of unit masonry as shown on the Drawings and as specified.

PART 2 - PRODUCT HANDLING

A. Store all masonry units on screeds and under cover to properly protect from the elements until ready for use. Dirty, cracked, chipped, or otherwise damaged masonry units shall not be used.

PART 3 - ENVIRONMENTAL CONDITIONS

A. Masonry shall not be laid in freezing weather unless suitable means are used to heat the materials and protect the work from cold and frost, and to insure that the mortar will properly harden without freezing.

PART 4 - PROTECTION

A. The Contractor shall protect exposed masonry materials of every kind against staining, and the tops of all walls shall be kept covered with non-staining waterproof covering at the end of each work day and at any time the work thereon is not in progress. When starting or resuming work at a new level, the top surface of the work in place shall be cleaned of all loose mortar and foreign materials and in drying weather thoroughly wetted with clean water. Then resume laying.

PART 5 - MATERIALS

A. Masonry Units:

1. Concrete block for general use throughout the project shall be hollow, load-bearing concrete masonry units complying with ASTM C90, Grade N-1, shall have nominal 8" x 16 face, or as shown, shall have a compressive strength of not less than 800 p.s.i. for individual units and an average of 1,000 for five units.

a. Exterior CMU shall be waterproof with waterproof mortar; color, Buff.

b. All aggregates for concrete masonry units shall conform to ASTM C33I, and shall be expanded shale produced by the rotary kiln process.

c. All units shall be made with Portland cement complying with ASTM CI50, and weighing not more than 100 lbs. per cubic foot.

d. All units shall be square, true, and have sharp arriser. They shall be of consistent texture, and shall be dimensionally stable with regard to height, width, and lengths. All units shall be free of organic impurities that will cause rusting, staining, or pop-outs, and shall contain no combustible matter.

e. Steam Curing. All concrete blocks shall be steamed in an atmosphere of 100 degrees F. for a period of 4 to 6 hours. Steam curing shall commence after masonry units have been allowed to "set" for a period of 1-1/2 to 2 hours. After steam curing, allow kiln temperature to drop slowly before removing blocks from kiln. Blocks shall be stored for a period of 30 days and protected from the weather during this period before delivery to site.

2. Fire rated concrete block for use in interior shafts shall conform to general specifications for other concrete block set forth above, and shall conform to Underwriter's Laboratories D-2 classification for two-fire rating.

a. Manufacturer of concrete block units shall provide U.L. standard certificate certifying that materials furnished meet classification specified to the Architect for approval prior to delivery of units to the site.,

B. Masonry Wall Reinforcement:

1. Provide all prefabricated internal or external corners required by installation.

C. Anchors and ties shall be of corrosion resistant metal equal in strength, size and numbers to conform with requirements of American standard A41.1 titled American Standard Building Code Requirements for Masonry.

1. Brick wall ties. crimped wall ties for anchorage of face brick to backing in metal stud frame shall be crimped galvanized metal 22 gauge, 7/8" wide x 7" long.

2. Truss type reinforcement for horizontal reinforcing at concrete masonry partitions. Reinforcement shall be Dur-O-Wall Truss No. 9 gauge cross rod or approved equal. All components of anchor to have a hot dipped galvanized finish. Place joint reinforcement directly on masonry and place mortar over wire to form bed joint.

PART 6 - LAYING CONCRETE BLOCK

A. Lay all concrete block in exterior and interior wall construction where indicated, using Type N mortar furnished under work of Section 04100, except that Type S mortar shall be used in laying concrete block below grade.

B. All bed and head joints shall be completely filled with mortar. Bed joints shall be filled by spreading a thick bed of mortar. Fill head joints with a heavy buttering of mortar on one side (each flange) of block, press the block down into the bed joint, and push the block into place so that the mortar squeezes out from the top and sides of the head joint. Mortar should correspondingly cover the end flange of the block before placing the next block. Attempting to fill joints by slushing or dashing will not be permitted. Partial filling of joints with mortar cut from the extruded bed joint will not be permitted. Where closures are required, fill with mortar so that the intersection of the closure will extrude mortar, both laterally and vertically. Extend walls and partitions to heights indicated, building in around joist bearings, etc. as shown or required. Cut units as required to properly course in plan and vertical section as shown on the Drawings or as directed by the Architect. All cuts shall be accurately made with masonry saw.

1. Anchorages of concrete block to various backup material shall be as specified under Article 8 above for brick.

C. Joints and Bond. All concrete masonry units shall be laid in running bond. Joints in concrete block work shall be 3/8" wide for both head and bed joints. Joints in masonry scheduled to receive separate finish or where concealed in the work shall be cut flush. Rake joints 3/8" deep at control joints, where masonry abuts concrete surfaces, etc., and otherwise where shown on the Drawings, for caulking by others under work of Section 07900.

D. Reinforcement. Concrete masonry walls and partitions shall be reinforced continuously in every other course, (16" o.c. vertically) using masonry wall reinforcement of types as hereinbefore specified. Reinforcement shall be seated in the mortar bed by lifting cross ties as work progresses. Lay internal and external corners and intersections as required for the completed job.

- E. Chases for pipes, conduits, etc. shall be plumb and smooth on the inside, with offsets formed where required, kept free of obstructions and cleaned out on completion. There shall be at least 8" of masonry between chases and the jambs of openings.
- F. Build units accurately to metal door frames, building in anchors furnished with frames. Slush solid with mortar at jambs and head.
- G. Coordinate work with other trades, building in all items shown to be installed in concrete block work such as lintels, anchors, sleeves, etc. Prepare openings as shown or required for proper installation of mechanical, electrical, and other items.
- H. Cleaning. Extreme care shall be exercised during laying to protect units from mortar droppings, etc. Upon completion of work, all exposed concrete block shall be properly cleaned with a stiff bristle brush to remove all excess mortar, dirt and stains. Do not use acid.
- I. Workmanship. The contractor is cautioned that the Architect will demand first class workmanship. All concrete masonry work shall be performed by experienced masons. Any chipped, cracked or otherwise damaged or defective work will be rejected.

End of Section

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

- A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this section.

PART 2 - RELATED WORK SPECIFIED ELSEWHERE

- A. Grouting, Division 3.

PART 3 - REQUIREMENTS FOR REGULATORY AGENCIES

- A. AISC Specification Structural Steel for Buildings shall mean AISC Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings, adopted November 1, 1978.
- B. AWS Building Code shall mean AWS "Code for Welding in Building Construction", D1 .0-69.

PART 4 - QUALIFICATIONS

- A. Welding procedures, welders, welding operations and tackers shall be qualified in accordance with AWS Building Code.

PART 5 - SUBMITTALS

- A. Shop Drawings:
1. Submit shop drawings indicating all shop and erection details, including cuts, copes, connection, holes, threaded fasteners and welds.
 2. All welds, both shop and field shall be indicated by AWS "Welding Symbols" A2.0-68.
- B. Erection Procedure: Submit descriptive data to illustrate the structural steel erection procedure, including the sequence of erection and temporary staying and bracing.
- C. Welding Procedure: Submit written description as required to illustrate each welding procedure to be performed in the specified work.
- D. Field Welding Equipment: Submit descriptive data for field welding equipment, including type, voltage and amperage.
- E. Reports of mechanical tests for high strength threaded fasteners.

PART 6 - PRODUCT HANDLING

- A. Delivery of materials to be installed under other sections:
1. Anchor bolts and other anchorage devices which are embedded in cast-in-place concrete or masonry construction shall be delivered to the project site in time to be installed before the start of cast-in-place concrete operations or masonry work.
 2. Provide setting drawings, templates, and directions for the installation of the anchor bolts and other devices.
- B. Storage of Materials:
1. Structural steel members which are stored at the project site shall be above ground on platforms, skids or other supports.

SECTION 05120 - STRUCTURAL STEEL

2. Steel shall be protected from corrosion.
3. Other materials shall be stored in a weathertight and dry place, until ready for use in the work.
4. Packaged materials shall be stored in their original unbroken package or container.

PART 7 - MATERIALS

A. Steel Shapes, Bars and Plates:

1. ASTM A 36-69.

B. Structural steel, fabrication and erection shall comply with the American Institute of Steel Construction, Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.

C. Anchor Bolts: Conform to Section IC of ASTM A 307-68

D. High-Strength Threaded Fasteners: ASTM A 325-74.

E. Filler Metals for Welding:

1. Shielded metal-arc welding: AWS A5.1-69 or A5.5-69.
2. Submerged arc welding: AWS A5.17-69.

F. Shop Paint Primer:

1. Standard Primer: SSPC Paint 14-64T.

G. All bolted connections shall be of high strength bolts conforming to ASTM A 325 and shall be bearing type with threads excluded from shear plane.

H. All structural steel shall be accurately set and properly secured in place. Field connections of steel work shall be welded or bolted with high strength bolts, size as called for on the drawings. Connections shall be as detailed. All welding to be done by certified welders with at least five years experience in structural welding, and in a neat workmanlike manner.

PART 8 - FABRICATION

A. Fabricate Structural Steel in accordance with the AISC Specification with the modifications and additional requirements specified in this section:

1. Shop and field welding shall conform to AWS and AISC Standards and Specifications.

B. Shop connections shall be welded.

C. Field Connections:

1. Provide bolted, except where welded connections are indicated.
2. High strength threaded fasteners shall be used for bolted connections, except where standard threaded fasteners are permitted.

SECTION 05120 - STRUCTURAL STEEL

D. High-Strength Bolted Construction Assembly:

1. Tightening shall be done in accordance with Section 5 of Specifications for Structural Joints.

E. Shop Painting:

1. Shop paint all steelwork.
2. Steelwork to be painted shall receive a one-coat shop paint system in accordance with SSPC Paint System PS7.0I Paint I4-64T.

PART 9 - ERECTION

- ### A. Erect structural steel in accordance with the AISC Specifications.

End of Section

SECTION 05500 - MISCELLANEOUS METALS

PART 1 - SCOPE

A. This Section includes the furnishing and installation of all miscellaneous metal items required for the project as shown on the Drawings and specified herein.

PART 2 - COORDINATION

A. Coordinate furnishing of items specified hereunder with work of other trades so that progress of related work is not delayed.

B. Take field measurements at the job as necessary to insure fit.

PART 3 - MATERIALS

A. Stock or manufacturer's standard items shall be as described under individual item specifications hereunder.

B. Fabricated items, made especially for this project, shall meet general materials specifications as listed hereunder. Materials shall be of the type, class, temper, etc., which best suit intended uses.

1. Steel shall conform to ASTM Specification A-7 or A-36 for structural steel. Architectural and miscellaneous steel not otherwise indicated or specified shall be mild steel.

Shop Drawings and Data: Show complete details and instructions for fabrication, assembly, and installation. Locate anchor bolts required for installation in other work.

Inserts and Anchorages: Furnish inserts and anchoring devices to be built into other work for installation of miscellaneous metal items.

Steel Plates, Shapes, Bars: ASTM A 36

Tubular Steel Items: Square and rectangular, ASTM A 501; pipe, ASTM A 120.

Cold-Rolled Steel Sheets: ASTM A 366.

Galvanized Steel Sheets: ASTM A 526, with ASTM A 525 G90 zinc coating.

Concrete Inserts: Malleable iron (ASTM A 47) or cast steel (ASTM A 27) inserts, with steel bolts, washers and shims; hot dip galvanized.

Shop Paint: FS TT-P-86, Type 2; or, SSPC-Paint 14. Apply to prepared steel surfaces at rate to provide a 2.0-mil dry film thickness.

Galvanizing: ASTM A 386 for assembled products; A 153 for iron and steel hardware.

Fabrication, General: Use materials of size and thickness shown. Shop-paint all items not specified to be galvanized after fabrication.

Curb Edge Bars: Fabricate of shapes as shown; miter corners and weld joints. Provide anchors 6" from ends of corners and 24" o.c.

Loose Bearing Plates: Provide for steel items bearing on masonry or concrete, as shown. Drill plates to receive anchor bolts.

Miscellaneous Framing and Supports: Provide as required to complete work and not included with structural steel framework.

Steel Pipe Railings: Fabricate to dimensions shown, with smooth bends and welded joints. Use 1-1/2" steel pipe unless otherwise shown.

Installation: Perform cutting, drilling, and fitting required for installation; set work accurately in location, alignment and elevation, measured from established lines and levels. Provide anchorage devices and fasteners where necessary for installation to other work.

PART 4 - SHOP PAINTING AND PROTECTIVE COATING

A. All ferrous metal shall be properly cleaned and given one shop coat of red lead, zinc chromate, or other approved rust resisting paint. Anchors that are built into masonry or concrete shall be coated with asphalt paint unless specified to be galvanized. Where galvanized or zinc coated metal is required, it shall not be shop primed unless specifically called for, but all abraded places and welding shall be touched up with aluminum paint. No prime coat is required for non-ferrous metal.

B. Where hot-dip galvanized or hot zinc coating is specified, it shall be done in accordance with the Standard Specifications of the American Hot Dip Galvanizers Association.

PART 5 - FASTENINGS

A. **Welding.** Perform all welding in accordance with American Welding Society publication AWS D1.0, latest edition with current supplements and addenda.

1. Welds shall be made only by operators experienced in performing the type work indicated.
2. Welds normally exposed to view in the finished work shall be uniformly made and ground smooth.
3. Where welding is done in proximity to glass or finished surfaces, such surfaces shall be protected from damage due to weld sparks or spatter.

B. **Bolted Screwed, and Riveted Connections.** In general, use bolts for field connections only as directed. Provide washers under all heads and nuts bearing on wood. Draw all nuts tight and nick threads of permanent connections to prevent loosening. Use beveled washers where bearing is on sloped surfaces.

1. Where screws must be used for permanent connection in ferrous metal, use flat head type, countersunk.
2. Where rivets are used, they shall be machine driven, tight, heads centered, countersunk and finished flush and smooth.

PART 6 - MISCELLANEOUS ITEMS

A. **Anchoring Devices.** Furnish all miscellaneous metal anchoring devices required to be built into concrete or masonry or welded to steel framing members for anchorage of collateral work which are not specified to be furnished under other sections of the Specifications. Items include, but are not necessarily limited to the following:

SECTION 05500 - MISCELLANEOUS METALS

1. Anchor bolts for miscellaneous anchorage built into concrete or masonry not furnished under work of structural steel shall be hex-head steel machine bolts of sizes shown in the details, shall conform to ASTM A354, and shall be furnished with nuts and plate washers of size to suit the particular application.

B. Loose Lintels. Furnish all loose steel angle and/or plat lintels not furnished as part of structural steel under work of Section 05120 as required for support of masonry over openings. Members shall be of sizes shown, and, unless otherwise indicated, shall have minimum bearing at each end of 8".

End of Section

SECTION 06112 - FRAMING AND SHEATHING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Roof sheathing.

1.02 REFERENCES

- A. ALSC - American Lumber Standards Committee: Softwood Lumber Standards.
- B. ANSI A135.4 - Basic Hardwood.
- C. ANSI A208.1 - Mat Formed Wood Particleboard.
- D. APA - American Plywood Association.
- E. AWWPA - American Wood Preservers' Association: Book of Standards.
- F. FS-TT-W-571 - Wood Preservation: Treating Practices.
- G. NFPA - National Forest Products Association.
- H. SFPA - Southern Forest Products Association.
- I. WCLIB - West Coast Lumber Inspection Bureau: Standard Grading Rules for West Coast Lumber.
- J. WWPA - Western Wood Products Association.

1.03 QUALITY ASSURANCE

- A. Lumber Grading Agency: Certified by ALSC.
- B. Plywood Grading Agency: Certified by APA.

1.04 REGULATORY REQUIREMENTS

- A. Conform to UL requirements to achieve rating indicated.

1.05 SUBMITTALS

- A. Submit product data under provisions of Section 013400.
- B. Provide technical data on wood preservative materials and application instructions.

C. In lieu of grade stamping exposed-to-view lumber and plywood, submit manufacturer's certificate under provisions that products meet or exceed specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store and protect products under provisions of Section 01600.

PART 2 - PRODUCTS

2.01 PLYWOOD MATERIALS

A. Roof Sheathing: APA Structural I, 19/32" x 4' x 8 SYP, CDX sanded.

2.03 ACCESSORIES

A. Fasteners: galvanized steel for exterior, high humidity, and treated wood locations; plain finish elsewhere; size and type to suit condition.

PART 3 - EXECUTION

3.01 SHEATHING

A. Secure roof sheathing perpendicular to framing members with ends staggered. Secure sheet edges over firm bearing. Use sheathing clips between sheets between roof framing members.

B. Secure wall sheathing horizontally perpendicular to wall studs, with ends staggered over firm bearing.

3.02 TOLERANCES

A. Framing Members: 1/4 inch maximum from true position.

B. Surface Flatness of Floor: 1/4 inch in 10 feet maximum

End of Section

SECTION 06192 - WOOD TRUSSES

PART 1 - GENERAL

SUMMARY

Provide prefabricated and pre-engineered wood trusses:

1. Gable-shaped trusses.
2. Hip and girder trusses at hip ends of roof.
3. Monopitch trusses.

1.01 SUBMITTALS

- A. Submit for approval shop drawings, product data.

QUALITY ASSURANCE

Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

- A. Standards: TPI, Design Specification for Metal Plate Connected Wood Trusses; TPI, Design Specification for Metal Plate Connected Parallel Chord Wood Trusses.

- B. Design Engineering: Registered Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Wood Trusses:

Lumber Standard: PS 20 American Softwood Lumber Standard.

Dressing: Dressed four sides.

Moisture Content: Seasoned, 19 percent maximum.

- B. Connectors, Fasteners, and Metal Framing Anchors:

1. Connectors: Hot-dip galvanized steel sheet, ASTM A 446, Grade A; ASTM A 525, G60.
2. Connectors: Electrolytic zinc-coated steel sheet, ASTM A 446, Grade A; ASTM A 591, Coating Class C.
3. Connectors: Aluminum-zinc, alloy-coated steel sheet, ASTM A 446, Grade A; ASTM A 792, Coating Designation AZ 50.

4. Connectors: Stainless steel sheet, ASTM A 446, Grade A; ASTM A 167, Type 304.
5. Nails, Wire, Brads, and Staples: FS FF-N-105.
6. Power Driven Fasteners: National Evaluation Report NER-272.
7. Wood Screws: ANSI B18.6.1.
8. Lag Bolts: ANSI B18.2.1.
9. Bolts: ASTM A 307, Grade A; ASTM A 563.
10. Metal Framing Anchors: Hot-dip galvanized steel sheet, ASTM A 446, Grade A; ASTM A 525, G60.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with recommendations of TPI Design Specifications for Metal Plate Connected Wood Trusses.
- B. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.
- C. Restore damaged components. Clean and protect work from damage.
- D. Attach all Wood Roof Trusses at all top plates with Simpson H5 connection.

End of Section

SECTION 06200 - FINISH CARPENTRY AND MILLWORK

PART 1 - SCOPE

A. This Section includes all labor, materials, equipment and related items required to complete the work of finish carpentry and millwork as shown on the Drawings and specified herein.

PART 2 - MATERIALS

A. Lumber Standards and Grade-Marking. Each piece of lumber and each board, exclusive of mouldings and trim, shall comply with Product Standard PS-20, latest edition, and with specific grading requirements of the association recognized as covering the species used and under whose grading rule it is produced. Each piece of lumber and each board shall be identified by the grademark of a recognized association or independent inspection agency. Such association or independent inspection agency shall be certified by the Board of Review, American Lumber Standards Committee, Washington, D.C., to grade the species.

B. Mouldings and trim shall conform to details on the Drawings. However, stock mouldings and trim of same sizes and with approximately the same profiles as those detailed may be used if all other requirements are met, subject to approval by the Architect.

C. Plywood shall be softwood plywood, unless otherwise specified under individual item specifications, and shall conform to requirements of "Product Standard PS-1, latest edition, for American Plywood Association." Plywoods for particular applications in this project shall be as specified under Art.3, below.

1. Each standard size panel shall be stamped or branded to show group, type and grade.

D. Moisture content of various materials shall meet the following requirements at time of installation:

1. Boards:

a. 8" or less in width Not more than 19%

b. Wider than 8" Not more than 15%

2. Finish Lumber and Millwork Not more than 12%

E. Dressed lumber shall be surfaced four sides (S4S) to conform to Product Standard PS-20 unless, in addition to being dressed, it has been notched, shiplapped or patterned.

F. Dimensions of lumber specified or called for by the Drawings are nominal, except that trim dimensions shown are actual.

PART 3 - GRADES AND SPECIES

A. Exterior wood trim 2" or greater nominal thickness and 2" or greater nominal width shall be of sizes and profiles shown on the Drawings, shall be S4S, and shall be one of the following species, provided the grade for each is not lower than the minimum shown.

Fir, Douglas, WCLB Rules "A" - Appearance Framing

Pine, Southern Yellow, SPIB Rules "A" - Appearance Framing

SECTION 06200 - FINISH CARPENTRY AND MILLWORK

At the Contractor's option, other specie of comparable appearance grade may be used in lieu of the above, if approved by the Architect. Running lengths of 10' or less in all applications shall be in single pieces.

B. Exterior wood trim 2" or less nominal thickness shall be of sizes and profiles shown on the Drawings, shall be S4S, shall be same specie specified above for 2" or greater exterior trim, and shall be one of the following, provided the grade for each is not lower than the minimum shown:

Fir, Douglas, WCLB Rules

Select Merchantable Boards

Pine, Southern Yellow, SPIB Rules

No. 1 Boards

At the Contractor's option, other specie of comparable appearance grade may be used in lieu of the above, if approved by the Architect. Running lengths of 10' or less in all applications shall be in single pieces.

C. Exterior and interior miscellaneous trim, door and fixed window frames, etc., may be one of the following species, provided the grade for each is not lower than the minimum shown:

Fir, Douglas, WCLB Rules

"D" Finish

Pine, Southern Yellow, SPIB Rules

"C" Finish

At the Contractor's option, other specie of comparable appearance grade maybe used in lieu of the above, if approved by the Architect. Running lengths of 10' or less in all applications shall be in single pieces and may be finger-jointed.

D. Plywoods shall be of the types and minimum grades specified hereunder for specific applications listed. All plywoods shall be from Group 1 Species as listed by the American Plywood Association.

E. Rough hardware needed for the proper installation of all finish carpentry and millwork shall be provided. Nails, screws, bolts and similar items shall be of proper types and ample sizes to fasten and hold the various members and items securely in place.

F. Other materials shall be as specified hereunder.

PART 4 - STORAGE AND PROTECTION

A. All lumber shall be piled in a manner which ensures proper ventilation and drainage, and shall be covered to protect it from the elements.

B. Millwork and wood trim shall be protected against dampness during and after delivery. It shall be stored in well-ventilated buildings and where not exposed to extreme changes in temperature or humidity. Wood doors shall be stored in flat positions, one above another on solid, level supports, with air circulation excluded from top and bottom surfaces.

C. Improper storage resulting in damage to millwork or trim, or warping of doors, shall be cause for their rejection.

PART 5 - GENERAL

A. Finish Carpentry. Work of finish carpentry shall be laid out as shown on the Drawings, and shall be cut and fitted as necessitated by conditions encountered. All work shall be plumbed, leveled, and

properly jointed and secured with sufficient nails, screws, bolts, etc. to ensure proper alignment and rigidity.

B. Any piece of wood or other material with a defect or defects that prevent it from serving its intended purpose satisfactorily, including warped, split, or otherwise defective material, will be rejected and shall be replaced with an acceptable piece.

PART 6 - EXTERIOR AND INTERIOR TRIM

A. Miscellaneous exterior and interior softwood trim, including fascias, mouldings, casings, etc., shall be of species and grades hereinbefore specified, as approved by the Architect and shall be furnished in longest practicable lengths.

B. Joints in all work shall be tight and formed to conceal shrinkage. Door and window trim shall be in long lengths and jointed only where solid fastenings can be made. End joints in all built-up members shall be well distributed so that no joint occurs over another. External and internal corners shall be mitered. Where necessary, woodwork shall be scribed to adjacent work.

1. Joints in running trim, including continuous wood fascia members, shall be scarfed at 45 degrees, except where butt joints may be specifically permitted by the Architect, and shall be drawn up tightly for inconspicuous joints. External exposed corners of trim shall be mitered.

End of Section

SECTION 07210 - BUILDING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide building insulation:
 - 1. Foundation walls, board type.
 - 2. Thermal insulation in exterior cavity walls, board type.

1.02 SUBMITTALS

- A. Submit for approval product data, test reports.

1.03 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instruction.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Board Insulation:
 - 1. Type: Extruded polystyrene, rigid ASTM C578.
- B. Accessories
 - 1. Adhesive and mechanical anchors and clips.
 - 2. Crack sealers and tapes.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections. Provide full thickness in one layer over entire area, tightly fitting around penetrations.
- B. Install extruded polystyrene at foundation.

End of Section

SECTION 07311 - RESIDENTIAL ASPHALT SHINGLE ROOFING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Granular surfaced asphalt shingle roofing
- B. Moisture shedding underlayment, eave, valley and ridge protection.
- C. Associated metal flashing.

1.02 REFERENCES

- A. ASTM D226 - Asphalt Saturated Organic Felt Used in Roofing and Waterproofing
- B. ASTM D228 - Method of Testing Asphalt Roll Roofing, Cap Sheets and Shingles.
- C. ASTM D3018 - Class A Asphalt Shingles Surfaced with Mineral Granules.
- D. ASTM D3462 - Asphalt Shingles made from Glass Felt and Surfaced with Mineral Granules.
- E. ASTM D4586 - Asphalt Roof Cement, Asbestos-Free.
- F. UL 580 - Tests for Wind Uplift Resistance of Roof Assemblies.
- G. UL 780 - Tests for Fire Resistance of Roof Covering Materials.
- H. Good Housekeeping Seal of approval.

1.03 SUBMITTALS

- A. Shop Drawings: Indicate metal flashing, joining methods and locations, fastening methods and locations, and installation details.
- B. Product Data: Provide data indicating material characteristics, and performance criteria.
- C. Manufacturer's Installation Instructions: Indicate preparation required and installation procedures.
- D. Manufacturer's Certificate: Certify that products meets specified requirements.

1.04 QUALITY ASSURANCE

- A. Perform work in accordance with manufacturer's instructions.
- B. Maintain one copy of each document on site.

SECTION 07311 - RESIDENTIAL ASPHALT SHINGLE ROOFING

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable local building codes for shingle types specified.
- B. UL: Class A: Fiberglass Asphalt Shingles.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site.
- B. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Do not install shingles when ambient, or wind chill temperatures are below 50 degrees F.

PART 2 - PRODUCTS

2.01 MANUFACTURER - ASPHALT SHINGLES

- A. The Celotex Corporation, Product: 30 year shingles or equal.

2.02 ASPHALT SHINGLES

- A. Asphalt Shingles: ASTM D3018, ASTM D3462, Class A with Type I - Self Sealing, UL Rating of A and Wind Resistance Label, glass fiber mat base, mineral granule surface type, self sealing type, color: Autumn Blend.

2.03 SHEET MATERIALS

- A. Eave Ice Dam Protection: Celo-Guard; rubberized, self-stick asphalt sheet, 45 mil total thickness, with strippable treated quick-release paper, manufactured by the Celotex Corporation.
- B. Underlayment: ASTM D226, No. 15 unperforated asphalt saturated felts as recommended for use in roofing and waterproofing.

2.04 ACCESSORIES

- A. Nails: Standard round wire shingle type, galvanized 3/8 inch to 7/16 inch diameter head, 11 to 12 gauge barbed shank roofing nails, of sufficient length to penetrate through roof sheathing 3/4 inch into deck lumber or penetrate through the APA approved plywood roof or OSB deck by 1/8 inch minimum, 1-1/2" minimum nail length.
- B. Plastic Cement: ASTM D4586: Elastigum Roof Cement; plastic asphalt type with mineral 1-1/2" fiber components, free of toxic solvents, manufactured by The Celotex Corporation.

2.05 FLASHING MATERIALS

- A. Drip Edge: Corrosion resistant material, 3 inch wide roof coverage.
- B. Nails: Standard round wire roofing type, galvanized or non-rusting; minimum 19/64 inch head diameter and 0.104 inch shank diameter, of sufficient length to penetrate through roof sheathing ½ inch into wood substrate.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify existing site conditions.
- B. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.
- C. Verify roof openings are correctly framed prior to installing work of this Section.
- D. Verify deck surfaces are dry, free of ridges, warps, or voids.

3.02 PREPARATION

- A. Broom clean deck surfaces under eave protection and underlayment.

3.03 INSTALLATION-EAVE ICE DAM PROTECTION

- A. Apply Celo-Guard underlayment at eave in accordance with manufacturer's instructions.
- B. Extend Celo-Guard from roof perimeters to 2 feet inside interior wall line, including rake areas. Provide 6 inch side and end laps at eave and valley locations. Stagger end laps of consecutive layers 12 inches.

3.04 INSTALLATION - PROTECTIVE UNDERLAYMENT

- A. Place one layer of underlayment over deck surface, lapping ends sheet 19 inches. Lap ends minimum 4 inches. Stagger end laps of each consecutive layer. Nail in place. Lap underlayment 12 inches onto valley.
- B. Weather lap and seal watertight with plastic cement, items projecting through or mounted on roof.
- C. When using eave ice dam protection, start underlayment above protection, lapping underlayment 12 inches over eave ice dam protection.

3.05 INSTALLATION - ASPHALT SHINGLES

- A. Install shingles in accordance with manufacturer's instructions.

SECTION 07311 - RESIDENTIAL ASPHALT SHINGLE ROOFING

- B. Project first course of shingles 3/8 inches beyond fascia boards.
- C. Cap hips and/or ridges with individual ridge shingles, maintaining 5/4" inch weather exposure. Place to avoid exposed nails.
- D. Coordinate installation of roof mounted components or work projecting through roof with weather tight placement of counter flashing.
- E. complete installation to provide weather tight service.

3.06 FIELD QUALITY CONTROL

- A. Field inspection will be performed by Owner and Architect.

3.07 PROTECTION OF FINISHED WORK

- A. Protect finished Work.
- B. Do not permit traffic over finished roof surface.

End of Section

SECTION 07400 - VINYL SOFFITS AND TRIM

PART 1 - SCOPE

A. This Section includes all labor, materials, equipment, and related items required for vinyl soffits, and trim as shown on the Drawings and as specified.

PART 2 - SUBMITTALS

A. Manufacturer's Literature. The Contractor shall submit to the Architect, in five (5) copies, for approval prior to furnishing any materials at the job site, product literature, materials specifications, and installation instructions as required to properly evaluate each item proposed to be furnished.

B. Color Samples. The Contractor shall submit to the Architect, in duplicate, for approval and color selection prior to furnishing any materials at the job site, color samples of available colors for each item proposed to be furnished.

PART 3 - MATERIALS

A. Manufacturers. Vinyl soffits and trim as manufactured by Alcoa are specified herein below as the standard of quality expected to be furnished. Equivalent items of same material, configuration, finish, etc., as manufactured by G.A.F., Wolverine, or other nationally recognized manufacturer of vinyl siding and trim are acceptable, subject to approval of submittals as specified above.

B. Vinyl soffit panels shall be standard 12" wide double V-groove or 6" wide single V-groove style, and shall be furnished in both ventilated and non-ventilated types as required for the completed installations. Color shall be from manufacturer's standards as selected by the Architect.

1. Furnish ventilating sections in sufficient quantities to provide minimum free ventilating area at overhangs equal to or exceeding 1/600 of building roof area. Provide manufacturer's technical product data confirming ventilating area and consult with the Architect as to spacing of ventilating sections prior to proceeding with the installations.

C. Trim and Accessories, including Round Vents.

1. Vinyl trim, including starter stripe, inside and outside corner posts, general purpose trim, etc. shall be by same manufacturer as vinyl siding and soffit materials, shall be minimum of .040" thick, and shall be as shown or required for the completed installations. Furnish trim in longest available lengths for single-piece applications where not exceeding manufacturer's standards.

2. Coil stock for covering exterior wood trim shall be vinyl (PVC) coated aluminum .019 gauge with a wood grain texture. Field break coil stock as necessary for smooth application.

3. Colors of vinyl trim shall match those of vinyl siding or soffits with which in connection.

4. Nails, fasteners, etc., shall be those specifically recommended by the siding and soffit manufacturer for applications shown.

PART 4 - INSTALLATIONS

A. General. Inspect all supporting construction, openings, etc., in connection with vinyl siding, soffits, trim, etc., and report in writing to the Architect any defects or improper conditions affecting the installations. Proceeding with installations shall be construed as acceptance of the supporting

construction, and the Contractor shall be held responsible for any defects in the work of this Section resulting therefrom.

B. Install all vinyl siding and soffits, and trim, etc., furnished in connection therewith in strict accordance with manufacturer's specific installation instructions and as shown or detailed on the Drawings. Items shall be neatly cut and fitted, and securely attached. Joints where necessary shall be neatly made. Take care in the installations not to damage adjacent collateral work. Contractor shall provide under work of this Section each and every component, device, accessory, sealant, etc., necessary for the satisfactory completion of the vinyl siding and soffit work, whether or not such items are specifically mentioned hereinbefore.

C. At completion, vinyl siding, soffits, trim, etc., shall be properly installed, securely fastened, water and weather tight, and free from damage of any kind. Contractor shall replace any damaged or defective materials at no additional cost to the Owner.

End of Section

SECTION 07631 - GUTTERS AND DOWNSPOUTS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Prefabricated aluminum eave gutters and downspouts, with baked enamel finish, complete with required connecting pieces, roof aprons, end caps, anchorages, etc. as required for a complete installation.
- B. Precast concrete splash pads.

1.02 REFERENCES

- A. ASTM B209 - Aluminum Alloy Sheet and Plate

1.03 SUBMITTALS

- A. Submit shop drawings of gutters and downspouts.
- B. Clearly indicate general construction, configurations, jointing methods and locations, fastening methods and locations and installation details.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Alcoa
- B. Reynolds Metals
- C. Kaiser
- D. Substitutions: Reviewed equal.

2.02 MATERIALS

- A. Gutters shall be made of 3005-H25 Aluminum Sheet.
- B. Gutter shall be standard 5" Ogee pattern with nominal 2" x 3" downspouts.
- C. Expansion joint to be aluminum, lined with neoprene.
- D. Downspout Clip .014"
- E. Gutter hangers shall be strap hangers.
- F. All Accessories used shall be by the same manufacturer.
- G. Splash Pads: Precast concrete type, 12"x 30" nominal, one per downspout.
Minimum 4,500 psi at 28 days, with minimum 5 percent air entrainment.

2.03 FABRICATION

- A. Form gutters and downspouts of profiles and sizes indicated on Drawings and as required to properly collect and remove water. Fabricate complete with required connection pieces.
- B. Form sections square, true and accurate in size, in maximum possible lengths and free of distortions and defects detrimental to appearance or performance. Hem exposed edges. Allow for expansion at joints.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Before starting work, verify governing dimensions at building; examine, clean and repair, if necessary, any adjoining work on which this work is in any way dependent for its proper installation.
- B. Upon completion, the contractor shall clean all aluminum work.
- C. Dissimilar materials
 - 1. Care must be exercised in placing aluminum in contact with metals or materials not compatible with aluminum.
 - 2. Dissimilar materials shall be painted or otherwise protected when they are in contact with aluminum or when drainage from them passes over aluminum.

PART 4 - RIDGE VENT

- A. When indicated on the Drawings, furnish and install at building roofs manufacturer's standard, continuous, ridge-type with minimum high impact copolymer vent such as shingle vent II Series SHFV203 as manufactured by Air Vent, Inc., Peroia, Illinois or reviewed equal with minimum net free area of 18 sq. inches per linear foot, and shall include end and connector plugs, weather baffles, joint covers, and aluminum screw shank nails as required by the installations or reviewed equal.
- B. Installation shall be in accordance with manufacturer's printed instructions.
- C. Colors to match roof.
- D. Slant Vents
- E. Furnish and install where shown on drawings, manufacturer's standard slant vent such as RV-61, net free area, 61 square inches, heavy-duty polypropylene construction with aluminum screen, nominal 19½"x16¼" size by the solar group, Taylorsville, Mississippi or reviewed equal.
- F. Color to match roof.

End of Section

SECTION 07900 - CAULKING

PART 1 - SCOPE

A. This Section includes all labor, materials, equipment, and related items required for the work of caulking as shown on the Drawings and as specified herein. Work under this Section includes but is not necessarily restricted to the following:

1. Caulking of exterior or interior expansion or control joints in concrete or masonry.
2. Other joints, exterior or interior, in the building construction shown, specified, or required to be caulked.

PART 2 - SUBMITTAL

A. Contractor shall submit to the Architect, in duplicate, for approval the following items prior to furnishing any materials at the job site.

1. Sample cards of all exposed caulking and sealant for color approval. Unless otherwise directed, apply samples in minimum 3" runs on cards.
2. One lineal foot of each type of backer material proposed.

PART 3 - PRODUCT HANDLING

A. Deliver caulking, and related accessories to the job site in factory sealed, unopened containers bearing manufacturer's name and product designation.

B. Store materials in unopened containers, following manufacturer's recommendations for storage temperature and shelf life.

C. Follow manufacturer's recommendation for handling products containing toxic substances. Keep flammable materials away from heat, sparks, and open flames. Use recommended solvents and cleaning agents for cleaning tools and equipment.

PART 4 - ENVIRONMENTAL CONDITIONS

A. Schedule caulking operations so that working joints are most likely to be normal size. Apply materials within manufacturer's recommended surface and ambient temperature range.

PART 5 - PROTECTION

A. Use masking tape where practicable to control lap of materials onto adjacent surfaces or to facilitate tooling. Remove tape immediately after caulking operation.

PART 6 - MATERIALS

A. General. All caulking, primers, and accessories shall be non-staining to adjacent exposed materials. Products having similar application and usage shall be of the same manufacturer and type. Unless otherwise specified, colors shall be selected from approved manufacturer's standard color sections. Use gun consistency compounds unless otherwise required by job conditions.

B. Exterior caulking shall be a one or two-component polysulfide base, elastic, synthetic rubber compound, conforming to Federal Spec. TT-S-00230, and shall be "Sonolastic" as manufactured by the

Sonneborn Building Products, Inc., "Synthacalk" as manufactured by the Pecora Chemical Corp., or "Rubber Calk 500" as manufactured by the Products Research & Chemical Corp or an approved equal.

1. Colors shall be from manufacturer's standards as selected by the Architect.

C. Interior caulking for general use shall be a one-component acrylic latex compound, and shall be "Sonolac" as manufactured by the Sonneborn Building Products, Inc. "AC-20" as manufactured by the Pecora Chemical Corp., or "Latex Caulk" as manufactured by DAP, Inc.

D. Primers shall be as manufactured and recommended for each substrate by the manufacturer of each caulking compound used in the work.

E. Backer materials shall be as recommended for and compatible with each caulking used, and shall be as follows unless otherwise required to meet specific job conditions.

1. Backer rod for use in all joints requiring backer for caulking shall be a soft, closed cell polyethylene foam meeting requirements of AASHTO Specifications M153-54, Type I and III, and shall be as manufactured by the Dow Corning Corp., Sonneborn Building Products, Inc., or Williams Products, Inc.

F. Release material, where required, shall be polyethylene film.

PART 7 - MIXING

A. Job mix multi-component sealants with suitable power operated equipment, following specific directions of sealant manufacturer.

B. Base and accelerator components of multi-part sealants shall have batch control numbers clearly indicated on containers. Control numbers for mixed components shall be identical.

PART 8 - CONDITION OF SURFACES

A. Inspect all surfaces to receive caulking materials, and report all defects. Starting work implies acceptance of surfaces as satisfactory. Verify that joints and spaces to be caulked are of proper width.

B. Concrete surfaces shall be thoroughly cured.

C. Apply no caulking materials in contact with surfaces contaminated with oil, grease, bituminous materials, form release agents, bond breakers, deleterious curing compounds, water repellents, and other special surface treatments. Aluminum surfaces shall be free of lacquer. Costs incurred by removal of such contaminants shall be borne by the trades responsible for their presence.

PART 9 - PREPARATION

A. Thoroughly clean all joints, removing all foreign matter such as dirt, dust, moisture, frost, rust, paint, lacquer, and protective coatings. Blow all joints free of loose particles.

B. Use no cleaning solvents which leave residue. Wipe joints free of solvent using clean, dry white cloths or white lintless paper. Do not permit solvent to air dry.

C. Follow manufacturer's directions for products and surfaces.

PART 10 - INSTALLATION

A. Unless otherwise required by these specifications, install materials in strict accordance with manufacturer's specifications and recommendations, using approved equipment.

B. Usage of various materials shall be as specified under Article 6 above.

C. Prime surfaces as recommended by the manufacturer's immediately prior to caulking or sealing. Make preliminary tests to ensure that primers will not stain exposed materials or deteriorate backer materials.

D. Unless otherwise required by caulking manufacturer's specifications and recommendations, use backer material to control caulking and sealant depth as follows (depths measured at bond face).

1. Polysulfide and Polyurethane Sealants. For joints up to 1/2" wide and less, make depth equal to width but not less than 1/4". Joints over 1/2" wide shall be 3/8" deep.

2. Acrylic Sealant. For joints 1/2" wide and less, make depth equal to width but not less than 1/4". Joints over 1/2" wide shall be 3/8" deep.

3. Do not twist or stretch preformed backer materials during installation.

E. At joints subject to movement, where required by nature of backer material used or where sealant contacts back of joint, use release material between backer material or back of joint and sealer to confine adhesion to surfaces of materials being joined. Follow manufacturer's recommendation exactly.

F. Neatly tool joints to slightly concave surface using tooling agent recommended by sealant manufacturers. Repair any air pockets exposed by tooling. Tool so as to compress material and improve adhesion to surfaces joined.

PART 11 - PATCHING

A. Patch or replace defective or damaged sealants as directed by the Architect. Be responsible for damage to adjacent surfaces caused by caulking and sealing operations.

PART 12 - CLEANING

A. Clean adjacent surfaces soiled by caulking and sealing operations. Remove wet material before it "sets". Follow manufacturer's recommendations for cleaning procedures. Cleaning agents shall not stain or be injurious to exposed surfaces nor shall they be potentially dangerous to glass and metal surfaces due to wash-off by rain.

End of Section

SECTION 08100 - METAL DOORS AND FRAMES

PART 1 - RELATED DOCUMENTS

- A. General provisions of Contract, General and Special Conditions, and General Requirements apply to this Section.

PART 2 - DESCRIPTION OF WORK

- A. Provide labor, materials, equipment, and services necessary for proper and complete installation of all hollow metal work.
- B. Include all view windows and side lights indicated on Drawings.
- C. Work Specified in Other Sections.
1. Finish Hardware is specified in another Division 8 Section.

PART 3 - SUBMITTALS

Submit Shop Drawings for all work, indicating materials, uses, gauges, details of construction, connections to other work, fastenings, and anchors, to Architect for his review. Do not start fabrication until these Drawings are approved.

PART 4 - MATERIALS

- A. Manufacturers offering products complying with requirements include:
- Steelcraft Mfg. Co.
Republic Steel Corporation
- B. Materials used shall be of best quality of their respective kinds.
- C. Steel in general shall be cold rolled stretcher level, prime quality steel, of U.S. Standard gauge as specified under the various headings.
- D. Doors, frames and framed openings exposed to the exterior shall be fabricated of zinc coated steel in the gauges scheduled. The steel shall be hot dipped so as to provide a ductile coating, tightly adherent to the base steel. The zinc coating shall be an A60 coating in accordance with ASTM specification A525 (.6 oz. of zinc per sq. ft. of steel total coverage.)

PART 5 - HOLLOW METAL STEEL DOORS, POLYURETHANE CORE

- A. Physical Properties:
- "R" Factor: 11.1
"U" Factor: .09
Compression Strength: 3600 P.S.F.
- B. Doors shall be equal to those manufactured by The Steelcraft Manufacturing Company, Cincinnati, Ohio, and designated as:
- LF-18 (1-3/4", 16 gauge steel)
- C. Doors shall be fabricated of:

1. Cold rolled steel, interior.
2. Galvanized steel with a zinc coating of .6 ozs. per square foot total, exterior.
- D. Door shall be flush with edge seams filled and ground smooth.
- E. Doors shall have 1/8" bevel in 2" on hinge and ground smooth.
- F. Doors shall have vertical mechanical interlocking seams on hinge and lock edges.
- G. Doors shall be provided with top and bottom inverted 14 gage steel channels spot welded within the door.
- H. Doors shall be mortised and adequately reinforced for all hardware.
 1. Mortised hardware reinforcements shall be drilled and tapped at the factory.
 2. Surface applied hardware shall be field drilled by others.
- I. Doors shall be reinforced internally with a 14 gage steel reinforcement for surface closers when specified.
- J. Out swinging exterior doors shall be provided with top caps for protection against weather and with a polyurethane core.
- K. Doors shall be phosphatized and receive one coat of baked on prime paint.

PART 6 - FRAMES

- A. Fabricate frames of 14 gauge steel. Manufacturers offering products complying with the requirements include:

Steelcraft Mfg. Co.
Republic Steel Corp.
Fenestra, Inc.
- B. All frames shall have welded and mitered corners, equivalent to Steelcraft Type F-14.
- C. Provide suitable anchors for jambs as required by wall construction. Provide a minimum of six (6) jamb anchors and two (2) base anchors per frame. Provide anchors as required for labeled frames.
- D. Reinforcing channels, where called for, shall be 12 gauge reinforcing channel in head.

PART 7 - HARDWARE REINFORCEMENTS

- A. Accurately mortise, reinforce, drill, and tap at factory all work to receive hardware, except do drilling and tapping for door checks and brackets at building.
- B. Reinforcements shall be of ample size and thickness to stiffen work against strain of service required. Reinforcements for locks and escutcheons shall be box type with spring lead contacts for lock cases.
- C. Provide cover boxes in back of all hardware cutouts in combination type frames.

PART 8 - FINISH

- A. All steel hollow metal work shall be phosphatized and receive one coat baked on prime coat.
- B. Each coat shall be baked on and sanded smooth.

PART 9 - INSTALLATION

- A. Set frames in their proper locations, plumb and true and securely braced in position.
- B. Receive, store and protect and be responsible for all doors to be installed hereunder. Report immediately to Contractor shortages, damage, improper preparation, defective finishes and warped doors. Do not install any material not perfect in every respect.
- C. Inspect openings and frames to receive doors. Report damage or discrepancy affecting proper installation of units to Contractor, and have corrective work done in a suitable and satisfactory manner.
- D. Install doors in openings as indicated on Drawings in conformance with shop drawings and hardware schedule. Install doors so they hang plumb and true, with proper clearances using items of hardware scheduled for openings.
- E. Accurately set all frames and thoroughly and rigidly anchor and fasten in place in building construction. Weld drywall anchors to frames.
- F. Check frames before and after walls are constructed to see that they are properly erected.

End of Section

SECTION 08530 - ALUMINUM WINDOW

PART 1 - SCOPE

A. This Section includes all labor, materials, equipment and related items required for the work of aluminum entrance work and framing as shown on the drawings and as specified.

B. This Section does not include the following related items.

1. Construction and preparation of openings to receive aluminum entrance work and framing.
2. Caulking of opening perimeters.
3. Glass and glazing.

PART 2 - STANDARD OF QUALITY

A. Standard of quality for aluminum window framing, etc., specified hereunder is for systems and components manufactured by the Kawneer Company Systems and components conforming closely to specification requirements hereinbelow may be approved, subject to approval of submittals specified.

PART 3 - SUBMITTALS

A. The Contractor shall submit to the Architect for approval, in four (4) copies, the following items prior to fabrication of aluminum entrance work and fixed window framing.

1. Shop drawings showing at ample scale elevations, frame sections and details, thicknesses, methods of assembly, hardware applications, glazing provisions, anchorages and fastenings, and relationship to other work.
2. Manufacturer's specifications and catalog data describing materials, finishes, installation requirements, etc. for other than manufacturer specified under Article 2 above as standard of quality.

B. Provide for connection of work with other work as shown on the Drawings or necessitated by Job conditions. Where required, provide for isolation of dissimilar materials.

PART 4 - ENTRANCE AND FIXED WINDOW FRAMING

A. General. Provide and install all entrance and framing components, vertical and horizontal members, transition members, trim, galls stops, adaptors etc. as shown or specified and as required for complete installations. System shall be Kawneer "Tribab 45IT, 2" x 4½" for 1" glazing, or system manufactured by Pittsburg or Amarlite closely conforming to these specifications.

B. Materials. Framing members, transition members, mullions, adapters, mounting etc., shall be extruded of aluminum with alloy and temper consistent with the method of manufacturer. Members shall be of aluminum alloy 6063T5 extruded aluminum. All screws, miscellaneous fastening devices and internal components shall be of stainless steel, or plated or corrosion-resistant materials of sufficient strength to perform the functions for which they are used.

1. Section sizes, profiles, etc., shall be as indicated by the details for specific applications and as standard for the system specified. All sections shall be formed true to details with clean, straight, sharply defined profiles, smooth surfaces of uniform texture, and free from defects impairing strength of durability.

2. Members shall provide for flush glazing on all sides, with through sight lines and no projecting stops or face joints, except at entrance framing as required.
3. Weatherstripping. Jamb and head frame sections of door frames shall have grooved integral door stop, and shall be fitted with manufacturer's standard metal-backed wool pile cloth weatherstripping.

C. Finish:

1. All exposed framing surfaces shall be free of scratches and other serious blemishes.
2. Bronze.

PART 5 - INSTALLATION

A. This Contractor shall inspect all openings prepared for installation of materials under this Section for compliance with details, and shall promptly report discrepancies or conditions affecting proper installation of his work to the Architect in writing. Installation of any materials specified hereunder will be construed as evidence of acceptance of openings as being satisfactory, and this Contractor shall be held responsible for any later corrective work required.

B. All work under this Section shall be installed in strict accordance with the detail requirements of the Drawings and approved shop drawings. Frames shall be erected plumb and true in openings, securely anchored to adjacent construction. Install doors and all hardware items. Check and readjust as required so that doors and appurtenances operate perfectly at completion. At completion, leave all surfaces absolutely clean and free of blemishes and in first class condition to the satisfaction of the Owner and Architect.

PART 6 - PROTECTION

A. Protect all work specified herein from any form of marring, disfigurement, blemish or defacement after completion of the installation and acceptance as evidenced by final payment. Failure to provide the protection required shall be sufficient cause for requiring replacement of any damaged units.

PART 7 - CLEAN-UP

A. During the course of the work, keep the work reasonably clean and clear of rubbish and debris. At completion of the work, remove all rubbish tools, equipment, etc. and leave the work clean and in perfect condition to the satisfaction of the Architect.

End of Section

SECTION 08710 - FINISH HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and General Provisions of Contract and Division-1 Specification Sections, Apply to Work of this Section.

1.02 SUMMARY

Work under this heading includes furnishing all hardware to the respective trades. The hardware supplier shall promptly furnish templates to all other manufacturers furnishing materials necessary for completion of this part.

Extent of finish hardware is indicated on drawing and in schedules.

The following specifications are a guide and a description of the quality materials required. No material of quality or weight less than that outlined in this specification will be accepted. The contractor will be responsible for supplying the correct quantity of all materials, whether or not specifically mentioned in this specification. Any additional items that may be required shall be furnished and be of type, quality and utility consistent with other hardware specified.

1.03 SUBMITTALS

ARCHITECT'S HARDWARE SCHEDULE:

Architect's hardware schedule is by hardware set number. Refer to drawings for designation of hardware set number applicable to each opening.

Certain additional items of hardware and/or hardware accessories specified herein shall be furnished.

SUPPLIER'S HARDWARE SCHEDULE:

A complete hardware schedule, indicating type, number, location and finish shall be submitted to architect for approval, together with such samples as may be required for review. Open numbers shall be same as used in contract documents. Schedule shall be prepared according to Door and Hardware Institute recommendations (schedule and sequence format) and shall include degree of door closer installation.

Supplier's hardware schedule will be reviewed by architect for type, quality and finish, and for function (other than hand). Contractor shall be responsible for checking schedule for correct hand of locksets and for supplying quantity of items required by contract documents.

Provide supplementary or revised hardware schedules if deemed necessary by architect.

Do not ship or deliver hardware to job prior to review of hardware schedules by architect.

Hardware schedule shall be submitted in the following format. Hardware schedules submitted to architect for review not in this format will be rejected.

HARDWARE SET 1

JOB NO

1 Single 90E door #001 exterior from corridor RHRB

KEY GROUP _____ 3'8" x 7'0" x 1¾" HMD x HMF Narrow Lite

Item No.	Quantity/Product Type	Manufacturer's Number, Size, Finish & Product Information
1.	3 ea. hinges	FBB199 NRP 4½ x 4½ x TMS x US26D
2.	1 ea. cylinder	1109 US26D x GGMK
3.	1 ea. Exit device	99NL US28 x 3'8" x 7'0" HMD x MHF x Narrow Lite x RHRB
4.	ECT	

1.04 QUALITY ASSURANCE

Hardware Consultant: as a mandatory requirement, all hardware shall be furnish by an established builders firm who maintains and operates an office, display and stock in this area, and who is a regular authorized distributor of the lock he proposes to furnish. All hardware for the project shall be scheduled and furnished by or under the direct supervision of an architectural hardware consultant, that is a regular member in good standing, of the Door and Hardware Institute, who is a full time employee of the supplier. All schedules submitted to the architect for approval and job use shall carry the signature of this consultant.

No consideration will be granted for any alleged misunderstanding of the material to be furnished or work to be done, it being fully understood that the tender of a proposal carries with it the agreement to all items and conditions referred to herein or indicated on plans, whether specifically mentioned herein or not.

It shall be the responsibility of the hardware supplier to provide the proper hardware for door function and to meet the proper codes. All discrepancies shall be brought to the attention of the architect a minimum of ten (10) days prior to bid date so an addendum may be issued. No additional compensation will be allowed after bidding for hardware changes required to meet the proper door function or to meet the proper codes.

Applicator: Finish hardware shall be installed by the carpentry contractor using mechanics skilled in this type of work. Installation shall be in a neat workman-like manner in accordance with approved hardware schedule. All items of hardware shall be secure and free-working in the manner intended. Hardware shall be accurately mortised and fitted before painting. Hardware shall not be applied until the painting is finished. After hardware is installed, the general contractor shall cover all exposed surfaces of kickplates, push plates, pulls, locksets, exit devices, holders, etc., with a suitable covering, such as masking tape and polyethylene film to protect the hardware from scratches, abrasion and tarnishing. This is to be left on until the building is complete and ready for final inspection. Upon completion of application, the Contractor shall deliver to the architect, for the owner's maintenance personnel, two copies of all installation instruction, templates, wrenches, installation tools, etc., supplied by the various manufacturers packed with the hardware necessary for installation and maintenance.

1.05 PROJECT CONDITIONS

DELIVERY, STORAGE AND HANDLING: Hardware supplier shall receive and check all hardware at his warehouse. All hardware shall be delivered to the job site by the hardware supplier in one shipment. Drop shipments to the job site from various manufacturers will positively not be permitted. All hardware shall be property wrapped in separate packages complete with trimmings, screws, etc., each plainly labeled

and numbered to agree with the door numbers and contractor's typewritten schedule. The contractor shall submit his schedules for corrections and approval to the architect before proceeding with any work. The hardware supplier shall repack all separate boxes and packages of hardware, in cartons or cases, and attach to the outside of each case or carton, a label indicating the manufacturer of the material, contents, quantity, item number on hardware schedule and door number, before delivery to the jobsite. Hardware, when required, shall be delivered to the shops of the various door manufacturers, properly marked and labeled following the same procedure outlined above for jobsite shipment.

The general contractor shall provide storage facilities for the finish hardware after delivery to the jobsite. A separate room, under lock and key, with shelves and bins as necessary to provide dry storage for all hardware items will be required.

1.06 ITEMS NOT INCLUDED

Hardware for metal windows, toilet partitions, cabinets, access panels, etc., is not included in this specification. See other sections of the specifications for hardware to be furnished by others under such sections.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Numbers given in this schedule are of the following manufacturers.

<u>Substitute Products</u>	<u>Manufacturer Specifies</u>	<u>Acceptable</u>
Hinge	Hager	Bommer; Stanley
Pivots	Rixon	Hager
Locks	Yale	Corbin; Sargent
Mortise Bolts	Trimco	Rockwood; Cipco
Kickplates	Trimco	Baldwin; Hager
Thresholds	Nat'l Guard	Hager; Pemko
Weatherstrip	Nat'l Guard	Hager; Pemko

B. Refer to Part 3 - EXECUTION FOR FINISH HARDWARE SCHEDULE

2.02 MATERIALS

General: Materials and products specified herein are deemed equally acceptable. To simplify hardware schedule, however, only one manufacturer's product is listed in hardware sets. In each case, product of manufacturer first named in specification is used in schedule. Where specific product of each manufacturer is not identified by series or catalog number, most comparable items of each manufacturer name of item specifically identified shall be considered equal of product identified. Where only a series of a manufacturer is named, other characteristics such as function shall be the same as for product specifically identified.

2.03 HARDWARE FINISHES

Hardware finishes shall be as follows unless specified in hardware sets:

US-26D - Hinges, Pivot, Lock, Stop, Bolt, Over Head Holder
US-32D - Push plate, Pull

US-32D - Exit Device
 Sprayed aluminum enamel - door closer
 Aluminum - threshold and weatherstrip
 US-32D - Protective Plate

2.04 HINGES

Hinges shall be five-knuckle construction. Hinges for exterior doors shall be solid bronze with non-removable pins, in the finish specified. Hinges for interior doors shall be steel, plated in the finish specified.

Oil impregnated bearings are not an acceptable substitute for ball bearings. All hinges shall be 4½" x 4½" unless otherwise specified.

2.05 PIVOT

Pivots for non-lable openings shall be fenced bronze with plated finish as indicated. Pivots shall have ball and needle bearings with 3/4 offset. Pivots shall support a door weight of 400 pounds per set. Pivots for lable openings shall be malleable iron and shall support a door weight of 350 pounds per set.

2.06 LOCKSETS

All lever locks shall be mortise or bored type as indicated. Lock bodies and lock trim shall be by the same manufacturer. Backset on all lever locks and deadlocks shall be 2¾". All deadlocks shall have 1" throw bolts and be equipped with armor fronts. Trim for lever mortise lock shall consist of case lever. Rose to be 2-9/16" diameter, with self aligning thru bolts with fully concealed attachment. Trim for bored locks shall consist of cast lever. Rose to 3-1/8" diameter. Bored locks shall have curved lip strike. Mortise locksets for single doors to have 1¼" curved lip strike, pairs of doors to have 1-1/8" curved lip strike with strike box. Trim for locksets shall be as indicated in the hardware sets.

2.07 EXIT DEVICES

Exit devices shall be rim type. Exit devices shall be operated by horizontal touch bar. Touch bar assembly shall have std dogging feature. Finish for exit devices shall be US-32D. Exit devices for UL doors shall be rim type or vertical rod type. Trim shall be of material, design, and dimensions as specified. Devices for label doors shall be listed with underwriters laboratories as fire exit hardware and shall have their label attached to the device.

2.08 CLOSERS

Door closers shall be full rack and pinion type. Closers shall be surface mounted and shall project less than three (3) inches from surface of door or frame. Equip closers with two (2) key operated regulating valves for individual control of both closing and latching speeds. Regulating valves shall be accessible from top of closer only and shall be completely unobtrusive. Closer shall have minimum of 15% door closing power adjustment and adjustable back check. Enclose closer in a cover of plastic. Mount closers without use of brackets or other obstructions in door opening. Closers on all exterior out-swinging doors, and others as scheduled, shall be parallel arm installation. Closers bodies and/or closer feet to be mounted on surface of doors shall be supplied with sex bolts.

2.09 PROTECTIVE PLATES

Kick, armor and mop plates shall be height listed in schedule and width of 2" less than door width or 1" less than door width of each leaf on pairs of doors. Plates shall be 16 ga stainless steel, beveled 3 sides.

2.10 THRESHOLDS

Thresholds - provide (aluminum) thresholds where scheduled, with machine screws, lead expansion shields and R.C.E. feature.

2.11 DOOR STOP

Provide door stops wherever necessary to prevent door or hardware from striking an adjacent partition or obstruction. Provide wall type whenever possible. All door stops and holders mounted on concrete floor or masonry walls shall have machine screws and lead expansion shields. Provide stop at carpeted areas with ½" spacers.

2.12 SILENCERS

Provide GJ-64 silencers for all hollow metal frames. Single doors shall have three (3) silencers. Double doors shall have two (2) silencers.

2.13 KEYING

Each lock shall have three (3) change keys. Key locksets to new grand master key system. Key locks in sets, grand master and master keyed as directed by owner. Obtain owner's approval and/or corrections before ordering locksets. Owner is to sign off on final approved keying. Perform all keying at lock factory, and register key data there. Deliver all master keys to architect. No master keys shall be delivered to any other person. Supply to the owner, at no charge, a factory registered bitting list. Furnish six (6) each master, grand master and great grand master keys per set. Provide fifty (50) key blanks per section used.

PART 3 - EXECUTION

3.01 APPLICATION

Installation: Work shall be done by a craftsman skilled and experienced in installation of finish hardware. Mortised items shall be neatly set in and made flush with door or frame surface. Manufacturer's instructions and recommendations shall be strictly followed.

Locations: Mortise items shall be installed at frame manufacturer's standard locations. Surface mounted items shall be installed at heights recommended by the Door and Hardware Institute, Arlington Virginia.

Fasteners: Hinges, pivots, locks and exit devices shall be installed with proper sex bolts, wood or machine screws as supplied by the manufacturer. Surface closers shall be mounted to door with sex bolts. Door pulls shall be installed on doors with thru-bolts as supplied by manufacturer.

FINISH HARDWARE SCHEDULE**Hardware Set: 1**

6	Each	Hinge	BB1199NRP 4.5 x 4.5 26D Hager
1	Each	Lockset	AU5407LN 26D Yale
2	Each	Flush Bolt	282D 26D Hager
1	Each	D. Strike	280X 26D Hager
2	Each	Surface Stop	4-226 26D Rixson
1	Each	Threshold	410S-A Alum Hager
1	Roll	Weatherstrip	726 Black Hager
2	Each	Sweep	750 Alum Hager

NOTE: Astragal to be supplied by HM DR supplier.

End of Section

SECTION 08800 - GLASS AND GLAZING

PART 1 - SCOPE

A. This Section includes all labor, materials, equipment and related items required for the work of glass and glazing as shown on the Drawings and specified herein.

PART 2 - SUBMITTALS

A. The Contractor shall submit to the Architect for approval prior to furnishing materials at the job site, in five (5) copies, manufacturer's specifications, application and performance data, etc. for all glass and glazing materials, except miscellaneous accessories specified hereunder.

PART 3 - CODES AND STANDARDS

A. All glazing compounds and methods of glazing shall be in accordance with applicable portions of the Flat Glass Marketing Association's "Glazing Manual", latest edition.

B. All safety glazing shall meet requirements of the Kentucky Department of Housing, Buildings, and Construction and appropriate Kentucky Revised Statutes.

PART 4 - PRODUCT HANDLING

A. Glass shall be delivered to the job and shall be stored on end and under cover. Glass shall be properly crated, packaged, and protected from damage. Glazing compounds shall be delivered in manufacturer's sealed containers, with attached labels properly identifying the types.

PART 5 - MATERIALS

A. Insulating glass for installation in aluminum windows shall be of sizes shown, composed of outer and inner panes of $\frac{1}{4}$ " clear $\frac{1}{4}$ " clear .548, 1" O.A. , by LOF separated by a $\frac{1}{2}$ " dehydrated air space. Each unit shall be hermetically sealed and glass shall be separated by a spacer around the edges as standard with the manufacturer.

1. Warranty. Each unit shall be guaranteed by the manufacturer not to develop, under normal conditions, material obstruction of vision as a result of film formation on the internal glass surfaces caused by failure of the hermetic seal other than through glass breakage for a period of ten (10) years.

B. Compound for glazing in openings other than those which are dry-glazed shall be non-staining, one-part polysulfide base sealant, and shall be PRC "Rubber Caulk 5000", Pecora "Synthacalk GC-9", or DAP "Flexiseal". Color of compound shall be manufacturer's standard as selected by the Architect.

C. Miscellaneous Items. Provide neoprene spacers, setting blocks, clips, and all accessories required for the work of glazing.

D. Other material shall be as specified hereinafter.

PART 6 - GLAZING

A. General Requirements:

1. Glazing shall be done in a weathertight and waterproof manner. No glazing work shall be done when the temperature is below 40 degree F.

2. Glazing surfaces shall be extremely clean, dry and completely dust free before commencing application of glazing materials.
 3. Remove glazing beads completely, perform glazing operations and set back in correct location. Do not mar beads, screws and the like.
 4. Glazing shall be done at the building after windows, frames, doors, etc. are installed.
 5. Remove excess glazing compound from glass and other adjacent surfaces to prevent permanent stains or other damage.
- B. Aluminum entrance doors and fixed window frames shall be glazed in strict accordance with entrance manufacturer's instructions and details for these operations.

PART 7 - CLEANING

- A. At completion, remove dirt, stains, etc. from glass. Wash and polish glass inside and outside surfaces. Exercise care so as not scratch or damage glass. Do not use acid solution or water containing caustic soaps. Leave work in perfect condition as approved by the Architect.

End of Section

SECTION 09250 - GYPSUM DRYWALL

PART 1 - SCOPE

- A. This Section includes all work of gypsum drywall in connection with the building construction where shown or as scheduled on the Drawings and specified.

PART 2 - MATERIALS

- A. All materials herein specified shall be by the United States Gypsum Company or an approved equal.
1. All Gypsum Wallboard shall be ½" MR.
 2. Drywall Screws shall be USG Brand S or W Type as applicable.
 3. Joint Treatment shall be Perf-A-Tape Joint compounds.
 4. Caulking shall be USG Acoustical Sealant.
- B. Lengths of materials shall be as long as practical to minimize number of joints or splices.
- C. The Installation and Application of all materials shall be in accordance with the latest printed directions or specifications of United States Gypsum Company and conform to ANSI A97-1 "Standard Specification for Application and Finishing Wallboard."
- D. All Fixture Attachment Reinforcement shall be installed before drywall is installed.
- E. General Requirements
1. Erection of Gypsum Board shall be such that the long dimensions are at right angles to the ceiling joists, studs and resilient channels. All abutting end or edge joints shall be fitted neatly and accurately with end joints staggered. Joints on opposite sides of partitions shall be so arranged as to occur on different studs. Gypsum board shall be properly supported and neatly fitted around all cut-outs and openings. Work done by this Contractor shall be coordinated properly with that done by other trades. Installation shall be in accordance with USG folder SA-927.
 2. Perf-A-Type Joint Compound System shall be used to finish all face board joints, screw heads and internal angles formed by the intersection of walls and ceilings or walls and walls.
 3. Ceiling Finish smooth.

PART 3 - GENERAL

- A. In cold weather and during the period of wallboard lamination and joint finishing, temperatures within the building shall be maintained uniformly within the range of 55 degrees to 70 degrees Fahrenheit. Adequate ventilation shall also be provided to eliminate moisture within the building during the same period.

B. All materials shall be delivered to the job in their original, unopened containers or bundles, stored in a place providing protection from damage and exposure to the elements.

C. Installation of all material shall be in accordance with latest printed directions or specifications of the materials manufacturer.

PART 4- FINISHING

A. Caulking. Caulk joints of all walls and partitions containing sound attenuation blankets at intersections of gypsum board with floor slabs, ceiling board, at corner framing and other fixed obstructions. In such partitions, caulk also around outlet boxes and any other openings to the stud or joist space. Caulking shall be prior to finishing, in compliance with details, and in strict accordance with manufacturer's instructions.

B. Finishing:

1. Exposed Surfaces. Gypsum board surfaces to be exposed at completion under work of this Section or for painted finish under work of Section 09900 shall be finished in accordance with requirements of the tape joint system used. Tapered edges and corner and casing bead flanges shall be taped and filled to smooth, true planes. Fill nail head depressions and defects in board surfaces smoothly. When dry, re-coat joints, nail heads, etc., one or more times until surfaces are flush. Sand to true, even and smooth surfaces, ready for texturing or painting.

2. Temperature and Ventilation. During cold weather, provide thermostatically controlled heat to maintain 55 degrees Fahrenheit minimum temperature until buildings are occupied. Unvented gas or oil heaters shall not be used to provide heat. Adequate ventilation shall be provided at all times for proper drying.

End of Section

SECTION 11220 - SUBMERSIBLE NON-CLOG PUMPS

PART 1. GENERAL

1.1 Work Included

The Contractor shall furnish all labor, materials, equipment and labor for installing, testing and placing in service submersible non-clog pumps, motors, controls, valves, piping and appurtenances.

1.2 Manufacturer

Pumps shall be as manufactured by Flygt or KSB.

1.3 Submittals

Submittals shall contain descriptive literature as to dimensions and materials of construction. Performance data shall include size of pump, GPM (200), TDH in feet (3 to 15), BHP, pump efficiency (inlet through discharge head), RPM, performance curves, shutoff head, weight of complete motor/pump as a unit and discharge diameter.

Installation information shall include drawings and information necessary for connecting piping and valves, electrical connections, starting and auxiliary equipment. Submit drawings showing dimensions and scaled assembly outline of the complete pump and all associated equipment. Such drawings shall show plan, elevation and any other views or sections requested. For all pumping units, a scaled cross-sectional drawing of the assembled pump showing full details, parts list of all items and materials of construction shall be submitted for approval.

The Contractor shall submit all other drawings, and other information specified, requested, and/or necessary to show complete compliance with all the details of the contract documents.

The pump manufacturer shall submit an Operations and Maintenance Manual containing all information necessary for proper operation and maintenance of pumping units as well as location of the nearest permanent service headquarters. The Operations and Maintenance Manuals shall detail all aspects of the pumps, including dimensions of impeller/wear rings, clearances, model number/size of bearings, size of mechanical seals and related data. There shall be two (2) manuals submitted for each pumping station. These manuals must be submitted when pumps are delivered.

1.4 Warranty

The pumps and motors will be covered by a full one (1) year warranty from date of Owner's acceptance. The initial one year from startup of the equipment shall be covered 100% for parts and labor. The warranty shall also include the cost of freight for pumps sent to repair facilities. This warranty shall not be limited by hours of running time or operation from variable speed drives.

PART 2. PRODUCTS

2.1 General

See plans for pump requirements and operating conditions.

The pumps shall be non-clogging sewage pumps capable of operating in a partially or entirely submerged condition. The design shall be such that pumps will be automatically connected to the discharge piping when lowered into place on the discharge connection. The pumps shall be easily removable for

SECTION 11220 - SUBMERSIBLE NON-CLOG PUMP STATION

inspection or service, requiring no bolts, nuts or other fastenings 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 of adequate strength and length to permit raising the pump for inspection and removal.

2.2 Parts

All major parts, such as stator casing, sliding bracket and volute shall be of high tensile cast iron. All surfaces coming into contact with sewage shall be protected by a coating resistant to sewage. All exposed nuts and bolts shall be of stainless steel. All openings in the pump impeller and volute case shall be large enough to pass a three inch spherical solid.

2.3 Motors

Pump motor shall be housed in an oil/air 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. Ball bearings shall be designed for 50,000 hours B-10 life. A heat sensor thermostat shall be attached to and imbedded in the winding and be connected in series with the motor starter contactor coil to stop motor if temperature of winding is more than 120C. The thermostat shall reset automatically when motor cools to safe operating temperature. Two heat sensors shall be used on 3 phase motors. The common pump, motor shaft shall be of 416 stainless steel. Motor shall be integral to the pump for submersible operation.

2.4 Seals

The motors shall be protected by two mechanical seals mounted in tandem with a seal chamber between the seals. Seals shall be silicon carbide or tungsten carbide.

A double electrode shall be mounted in the seal chamber to detect any water entering the chamber through the lower seal.

Water in the chamber shall cause a red light to turn on at the control panel. This signal shall not stop the motor but shall act as a warning only, indicating service is required.

2.5 Impeller

Impellers shall be cast or ductile iron, non-clogging and dynamically balanced.

2.6 Pump Case

The volute case shall be cast iron and have a flanged center line discharge. Discharge flange shall be as required on the plans and shall be standard with bolt holes straddling center line. Pumps shall be capable of handling raw, unscreened sewage and pumping 3 inch diameter spherical solids.

2.7 Pump and Motor Castings

All castings shall be of high tensile cast iron and shall be treated with phosphate and chromate rinse. All fasteners shall be 302 stainless steel.

2.8 Bearing End Cap

Upper motor bearing cap shall be a separate casting for ease of mounting and replacement. All fasteners shall be stainless steel type 303.

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2.9 Power Cables

Power cord and control cord shall be double sealed. The power and control conductor shall be single strand sealed with epoxy potting compound and then clamped in place with rubber seal bushing to seal outer jacket against leakage and to provide for strain pull. Cords shall withstand a pull of 300 pounds to meet UL requirements.

Insulation of power and control cord shall be type SOW or STOW. Both control and power cords shall have a green carrier ground conductor that attaches to motor frame. The pumps and motors shall be made by the same manufacturer and shall be designed to operate in a sewage pumping station pumping raw sewage.

2.10 Lift Out Rail System

Each lift out rail system shall consist of a ductile iron discharge base, bronze pump attaching and sealing plate, bronze pump guide plate, and cast iron elbow. All exposed nuts, bolts, and fasteners shall be of 300 series stainless steel. No fabricated steel parts shall be used.

Two rail pipes shall be used to guide the pump from the surface to the discharge base connection. The guide rail shall be 2 inch schedule 40 stainless steel pipe. The weight of the pump shall bear solely on the discharge base and not on the guide rails. Rail systems which require the pump to be supported by legs which might interfere with the flow of solids into the pump suction will not be considered equal. The guide rails shall be firmly attached to the access hatch frame. Systems deeper than 21 feet shall use an intermediate guide for each 21 feet of wet well depth.

One aluminum top rail support plate shall be provided for each installed pump. This plate shall be fabricated of aluminum plate and shall contain expandable rubber bushings to accept the 2 guide rails. These rubber bushings when completely tightened shall provide for a tight, vibration free guide rail installation. Notched openings in the rail support plates shall provide for horizontal adjustment. All fasteners shall be stainless steel.

2.11 Sealing

A sealing plate shall be attached to the pump. A simple downward sliding motion of the pump and guide plate on the guide rails shall cause the unit to be automatically connected and sealed to the base. The open face of the sealing plate shall have dovetailed groove machined into the face to hold a sealing "o"-ring. The "o"-ring shall provide a leak-proof seal at all operating pressures. No leakage will be acceptable.

2.12 Lifting Chain

An adequate length of 5/16" stainless steel lifting chain shall be supplied for removing the pump. The chain shall be of sufficient length and shall include an adequate number of lifting rings for easy removal. Length shall be 3 feet greater than the overall wet well depth. A stainless steel fabricated hook shall be provided for each chain. These hooks shall be secured to the hatch frame with stainless steel bolts and nuts before the hatch is cast into concrete.

2.13 Discharge Piping

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.

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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 shutoff 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 hand wheel. 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 adapters shall have one end suitable for bolting to a pipe flange and the other end of flexible coupling. All flanged adapters shall be harnessed. The adapters 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 adapter. Flanges on flanged adapter (unless otherwise indicated or required) shall be faced and drilled ANSI B16.1 Class 125. Flanged adapters 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.

2.14 Gauges and Gauge Taps

A minimum of three 3/4" NPT taps shall be supplied. Each tap shall be supplied with a type 304 stainless steel nipple and bronze ball valve. One (1) 4-1/2" diameter liquid filled gauge with stainless steel diaphragm seal shall be supplied. A tamper proof strap shall be installed between the gauge and seal to prevent the seal from being broken. Gauge shall be equal to Ashcroft or approved equal. Gauge range shall be sized to allow gauge to operate in its mid range. A gauge protector shall be installed between the seal and gauge.

2.15 Controls and Motor Controllers

A. The Contractor shall provide from the submersible pump manufacturer as part of a complete assembly a level control and resultant motor starter/control equipment as required to provide a complete operating system as specified herein.

B. The station control panels shall be inclusive of but not limited to the following major components.

1. Circuit breakers for each pump motor - minimum 5,000 A. RMS - 480V.
2. Fuse control circuit for level control (24 volt).
3. Phase Failure - Provide anti-single phase protection for each motor starter. Overload sensing is not acceptable.

SECTION 11220 - SUBMERSIBLE NON-CLOG PUMP STATION

4. Power Factor Correction - Capacitors shall be provided for each pump motor 10 HP and larger. Capacitors shall be furnished with fuse protection and blown fuse indicators.
5. Motor starters shall be NEMA reduced voltage autotransformer starter with circuit breaker.

Starters shall have surge suppression on the input and the output and SCR fusing. Starter shall have necessary circuitry to include the power factor connection capacitors within the same housing and switched with the starter.
6. Provide elapsed time meter for each motor (calibrated in hours).
7. Enclosure - Service/circuit breaker protection equipment and control equipment shall be housed in all welded code gage sheet stainless steel enclosure. Enclosure shall be NEMA 4 x stainless steel (304), single or double door, hinged gaskets with provisions for locking. Provide a swing out panel for meters, switches and control items with starters, and equipment mounted on rear of enclosure. Panel to be factory wired with terminal strips at the bottom of enclosure for all field connections. Finish shall be natural stainless steel. Interior color shall be white for panels. Following installation, complete interior of enclosure shall be sprayed with an aerosol corrosion resistant compound equal to "2-26" by CRC Chemicals, Inc. Warminster, PA. All hardware shall be stainless steel. Enclosure pedestal shall be stainless steel.
8. Liquid level controls shall include mercury switch level sensors in corrosion and shock resistant plastic casing with flexible cord and weight. The level control system shall include support brackets for suspending sensors at proper levels in the wet well as shown on the Drawings. Cable assemblies shall be of sufficient length to extend to system controller as shown on the Drawings (without a splice). Sensors shall be internally weighted. Control components shall include automatic alternation and/or pump additive scheme based on levels as shown on the contract Drawings for the respective stations. Provide a switch for manual bypass of alternator.
9. Provide a panel mounted alarm light with impact resistant plastic globe and guard, and an audible hour alarm to indicate pump overload, malfunction or high water alarm.
10. The pump control panel shall be provided with auxiliary contacts for remote run and alarm.

2.16 Electrical Requirements

A. Provide all material, labor and equipment required to install electrical services, controllers and make all equipment connections as shown on the Drawings and contained herein in these Specifications. All work shall be done in accordance with the latest edition of the National Electric Code and its supplements. All material and equipment shall be new and shall bear Underwriter's Laboratories (UL) labeling.

B. Locations of service poles as shown on the Drawings shall be verified with the Utility Company and adjusted accordingly. Installation of metering equipment shall meet the approval of the Utility Company.

C. Raceways for service shall be rigid steel. All rigid steel couplings, fittings, etc., shall be threaded. Raceways shall be run at minimum of 30" below grade.

Branch circuit feeder raceways shall be rigid steel. Secondary branch feeder raceways shall be buried at a minimum of 30" below grade. All rigid fittings and couplings shall be threaded.

Conduit seals shall be provided in all conduit runs between control panel and pump pit.

D. Provide all wire required to make circuit extensions as shown on the Drawings and hereinafter designated. All wire and cable shall be copper and shall be rated for 600 volts.

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Wire shall be code grade THHN and may be either solid or stranded except as otherwise specifically noted on the Drawings.

Connectors: Connections, splices terminations, etc., shall be accomplished with mechanical connectors suitable for conductor material used and shall be of the mechanical pressure type. Soldering and tapping will not be acceptable.

E. Poles shall be pressure-tested wood: Southern pine, douglas fir, ponderosa pine, jack pine, lodgepole pine, red pine, or western cedar at the option of the Contractor. Poles shall be of the length and class indicated. Pole marking shall be located approximately 10 feet from the butt of the pole, except where other locations standard with the pole manufacturer are approved. Poles shall be turned smooth full length, and shall be roofed, gained and bored prior to pressure treatment.

Poles held in storage for more than two weeks shall be stored in accordance with ANSI Standard 05.1. The handling of poles shall be in accordance with ANSI Standard 05.1, except that pointed tools capable of producing indentations more than 1 inch in depth shall not be used.

Pole holes shall be drilled and poles shall be set 5'-0" deep. Holes shall be dug large enough to permit the proper use of tampers to the full depth of the hole. Earth shall be thrown into the hole in 6-inch maximum layers, then thoroughly tamped before the next layer is thrown in. Surplus earth shall be placed around the pole in a conical shape and packed tightly to drain water away from the pole.

F. Provide all pole hardware required to provide for utility company service attachment. Provide screw type anchors, down guy insulators and guy guard as required to anchor pole against utility company service drop. Utility company shall provide, install and connect secondary service drop cable to service entrance conductors at weatherheads.

G. Disconnect Switches: Service disconnect switches shall be three (3) pole, double throw, fusible with neutral and ground lugs. All disconnects shall be NEMA 3R and shall be capable of being locked in either position. Disconnect switches shall be Square D, General Electric, Westinghouse, Allen Bradley, or approved equivalent. Provide provisions for weatherproof padlock at each disconnection switch.

H. Provide fuses for all disconnects of sizes shown on the Drawings. All fuses shall be of the dual element type Bussman Fusetron or equal.

I. All raceways shall be installed with smooth bends. Splices, in junction boxes below grade shall not be acceptable. Raceways shall be cleaned of all dirt, debris and moisture before wire and/or cable is pulled. Contractor shall provide all mounting frames required for controllers, disconnects, etc.

J. Personnel Qualifications: All electrical work shall be accomplished by qualified electrical personnel, currently maintaining the class "Journeyman Electrical". The Engineer reserves the right to request the qualifications of personnel accomplishing electrical work.

2.18 Coatings

Wet well and valve vault pipe, fittings and valves other than stainless steel shall be coated with primer Tnemec Series 66 Hi Build Epoxiline 3.0 to 5.0 mils and finish coat Tnemec Series 66 Epoxiline 4 to 6 mils, or equal.

PART 3. EXECUTION

3.1 Installation

Install pump stations in accordance with manufacturer's instructions at location shown on plans. Test equipment to check for pump performance, excessive vibration, leaks in all piping, correct operation of

SECTION 11220 - SUBMERSIBLE NON-CLOG PUMP STATION

the control system and of auxiliary equipment. The controls shall be adjusted to start and stop the pumps at the required levels.

3.2 Startup

The Contractor shall provide at no cost to the Owner, the services of an accredited representative of the pump manufacturer who shall supervise the installation and testing of each pumping unit and also give operating and maintenance instruction to the Owner's personnel. Pumping equipment shall be tested for performance according to curves and other approved data. Failure of the equipment to perform as curves indicate and with other approved data shall be sufficient cause for rejection.

Contractor shall submit a certificate from the manufacturer, stating that the installation of the pumping unit is satisfactory, that the unit is ready for operation, and that the Owner's operating personnel have been suitably instructed in the operation and maintenance of the unit.

End of Section

SECTION 11227 - WELL PUMP

PART 1. GENERAL

1.1 Work Included

The work in this section includes furnishing and installing a well pump.

1.2 Submittals

Submit manufacturer's product specifications, pump performance curves, and operation and maintenance instructions.

1.3 Warranty

The manufacturer shall guarantee for two years from date of delivery that all components shall be free from defects in design, materials and workmanship. In the event a component fails to perform as specified or is proven defective in service during the guarantee period, the manufacturer shall provide replacement without cost to the Owner.

PART 2. PRODUCTS

2.1 General

Well pump and tank shall be Goulds Pumps Model JRS5L or approved equal. Well pump shall have the following capabilities:

Suction port	1 1/4 inch
Discharge port	1 inch
Discharge capacity	60 gpm at shutoff, 10 gpm at 40 psi
Total Head	92 feet minimum
Suction Head	26 feet minimum
Horse power	0.5 minimum

PART 3. EXECUTION

Not used.

End of Section

SECTION 11228 - TRASH PUMP

PART 1. GENERAL

1.1 Work Included

The work in this section includes furnishing one portable trash pump.

1.2 Submittals

Submit manufacturer's product specifications, pump performance curves, and operation and maintenance instructions.

1.3 Warranty

The manufacturer shall guarantee for two years from date of delivery that all components shall be free from defects in design, materials and workmanship. In the event a component fails to perform as specified or is proven defective in service during the guarantee period, the manufacturer shall provide replacement without cost to the Owner.

PART 2. PRODUCTS

2.1 General

Portable trash pump shall have the following capabilities:

Suction port	3 inch diameter
Discharge port	3 inch diameter
Discharge capacity	343 gallons per minute minimum
Total Head	92 feet minimum
Suction Head	26 feet minimum
Horse power	7.5 minimum
Fuel tank capacity	1.4 gallons minimum

PART 3. EXECUTION

Not used.

End of Section

SECTION 11510
ROTARY LOBE BLOWERS

PART 1 - GENERAL

1.1 SUMMARY

- 1.A. The Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, test and place in satisfactory operation of two Rotary Lobe blower unit(s) complete and operational.
- 1.B. All equipment specified in this section shall be designed and furnished by the Lobe Blower Manufacturer who shall be responsible for the compatibility of all included equipment.
- 1.C. The manufacturer is reminded that deliveries shall be coordinated with the Contractor. Prior to delivery of any equipment the manufacturer shall submit recommended storage requirements to the Engineer and Owner.

1.2 MANUFACTURERS

- 2.A. The blower equipment shall be as manufactured by Atlas Copco or approved equal.
- 2.B. The air blower/motor assemblies, and all accessories shall be supplied by a single manufacturer who is fully experienced, reputable, and qualified in the supply of the equipment to be furnished. The manufacturer of the blower shall be well represented in North America & must have its own local service organization to ensure good overall service support during start-up and later when the blowers are in service.
- 2.C. The blower manufacturer's machining and assembly shops must be ISO 9001 certified to assure conformance to the highest quality standards of the industry.
- 2.D. All factory authorized spare parts shall be available from at least one location within the USA.
- 2.E. The manufacturer of the blower shall be well represented in Kentucky and must have its own local service organization to ensure good overall service support during start-up and later when the blowers are in service.
- 2.F. The listing of any manufacturers name shall not imply tacit approval of same. The selected manufacturer shall be required to meet the specification.
- 2.G. Blower layout and design is based on Atlas Copco. This representation is only a result of managing design effort and rather than produce a detailed design for each blower configuration.
- 2.H. If equipment from another manufacturer is furnished, the Contractor is responsible for coordinating with the proposed blower manufacturer and the requirements of this design to result in a complete and functional installation at no additional cost to the owner.
- 2.I. Contractor shall install enclosure, mounted and external equipment supplied by the blower manufacturer and shall provide and install all external piping, pipe supports, wiring, conduit, and accessories not provided by the blower manufacturer for a complete and functional blower system.

1.3 TESTING

3.A. Mechanical and Functional Test

- 3.A.1. Each blower shall be mechanically tested as a whole package following production.
- 3.A.2. Manufacturer standard checks shall be performed, and measurements shall be within limits set for the product line by the manufacturer.
- 3.A.3. A functional control check shall be performed on the control panel & all integral instruments.
- 3.A.4. Mechanical and Functional tests shall be conducted using the job motor, job base frame and job controls system. Any exceptions required must be outlined in detail at the time of quotation.
- 3.A.5. Any measurement exceeding the standard limits or failure of functionality shall result in the manufacturers immediate repair or replacement of unit until it passes all checks and test.
- 3.A.6. Shipment of the unit for field repair shall not be allowed.

3.B. Performance Test & Design Requirements

3.B.1. Simplified Factory Performance Test

- 3.B.1.a. Each blower shall be tested in accordance with CAGI/ ISO 1217, Annex C (2009 – 4th Edition) using the latest edition. Performance shall provide kW input to the package and a

volumetric flow measurement at rated flow and pressure. This shall be compared to the documented performance for the blower's exact model to assess a passing or failing performance per ISO 1217 guidelines.

- 3.B.1.b. The design condition requirements are measured at the package discharge to ensure the output value does not include the inherent and added internal flow and pressure losses of components in the package.

3.B.1.c. Each blower for the **Primary** Application (Activated Sludge and Digester) shall be furnished for the following design operating conditions and meet the required design points at both the minimum and maximum conditions.

1.A.1.a.i.	Quantity	1 Duty + 1 Standby
1.A.1.a.ii.	Atmospheric Pressure	14.33 PSIA
1.A.1.a.iii.	Inlet Pressure (if different)	14.33 PSIA
1.A.1.a.iv.	Max inlet temperature to the blower	
.....	104 °F	
1.A.1.a.v.	Max Relative Humidity	80 %
1.A.1.a.vi.	Min Inlet temperature	4 °F
1.A.1.a.vii.	Min Relative Humidity	20 %
1.A.1.a.viii.	Design Outlet Flow	425 CGM
1.A.1.a.ix.	Design Outlet Pressure	6.5 PSIG
1.A.1.a.x.	Motor Size Limit	25 HP
1.A.1.a.xi.	Low Flow required	282 CFM
a.	If different from design flow	

1.4 SUBMITTALS / OPERATION & MAINTENANCE MANUALS

4.A. Submittals during construction and the operation and maintenance manuals shall be made in accordance with the General Requirements. In addition, provide this information in the following format:

- 4.A.1. Blower outline drawings showing the dimensions and weight of the blower package, including connection locations, sizes and any piping load limits. Also show center of gravity, maintenance sizes and weight of heaviest maintenance item along with maintenance removal distances. Also include notes regarding customer's piping, lifting etc.
- 4.A.2. As these lobe blowers do not require any special foundations or anchoring, the need for a special mounting platform / slab is not foreseen provided the unit is level and sturdy. However, if the manufacturer does have any special requirement, these must be clearly stated with details of the static forces acting on foundation and static pad loadings etc.
- 4.A.3. Provide process and instrumentation diagrams, showing legend, component list with description of components, and instrument list with alarms, shutdowns, setpoints and interlocks shown using logic blocks.
- 4.A.4. Electrical schematic designed to show a complete loop of each circuit with termination points included, three wire diagrams of the power distribution system, diagram for instrumentation etc.
- 4.A.5. Wiring diagram designed to show the detailed electrical arrangement drawings for electrical equipment furnished.
- 4.A.6. If the manufacturer is supplying any loose accessory equipment, then outline drawings of the loose shipped accessories shall be provided.
- 4.A.7. Operations and Maintenance manual as per the manufacturer's format shall be provided but these manuals shall include
 - 4.A.7.a. Preface – Safety Precautions, receiving and storage, warranty, limit of liability, standard preventative maintenance agreements, and revisions.
 - 4.A.7.b. General Blower Description
 - 4.A.7.c. Installation
 - 4.A.7.d. Lubrication System
 - 4.A.7.e. Control System
 - 4.A.7.f. Operation
 - 4.A.7.g. Maintenance

- 4.A.7.h. Spare Parts List
- 4.A.7.i. Drawings
- 4.A.7.j. Component Literature
- 4.A.7.k. Additional Specifications and Procedures
- 4.A.8. Blower & Motor Tests – Submit the general schedule, test setup and preparation, mechanical test run, performance test run with test conditions, documentation, acceptance criteria for test run, oil system parameters, visual inspection, and final documentation.
- 4.A.9. Unloading, Handling, Storage & Maintenance Requirements
- 4.A.10. Surface Preparation & Shop Paint Specifications

1.5 TOOLS AND SPARE PARTS

5.A. It is not foreseen any need for special tools / appliances necessary to disassemble, service, repair and adjust the lobe blowers; however, if the manufacturer does recommend special tools and appurtenances, these shall be provided with the machines along with a (2) year supply of the following spare parts for each blower:

- 5.A.1. V-belts
- 5.A.2. Blower oil
- 5.A.3. Air filter(s)
- 5.A.4. Any other expected maintenance item(s)

5.B. All spare parts shall be suitably packaged and clearly identified with indelible markings on the containers. Tools and spare parts shall be clearly marked, "Tools and Parts for two Blowers".

1.6 WARRANTY

6.A. The blower manufacturer shall guarantee in writing the unit package free of defects in material workmanship for a period of at least 24 months from shipment.

PART 2 - PRODUCTS

2.1 GENERAL

1.A. All components shall be new and both workmanship and materials shall be of the very best quality and shall conform to all applicable sections of these specifications. Components specified shall be understood to establish minimum requirements only, and do not relieve the Contractor of responsibility for providing a properly functioning system.

1.B. The blower(s) shall be variable speed electric motor driven, single-stage, air cooled rotary Tri-lobe type complete with v-belt drive and accessories as described.

1.C. Tag Numbers:

- 1.C.1. Blower No 1
- 1.C.2. Blower No. 2

1.D. Blowers Shall be:

- 1.D.1. Installed indoor
 - 1.D.1.a. If indoors the blower shall draw air from inside the building
 - 1.D.1.b. Variable speed

2.2 BLOWER SCOPE

2.A. The lobe blowers shall be air-cooled, single-stage, electric motor-driven and must deliver 100% oil-free air.

2.B. The blower shall require two (2) incoming 460V electrical power connections and (1) discharge air connection to operate. Any other requirements are to be provided externally by the contractor.

2.C. The blower shall include

- 2.C.1. Base Frame & Acoustic Enclosure
- 2.C.2. Enclosure Cooling Fan
- 2.C.3. Air inlet filter silencer
- 2.C.4. Drive motor
- 2.C.5. Blower element
- 2.C.6. Safety Blow off valve (units w/ 3" discharge)
- 2.C.7. Check valve
- 2.C.8. Outlet Compensator / Expansion Joint (Stainless Steel)

- 2.C.9. Outlet silencer / Pulsation dampener
- 2.C.10. Oil system
- 2.C.11. Belt Guard
- 2.C.12. Discharge Pressure Gauge
- 2.C.13. Inlet filter differential pressure Gauge
- 2.C.14. Combination Start-up relief & Safety Blow off valve (units w/ 4" or larger discharge)

2.3 BASE FRAME & ACOUSTIC ENCLOSURE

- 3.A. The "Oil Free" blower shall be mounted on a sturdy industrial grade steel base frame with forklift slots allowing the unit to be placed on any level floor capable of taking the weight of the unit, no foundation or fixation should be required.
- 3.B. The complete assembled blower / belt drive / motor unit should be mounted with vibration dampers in a 6-sided sheet metal acoustic enclosure which incorporates air inlet baffling to reduce the sound level under 85 dB(A) as quantified by ISO2151.
- 3.C. All service points to the blower should be easily accessible via the use of large door panels that should be easily mounted / dismounted.
- 3.D. The enclosure shall be strengthened with proper support structure to eliminate any damage during transport or during operation.
- 3.E. Enclosure cooling fan shall require 460V supply and starter/overload combo supplied and wired by the contractor to ensure the fan interlocked to operate whenever the main blower motor is running.

2.4 AIR INLET FILTER

- 4.A. The air inlet filter shall be mounted within the acoustic enclosure with easy separate access. The filter shall be a polyester filter with high filtration efficiency no less than EN779 G4 standards.

2.5 BLOWER ELEMENT

- 5.A. The blower compression element shall comprise of two rotors, each with three lobes turning into each other.
- 5.B. The rotors shall be made of ductile iron, grade GJS500-7 or equivalent, machine to final dimensions.
- 5.C. The casing shall be finned and made of cast iron grade GJL200 or equivalent.
- 5.D. The intermeshing timing gears shall ensure the two rotors do not touch each other and maintain the requisite clearance between the rotors & ensure wear and tear is eliminated and no lubrication is required in the compression space. The timing gears shall be of spur type, Quality DIN Class 6 or equivalent & made of alloy steel 20 MnCr5, case hardened.
- 5.E. Provide a piston ring type oil seal at each bearing, designed to prevent lubricant from leaking into the air stream. Provisions shall be made to vent the lubrication system to prevent any possible carryover of lubricant into air stream.

2.6 EXPANSION JOINT

- 6.A. A stainless-steel or EPDM expansion joint shall be installed at the blower element discharge to ensure vibrations from the downstream piping are not transmitted to the blower compression element & vice versa.
- 6.B. Expansion joint size shall match the blower discharge size
- 6.C. Expansion joint shall have minimum 300°F temperature rating

2.7 START-UP & RELIEF VALVE

- 7.A. When the blower is turned off, the valve shall remain open to ensure the blower restarts in an unloaded condition. Upon starting, the valve shall remain open as the pressure builds until this pressure closes the valve with a pneumatic line, allowing air to flow through to the process. In the case the system pressure reaches the relief setting, the valve shall open & release some air to maintain this pressure.
- 7.B. The opening & closing of the start-up / relief valve shall be through a pneumatically operated spring with a setting based on the rated pressure of the machine, and via springs to maintain the open position while the blower builds pressure.
- 7.C. Units with a 3" discharge shall use a spring weighted pressure relief valve and start in a loaded condition in lieu of the startup relief valve.

2.8 CHECK VALVE

- 8.A. The check valve shall be single disc flapper type. It shall be able to withstand temperatures of +285°F.

8.B. Check valve shall be integrated with the blower package and mounted internal to the blower enclosure after the relief valve.

8.C. Seals must be MVQ – Methyl-Vinyl Silicone Rubber to withstand high discharge temperatures

2.9 PULSATION DAMPER

9.A. A carbon steel Pulsation damper shall be in built & connected to the air discharge from the blower compression element.

9.B. The maximum working pressure of this pulsation damper shall be minimum 18 PSIG. It shall also be capable of withstanding temperatures from +15 to +320°F.

9.C. The noise absorption material shall be stainless steel wool & average sound attenuation shall be minimum 30dB(A).

2.10 OIL SYSTEM

10.A. The timing gears and the bearings shall be splash oil lubricated from oil slingers. Sight glasses for oil level observation shall be provided. Grease lubricated bearings are not acceptable.

2.11 DRIVE MOTOR WITH V-BELT DRIVE

11.A. Each blower shall be provided with a horizontal, foot mounted, totally enclosed fan cooled (TEFC) squirrel cage induction motor.

11.B. The motor shall be designed in accordance with prevailing IEC / NEMA standards. The motor shall have a minimum 1.15 service factor for fixed speed and 1.0 service factor for variable speed motors.

11.C. Acceptable manufacturers are:

11.C.1. Siemens

11.C.2. WEG

11.C.3. Lafert.

11.D. Motors shall meet NEMA high efficiency design. Nominal and guaranteed efficiencies shall be in compliance with IEC/NEMA Standard.

11.E. The motor shall be suitable for operation on 460 volt (±10%), 3 phase, and 60 Hz power for ambient air temperature of up to 40°C. Motors shall be suitable for full voltage, Wye-Delta, & reduced voltage soft start.

11.F. Each impeller/shaft shall be supported by double row ball or spherical roller bearings sized for a minimum of 24,000 hours of B-10 life. Regardless of bearing life, expected period between overhauls should be a minimum of 5 years.

11.G. Provide V-belt drive assembly consisting of Sheaves, quick detachable bushings, V-belts, and sliding motor base. Provide drive assembly with a 1.4 service factor based on motor nameplate horsepower.

11.H. Provide OSHA Style steel belt guard to enclose drive and belts. Design guard for easy removal. The guard shall be constructed to allow visual inspection of the drive system without removing the guard.

2.12 Instruments

12.A. Provide each blower with a discharge pressure gauge integral to the blower package

12.B. Provide each blower with an inlet differential pressure gauge integral to the blower

12.C. For variable speed blowers Provide each blower with a field mounted discharge temperature switch settable to 300F to be wired as a protective interlock with the blower VFD.

12.D. Controls

12.E. Each package shall be supplied with a basic microcontroller to act as a single point control for blower operation. Unit Controller shall receive a dedicated constant power supply of 460V or 24VAC to remain on when the blower is off. Instruments reading to the unit controller shall replace gauges in all instances.

12.E.1. Unit Controller

12.E.1.a. The unit controller shall be vendor standard Microprocessor based control system including digital readout with physical buttons to navigate the control screens.

12.E.1.b. Shall be Pre-wired and integral to the blower package

12.E.1.c. Shall display instrument readings

12.E.1.c.1) Discharge Temperature

12.E.1.c.2) Discharge Pressure

- 12.E.1.d. Shall Display an Alarm if abnormal conditions are reported by the monitored instruments and devices
 - 12.E.1.d.1) Discharge Temperature
 - 12.E.1.d.2) Discharge Pressure
 - 12.E.1.d.3) Inlet Filter Differential Pressure High Limit
- 12.E.1.e. Shall be wired by the contractor to stop the main motor if the General shutdown contact is active. if abnormal conditions exceed pre-defined limits set by manufacturer as reported by the monitored instruments and devices
 - 12.E.1.e.1) Discharge Temperature
 - 12.E.1.e.2) Discharge Pressure
- 12.E.1.f. Shall control the remote starter / VFD's on/off status only.
- 12.E.1.g. Shall allow the monitoring these features remotely via dry contacts:
 - 12.E.1.g.1) Running
 - 12.E.1.g.2) General alarm
 - 12.E.1.g.3) General Shutdown
- 12.E.1.h. Shall allow the control of these features remotely
 - 12.E.1.h.1) Run/Off (Discrete)

PART 3 - EXECUTION

3.1 PRODUCT DELIVERY, STORAGE AND HANDLING

- 1.A.All equipment shall be skid mounted or crated to protect against damage during shipment. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed, and the units and equipment are ready for operation.
- 1.B.Finished surfaces of all exposed flanges shall be protected by fiberboard blank flanges strongly and securely bolted.
- 1.C. Shipment shall be made after approval from the Engineer in writing. Shipment is not to be made until the manufacturer coordinates shipment to the jobsite with the contractor, assuring that the equipment will be properly received and stored.
- 1.D. Upon receipt, store equipment in strict accordance with the manufacturer's instructions, connect and energize motor space heaters and any other protective devices, as required.

3.2 SURFACE PREPARATION AND SHOP PAINTING

- 2.A.All surfaces shall be prepared & painted as per the manufacturers standard paint system. The finished Layer thickness as per EN ISO 2178 shall be 80 - 120µm.
- 2.B.Machined surfaces, flange faces & threaded holes are to be masked to protect from paint.
- 2.C. Unpainted steel surfaces are to be protected with rust preventive suitable for 4 weeks outdoor storage.

3.3 INSTALLATION

- 3.A.The blower package shall be suitable for indoor installation in temperatures from -4°F to 122°F.
- 3.B.The blowers, motors, all aeration instrumentation, and appurtenances shall be installed in accordance with the instructions of the manufacturer and as shown on the Drawings. All piping shall be supported to preclude the possibility of exerting undue forces and movements on the blower flanges.
- 3.C. Each blower skid unit shall be mounted on a flat and level concrete pad + or – one degree in accordance with the recommendations of the blower manufacturer.
- 3.D. The Contractor shall furnish and install the required piping, pipe supports, flange gaskets, bolts, nuts, electrical supplies, fuses, and for initial operation in accordance with the manufacturer's requirements and recommendations.
- 3.E.Furnish a certificate stating that the installation of the equipment is satisfactory, that the equipment is ready for operation and that the operating personnel have been suitably instructed in the operation and care of each unit.

3.4 START-UP AND TRAINING

- 4.A.The Equipment Manufacturer shall furnish an experienced service representative to inspect the final installation of the equipment. The services of the representative shall be provided for a minimum of one

(1), eight-hour (8-hr.) day for each unit. If there are difficulties in operation of the equipment due to the manufacturer's fabrication, additional service shall be provided at no extra cost to the Owner.

4.A.1. Provide, as a minimum, the following field services:

4.A.1.a. Verify proper connection of piping and installation of accessories.

4.A.1.b. Check leveling of blower base.

4.A.1.c. Confirm proper wiring of electrical power and any instruments / field wired items.

4.B. A minimum one (1) hour field acceptance test shall demonstrate that, under all conditions of operation, each unit:

4.B.1. Has not been damaged by transportation or installation.

4.B.2. Has been properly installed.

4.B.3. Have no mechanical defects.

4.B.4. Has fully functional instrumentation and all are properly calibrated and set.

4.B.5. Will start, run and stop in the prescribed manner.

4.B.6. Has the proper shutdown sequence of standard stop, and emergency stop.

4.B.7. Is free of objectionable vibration and noise.

4.C. Field acceptance testing shall be conducted after the installation of all equipment has been completed and the equipment operated for a sufficient period to make all desirable corrections and adjustments. The Contractor shall schedule testing with the full knowledge and consent of the Owner and shall not adversely affect the operation of plant facilities.

4.D. A factory representative, who has complete knowledge of proper operation and maintenance, shall be provided for one (1), eight (8) hour day, if necessary, to instruct representatives of the Owner and Engineer on proper operation and maintenance, including start-up and shut-down procedures, proper lubrication practices and troubleshooting of all equipment. This shall be done during the installation and startup of the blower units.

SECTION 11500
11500 - Equalization Basins and Related Facilities

1.0 SCOPE OF WORK

The Equalization basins and related equipment shall be constructed to perform as an EQ ahead of the existing WWTP. The intent is to build it such that it will be modified later into an additional wastewater treatment plant train to the existing WWTP.

The equipment shall be as supplied and/or manufactured by

Sullivan Environmental Technologies
2146 Chamber Center Dr, Fort Mitchell, KY 41017
Bret T. Abner
O: 859-426-5178
M: 513-907-2735

and

Aero-Mod
7927 US-24
Manhattan, KS 66502
Todd Steinbach
todd.steinbach@aeromod.com
785-537-4995

Or equal.

The basins converted to WWTP shall use an activated sludge process, along with a D.O. control process. Design parameters are as follows:

Plant

Design flow:	0.080 MGD
Hourly peak:	0.192 MGD
Sustained peak:	0.192 MGD

Influent Organic Load:

BOD ₅ :	101 lbs/day
TSS:	58 lbs/day
NH ₃ -N:	22 lbs/day

Effluent Requirements

Clarifier Effluent Required:

BOD ₅ :	20 mg/l
TSS:	20 mg/l
NH ₃ -N:	1.0 mg/l

General

The EQ basin conversion to WWTP shall include a single-train plant that has one (1) selector tank, one (1) clarifier tank, one (1) first stage aeration tank, one (1) second stage aeration tank, and one (1) aerobic digester.

All continuous wetted metal shall be 304 stainless steel and all basin structures shall be cast-in-place concrete. All aeration shall be retrievable diffused air.

All equipment in this section shall be supplied by a single manufacturer as a total system. Items to be supplied are as follows:

1. Aeration basin equipment
2. Digester aeration equipment
3. Solids wasting equipment
4. Clarifier/RAS equipment
5. Plant controls with PLC and back up timers
6. Dissolved Oxygen Control System
7. Electrically Actuated and Manual Butterfly Valves
8. Stop Gates & Frames
9. All required wall mounted aluminum walkway & handrail
10. In-tank Installation Hardware & Pipe Supports

2.0 CLARIFIERS

A. Clarifier Fabrication

The clarifier equipment shall consist of (a) structural support frame with aluminum handrails and aluminum grating (b) coarse screening (c) hydraulic suction hoods for sludge removal (d) sludge return air lifts and MLSS return trough (e) floating skimmers (f) 3-weir level and rate control device and (g) the associated plumbing, equipment and accessories as noted herein or on the drawings.

The structural support frame shall be fabricated of two (2) support beams created by welding two (2) 3" x 3" 304 stainless steel tubes per beam. The support frames will be placed into notches in the clarifier tank walls. The frame will have the stainless steel MLSS return trough attached to its underside.

The hydraulic suction hoods and structural support fins shall be of reinforced fiberglass. The hydraulic suction hoods will set over concrete suction hood bases on the floor of the clarifier tank.

For this project, one (1) clarifier bridge shall be provided, installed, and arranged within

the clarifier tank as shown on the drawings.

B. Inlet Coarse Screens

Telene circular inlet screens shall be provided. A total of three (3) are required. Each inlet screen shall provide 4 linear feet of screen. The coarse screens shall consist of 1/2" wide slots on 2" centers. These screens have an 8" flange for connecting to the 8" PVC distribution piping. They are installed in the aeration tanks as per the drawings.

C. Grating and Handrails

A walkway shall be provided across the entire support frame consisting of aluminum grating set into a frame made of stainless steel.

A two-rail handrail system shall be supplied. Handrails shall be of 1-1/2" (OD) aluminum tubing with aluminum handrail fittings that allow the vertical posts to be a single aluminum rail. The handrail risers shall be securely mounted to the support frame and of proper length to place the top-rail 42" above the walkway with the other rail evenly spaced below the top rail and the frame.

D. Clarifier Chamber

The clarifier chamber shall be designed such that PVC pipe distribution headers are located along both sides of the outer edge of each hydraulic suction hood. These inlet headers have ports provided. The inlet headers and ports are sized to provide even distribution across the entire settling area to prevent inlet turbulence during surge flows. The clarifier shall be rectangular and provide 216 sf of surface area.

E. RAS

Return sludge air lifts made of 4-inch Schedule 40 PVC pipe shall be located every four feet along the apex of the hydraulic suction hoods. Each air lift rate shall have the ability to be isolated with a ball valve. A 1 1/4" electric ball valve will be installed on the SS air supply piping. The valves will control the air supply to the air lifts. A single flow regulating valve will be provided to control the amount of air provided to the air lifts. The flow rate for each air lift can be adjusted from zero to 150 gpm and can be operated continuously or intermittently by a timer device located in the plant process control panel.

F. Effluent Collector

Two (2) stainless steel triangular effluent collection pipes with 3/4" holes spaced at 8" CC shall be furnished along the entire support frame length for effluent withdrawal. The apex of each triangular pipe shall be located approximately 1 inch below the minimum water level within the clarifier. This submerged orifice collection pipe shall provide uniform effluent withdrawal across the entire length without regards to leveling, will not pass surface scum or floatables.

G. Skimmers

Specially designed floating-skimmer assemblies shall be located in the clarifier chamber as per the detail drawing. Each skimmer shall consist of a formed floating head with a telescoping pipe. This assembly will insert into union and discharge up into the MLSS return trough. Air is supplied from the 3"x3" stainless steel support frame tubing. The telescoping section shall allow unrestricted level adjustment to accommodate the rising and falling clarifier levels caused by the surge control system. The skimmers consist of a stainless-steel union and ell for connection to the RAS trough and PVC fittings and material sized to remove any floatables that enter into the clarifier chamber.

H. Level and Rate Control

An effluent box with adjustable low- and high-level weirs and a submerged orifice for surge control shall be furnished on the effluent withdrawal end of each triangular collection pipe. The low-level weir will set the minimum operating level, passing flow directly to an orifice plate for surge protection. The orifice shall be sized to limit the maximum effluent rate, keeping the clarifier surface settling rates below maximum design standards. The upper edge of the orifice plate shall serve as the high-level bypass weir to limit the maximum water level within the plant. The distance between the low- and high-level weirs shall provide 5" surge storage within the freeboard across the entire mixed liquor aeration tank. A manual swing gate valve will allow the operator to shut off effluent from each effluent box.

3.0 WALL MOUNTED DIFFUSED AERATION SYSTEM

A. Aerators

The basins requiring aeration shall have wall-mounted aerators as shown on the plans. These aerators shall provide the necessary air required to maintain proper operation. The diffusers shall be set at a submergence depth in the aeration tank as shown on the plans. As shown on the plans, the air manifolds (drop pipes) shall be wall mounted with a SS support system. Easy diffuser removal from above the water line shall be by lightweight PVC drop pipes. Removal and replacement shall be assisted by a 1 ½" Schedule 5 SS guide rail system. The guide rail shall be bolted to the SS wall mounting support system in the field. No field welding shall be required.

1. Aeration Tank – First Stage

The drop pipes used in the first stage aeration tank shall be 2" sch. 40 PVC pipe. A 2" SS throttling ball valve along with a SS union and ell shall be supplied in each aerator upper assembly. A single 2" connection from the air header to the flex connector on the aerator assembly is required for each aerator. SS

coarse bubble diffusers shall be used for air transfer, which shall thread into the header for each aerator. Three (3) aerators with four (4) 24" SS diffusers per drop pipe are required for this tank.

2. Aeration Tank – Second Stage

The drop pipes used in the second stage aeration tank shall be 2" Schedule 40 PVC pipe. A 2" SS throttling ball valve along with a SS union and ell shall be supplied in each aerator upper assembly. A single 2" connection from the air header to the flex connector on the aerator assembly is required for each aerator. SS coarse bubble diffusers shall be used for air transfer, which shall thread into the diffuser header for each aerator. Four (4) aerators with four (4) 24" SS diffusers per drop pipe are required for this tank.

3. Aerobic Digester Tank

The drop pipes used in the digester tank shall be 2" Schedule 5 welded SS pipe. A 2" SS throttling ball valve along with a SS union and ell shall be supplied in each aerator upper assembly. A single 2" connection from the air header to the flex connector on the aerator assembly is required for each aerator. SS coarse bubble diffusers shall be used for air transfer, which shall thread into the diffuser header for each aerator. Three (3) aerators with two (2) 12" SS diffusers per drop pipe are required for this tank.

4. Selector Tank

The drop pipes used in the selector tank shall be 2" Schedule 40 PVC pipe. A 2" stainless steel throttling ball valve along with a SS union and ell shall be supplied in each aerator upper assembly. A single 2" connection from the air header to the flex connector on the aerator assembly is required for each aerator. Stainless steel coarse bubble diffusers shall be used for air transfer, which shall thread into the diffuser header for each aerator. Two (2) aerators with two (2) 12" SS diffusers per drop pipe are required for this tank.

4.0 SLUDGE MANAGEMENT

A. Solids Wasting (WAS) Air Lift Pump

The sludge wasting airlift shall be sized for a running time at design loading of approximately 60-120 minutes per day. All components below the water line shall be of SS. An electrically controlled automatic valve and a manual throttling and shut-off valve shall be supplied in the air feed line. The entire assembly shall be provided with anchor bolts. For this project, one (1) airlift pump is required to waste mixed liquor from the aeration tank to the aerobic digester.

B. Supernatant Weir & Baffle

The digester shall be constructed with a notch over which a supernatant weir & baffle will be placed to control the digester water level and return displaced supernatant back to the aeration tank. For this project, one (1) supernatant weir & baffle assembly is required.

5.0 PLANT CONTROLS

A. Plant Process Control Panel

Plant Process Control Panel. This panel shall utilize a NEMA type 12 enclosure with an Allen-Bradley PanelView 12" Touch Screen Color Terminal, an Allen-Bradley CompactLogix PLC controller series 5380. For backup, the panel will include an Allen-Bradley model Micro 850 and a PanelView 800 7" touchscreen. This panel shall include a Secure VPN module for remote connectivity. This panel shall operate using 115-V, 15-amp service. Relays shall be used to transmit the operational signal to the various valves in the tankage. This panel shall provide the control for the four (4) main process functions required for the provided treatment equipment. This panel shall be located as shown on the plans.

1. Function 1 - RAS Timer

The timer function shall control the operation of the RAS airlift pumps in the clarifier. The control logic shall be xx minutes of operation followed by xx minutes of standby (time to be determined at time of startup). The operation shall then index to the next set of RAS banks.

An electric signal shall be sent to activate the electrically actuated ball valves on the clarifier RAS air supply.

2. Function 2 – Aeration/Digester Alternating Air Timers

These timer functions shall control the operation of the alternating aeration in the first and second stage aeration basins and the alternating aeration in the digester tanks. The control logic shall be xx hours of aeration valve closure in one aeration basin, followed by xx hours of aeration valve closure in the corresponding aeration basin. An overlap timer function of xx minutes shall keep both aeration valves open during the transition. The same logic will be used for all of the aeration basin stages and the digesters.

An electric signal shall be sent to activate the electrically actuated butterfly valves on the air headers for the first and second stage aeration basins and the digester tanks.

3. Function 3 – WAS Timer

These timer functions shall control the automatic solids wasting system that shall transfer solids from the aeration basins by a WAS pump system. The

control logic shall include the ability to set on which days the solids wasting will occur, and the time of day the solids wasting will occur. The timer function shall control the aeration in each of the digester tanks and the operation of an airlift pump located in one of the aeration basins. For the days that the wasting function operates, at the user-defined time(s) of day, the timer function shall close the butterfly valve in the air header for each digester and shall operate the airlift pumps, which shall pump the WAS at a set rate to the digesters. At the end of the timer function, the WAS airlift pump shall be turned off and the aeration butterfly valves shall be opened.

An electric signal shall be sent to activate the electrically actuated butterfly valves on the air headers for the digester tanks and the electrically actuated ball valves on the WAS airlift pumps.

4. Function 4 – Speed Control of Aeration Blowers for D.O. Range Control

The D.O. control process shall include a series of operator-established settings shall be incorporated to allow multiple adjustments in order to maintain a D.O. range within the aerated aeration basins. Timer functions shall be included that allow for blower shutdown, blower startup, and blower speed changes relative to the specified D.O. range that is set.

B. Dissolved Oxygen System

A.A.1) The automated control system will use the input from two dissolved oxygen sensors located in the aeration tanks and control the speed of the blowers via the VFD's to maintain a desired D.O. range.

A.A.2) Refer to plans for location of probes and junction boxes.

A.A.3) The DO equipment will consist of:

A.A.3.a. One (1) Insite IG Model MCA Process Analyzer w/ mounting bracket and sunshield

A.A.3.b. Two (2) Insite IG Model 10-33 Dissolved Oxygen Sensors

A.A.3.c. Two (2) Probe Handrail Mounting Kits

6.0 **WALL MOUNTED WALKWAYS**

Aluminum walkway and handrail shall be provided for installation on top of the concrete walls of the plant as per the drawings. The walkway frame shall consist of aluminum supports and channels to be either centered or cantilevered on top of the concrete walls. The walkway shall consist of aluminum grating set into aluminum frames.

A two-rail handrail system shall be supplied. Handrails shall be 1-½" OD aluminum tubing with aluminum handrail fittings that allow the vertical post to be a single aluminum handrail. The handrail system shall be field erected. The risers shall be securely mounted to the support frame and of proper length to place the top-rail 42"

above the walkway with the other rail evenly spaced below the top-rail.

7.0 AIR VALVES

The following valves and actuators/operators are to be supplied by the manufacturer:

- One (1) Electrically controlled 6" butterfly valves – 1st Stage Air Piping
- One (1) Manually controlled 6" butterfly valves – 1st Stage Air Piping
- One (1) Electrically controlled 6" butterfly valves – 2nd Stage Air Piping
- One (1) Manually controlled 6" butterfly valves – 2nd Stage Air Piping
- One (1) Electrically controlled 4" butterfly valves – Digester Air Piping
- One (1) Manually controlled 4" butterfly valves – Digester Air Piping
- One (1) Manually controlled 4" butterfly valves – Clarifier/WAS/Constant Air
- One (1) Electrically controlled 2" butterfly valve – Selector Tank
- One (1) Manually controlled 2" butterfly valve – Selector Tank

9.0 Miscellaneous

- A. One (1) stop gate, stainless steel frame with aluminum plate will be supplied. Gate is manufactured by R-W Gate Co.
- B. All PVC wall inserts and link-seals for concrete wall penetrations (for PVC pipe) for air system movement in the selector tank, aeration tanks, clarifier, and digester tank shall be supplied by the equipment manufacturer. These wall inserts are for PVC wall penetrations on interior tank walls only.
- C. All required PVC tap saddles, SS wall brackets, SS U-bolts, and SS anchor bolts for installation of the supplied equipment and contractor supplied PVC piping (in the selector tank, aeration tanks, clarifier, and digester tank).
- D. All DIP wall inserts and link-seals for concrete wall penetrations (for DIP pipe) for interbasin transfer in the selector tank, aeration tanks, clarifier, and digester tank shall be supplied by the equipment manufacturer and shall include gate valves and extended operators as shown.

10.0 WARRANTY

The equipment supplier shall provide a warranty for the clarifier equipment for a period of five (5) years from the date of start-up. All other equipment shall have a one (1) year

warranty or eighteen (18) months after ship date, whichever comes first.

11.0 O & M MANUALS

The equipment supplier shall provide an electronic copy of the operations and maintenance manual.

12.0 EQUIPMENT START-UP & OPERATOR TRAINING

The manufacturer shall provide two (2) days of on-site dry equipment inspection and equipment start-up/training upon complete installation of equipment. A check-off sheet shall be completed and signed by the contractor prior to dry equipment inspection.

The manufacturer shall provide two (2) additional days of on-site controls and automation start-up and training following a successful dry inspection and after the tanks are filled with water.

The manufacturer shall provide two (2) additional days of on-site equipment and process training after successful start-up of the plant and an adequate biomass has been established.

The manufacturer shall provide two (2) days of operator school at the manufacturer's home office for two (2) operators after the treatment plant is operational. The operator school shall provide 10 hours to the attending operator, as recognized by the State of Kentucky.

SECTION 11530
ULTRAVIOLET DISINFECTION EQUIPMENT

PART 1 GENERAL

1.1 Intent of Section

This section addresses the supply, delivery, supervision of installation and commissioning of the ultraviolet (UV) disinfection equipment as described herein.

1.2 References

Environmental Protection Agency (EPA)	
EPA/625/1-86/021	Design Manual, Municipal Wastewater Disinfection
NWRI	National Water Research Institute
IEEE 519-1992	Institute of Electrical and Electronics Engineers Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems

1.3 System Description

Furnish all equipment, material, labor and appurtenances required for the complete installation and operation of the open channel UV disinfection system, as specified in this section. The system shall utilize low pressure high intensity lamp technology and high frequency electronic ballasts.

1.4 Related Sections

3100	Concrete Formwork
3200	Concrete Reinforcement
3300	Cast-in-Place Concrete

1.5 Quality Assurance

- A. Only manufacturers of ultraviolet disinfection equipment who have been engaged in the business for at least five (5) years shall be allowed to bid.
- B. Only UV manufacturers who have had their system validated via a bioassay test by a third party shall be allowed to bid.
- C. The UV manufacturer shall offer state-of-the-art UV technology. The UV system shall include, but not be limited to, low pressure high intensity lamps, high frequency electronic ballasts capable of variable output, automatic cleaning system and status indication of each lamp.
- D. A statement by the equipment manufacturer listing any deviations or exceptions taken to these specifications. Include specification reference and proposed alternative with reason stated for exception.
- E. At least five (5) days prior to bid opening, the Engineer shall issue an addendum listing acceptable UV disinfection manufacturers. The Engineer shall evaluate each system on the basis of technical and performance capabilities and lowest life cycle cost which takes into

account capital, energy and maintenance costs. The following shall be used in assessing life cycle costs:

1. Lamp price. Maximum expected life shall not exceed 16,000 hours. Maximum lamp life factor of 0.9 shall be used.
2. Ballast life and price.
3. Quartz sleeve life and price. Maximum quartz sleeve fouling factor of 0.95 shall be used.
4. Scraper life and price.
5. Power Costs. The power costs shall be \$_____ per kWh. Power costs will be assessed based on total system power.
6. The plant's average flow rate shall be used for calculating the operating costs.

1.6 Submittals

- A. Submit six (6) copies of the following shop drawings.
- B. Layout, overall dimensions, required clearances and a general description of the equipment, including the location of electrical equipment, control panels and other auxiliary equipment.
- C. Details of attaching equipment, services, auxiliary equipment, accessories, *etc.*
- D. Complete data on materials to be used for fabrication for those parts in and out of the effluent.
- E. Electrical control schematics, wiring diagrams, panel layout and a general description including a list of materials.
- F. Operating characteristics of all electrical and control equipment: operating voltage and amperage tolerances and any ancillary electrical services that are required.
- G. List of what components and materials shall be shipped preassembled and a parts list for the other components and materials. Weights and physical dimensions shall be indicated for each part, assembly and/or package to be shipped.
- H. Provide Operation and Maintenance data for incorporation in the O & M manuals as specified. Include a complete description of the operation of the UV system together with the general arrangement and detailed drawings of the UV system: wiring diagrams for the power and control system. A parts catalog with a complete list of replacement parts with section drawings illustrating the connections and identifying numbers.
- I. Third-party bioassay validation report and calculations used to determine the MS2 Reduction Equivalent Dose (RED) or T1 Reduction Equivalent Dose (RED). The bioassay shall have been performed in accordance with the NWRI Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse (May 2003). Any equations used in sizing the UV system shall have been generated by the third-party that performed the validation testing. Calculations should verify the guaranteed log reduction of the target organism at end of lamp life, maximum flow, maximum influent concentration and minimum UV Transmittance.

1.7 Delivery and Storage

- A. Ship equipment pre-assembled to the degree that is practicable.
- B. Provide storage instructions indicating specific requirements to ensure there is no damage to or deterioration of components.

1.8 Coordination

- A. The Contractor shall coordinate the equipment delivery schedule with the construction schedule.

1.9 Acceptable Products

- A. The UV disinfection equipment shall be the *C³500™D*, as manufactured by De Nora Water Technologies, LLC or approved equal.

PART 2 PRODUCTS

2.1 Description

- A. The UV disinfection system shall reduce the concentration of viable microorganisms in the treatment plant effluent by irradiation with UV light at a wavelength of 254 nm. Less than 130 E. coli colonies per 100 mL, based on a 30-day geometric mean and less than 240 E. coli colonies per 100 mL, based on a 7-day geometric mean, shall be the target that must consistently be achieved.
- B. Equipment supplied with the UV system shall include stainless steel channel assembly with inlet and weir transition boxes, UV lamp racks, UV intensity sensors, power distribution center, and other equipment as required for the complete installation and operation of the system.

2.2 Basic Design Conditions

- A. The UV disinfection system shall be used to disinfect wastewater that has undergone secondary treatment.

- B. The system shall be designed for the following water quality and flow conditions.

1.	Design Flow per Channel (GPD)	160,000
2.	Minimum UV transmission at 254 nm (%)	65
3.	Maximum Total Suspended Solids (mg/L)	30
4.	Temperature (°F) / (°C)	34 - 95 / 1-35
5.	Effluent E. coli colonies per 100 mL, based on 30-day geometric mean	130
6.	Effluent E. coli colonies per 100 mL, based on 7-day geometric mean	240

- C. The system shall have the following overall outside dimensions:

1.	Length (inches)	138 1/4
----	-----------------	---------

- | | | |
|----|------------------------------------|-------------|
| 2. | Width (inches) | 16 |
| 3. | Depth (inches) | 24 7/8 |
| 4. | Effluent Depth in Channel (inches) | 12, nominal |
- D. The following system configuration shall represent the minimum number of lamps to be supplied. If it is the opinion of the manufacturer that a greater number of lamps are required to satisfy the disinfection requirements of this project then the manufacturer shall base its bid on the higher number of lamps and provide detailed information supporting that offering.
- | | | |
|----|---|---|
| 1. | Number of channels: | 1 |
| 2. | Number of banks per channel: | 1 |
| 3. | Number of racks per bank: | 1 |
| 4. | Number of lamps per rack: | 2 |
| 5. | Total number of UV lamps: | 2 |
| 6. | Number of UV intensity sensors: | 1 |
| 7. | Number of Power Distribution Centers (PDC's): | 1 |
- E. The system shall be capable of uninterrupted operation during the removal of UV lamp racks for routine maintenance or for the replacement of parts.
- F. The UV density available in the UV bank shall not be less than 4.5 W/L (total nominal UV power at 254 nm divided by effective volume of the water filled bank) at the end of lamp life.
- G. The system shall be capable of delivering a minimum MS2 RED of 30 mJ/cm², after 16,000 hours of lamp operation, at the design flow rate with 65 % UV transmission of the effluent at 254 nm and adjusting for quartz sleeve fouling.
- H. The calculated average intensity within the UV bank shall not be less than 12.507 mW/cm² at a UV transmission of 65% with new lamps and with clean sleeves, as determined by the TULIP subroutine of UVDIS, Version 3.1.
- I. The theoretical retention time shall not be less than 8.89 seconds at the design flow rate.
- J. The actual retention time of the effluent within the system determined by hydraulic analysis shall not be less than 0.9 times the theoretical retention time (almost complete use of the reactor volume).
- K. The flow through the system shall be turbulent with a Reynolds number greater than 4,000 at average flow.
- L. The headloss for each bank shall be less than 0.18 inch at the design flow condition with no lamps exposed to air.

2.3 Materials

- A. All metal components in contact with the effluent and UV light shall be Type 316 stainless steel. Manufacturers that use aluminum on any UV equipment installed in the channel shall not be considered for this project.
- B. All other stainless steel shall be Type 304.
- C. All wiring exposed to UV light shall be Teflon coated.
- D. All material exposed to UV light shall be stainless steel, quartz, Teflon or other UV resistant material.
- E. The equipment shall be designed to comply with NEMA 4X (IP65) ratings.

2.4 UV Lamps

- A. The UV system shall utilize low pressure high intensity amalgam lamps of the pre-heat start design.
- B. Each lamp shall produce UV light with at least 90% of its emission between the wavelengths of 230 to 300 nm.
- C. The lamp shall be rated for an average UV output of 205 W at 253.7 nm after 100 hour burn in. The average UV output of any proposed lamp cannot exceed 38% of the lamp input power.
- D. The lamp shall be rated to produce no ozone.
- E. The lamp arc length shall be 57 inches (1447 mm).
- F. The UV lamp type shall be GA64T10L.
- G. The lamps shall have a four pin electrical connector at one end only.

2.5 Quartz Sleeves

- A. The quartz sleeves shall be fabricated of Type 214 clear fused quartz circular tubing containing at least 99.9% silicon dioxide.
- B. The sleeve wall thickness shall be at least 1.50 mm (nominal).
- C. The quartz sleeve material shall be rated for 92% UV transmission and shall not be subject to solarization over its lifespan.
- D. The quartz sleeves shall be fabricated with one end closed so that only the open end requires sealing.

2.6 Lamp End Seals

- A. The open end of the quartz sleeve shall be sealed by means of a Type 316 stainless steel nut which threads onto a coupling and compresses a sleeve O-ring.

- B. The sleeve coupling nut shall have a knurled surface to allow a positive hand grip for tightening. The nut shall not require any tools for removal.
- C. The quartz sleeve shall be held in place by means of an O-ring and compression washer.
- D. The UV lamp rack shall be designed to isolate the individual lamps and to prevent moisture from coming in contact with the electrical connections of other lamps in the event of a seal failure or a quartz sleeve fracture.

2.7 Lamp Array Configuration

- A. The lamp array configuration shall be uniform with all lamps parallel to each other and to the flow.
- B. The lamps shall be evenly spaced in horizontal and vertical directions with equal center line spacing in both directions.
- C. Vertical lamp configurations shall not be acceptable due to higher headloss.

2.8 UV Lamp Racks

- A. Each UV lamp rack shall consist of two (2) UV lamps mounted on a Type 316/304 stainless steel frame.
- B. The ends of the quartz sleeve shall not extend beyond the frame of the UV lamp rack, so that the frame will help protect the lamp/sleeve assembly from breakage.
- C. The UV lamp rack shall be connected to receptacles on the Power Distribution Center (PDC) by means of one or two multi-conductor cable(s) with modular repairable connector(s). The cable connector and all of its components shall be field repairable. The connector shall be of a "Snap-On" design having no threads that may bind or be subject to cross threading. The connector shall also allow for visual confirmation that the connection is locked in place. Pins shall be made from a copper alloy with hard silver plating. The connector shall be coated with a corrosion resistant finish and all levers, bolts and screws shall be made of stainless steel. The connector shall meet IP65 (UL574) requirements for direct water spray when mated.
- D. At the point of exit from the UV lamp rack, the multi-conductor cable(s) shall pass through a water resistant strain relief.
- E. The UV lamp racks shall be designed so that when they are in place, in the UV banks with the grating removed, they shall support a live load of 300 lbs (136.4 kg) without damage. The tops of the racks shall present a surface on which workers can stand to access the racks in the UV bank.
- F. The UV lamp rack shall incorporate a protective shield to prevent UV light from radiating above the lamp bank during normal operation.
- G. The UV lamp rack shall be designed to comply with NEMA 4X (IP65) ratings.

2.9 Channel Assembly

- A. The channel assembly shall be comprised of three components: inlet box, channel and weir box. All components are fabricated from Type 304 stainless steel.
- B. The inlet box shall have an ANSI 150# stainless steel flange (or ANSI flange connection) for easy connection to the process flow. A diffuser is welded to the center of the inlet box to prevent short-circuiting and to enhance mixing.
- C. The channel supports the individual UV lamp racks and has four (4) adjustable supports to evenly distribute the weight of an operational unit.
- D. The level control weir shall be constructed of Type 304 stainless steel and shall be welded into the weir box. The weir shall maintain a minimum channel water level and shall be sized to maintain a maximum height of 2.0 inches (50.8 mm) of effluent over the top lamp at peak flow conditions with no short circuiting of the lamp array. The weir box shall have an ANSI 150# stainless steel flange (or ANSI flange connection) for easy connection to the process flow.

2.10 UV Intensity Sensor

- A. A submersible UV sensor shall continuously sense the UV intensity produced in the bank of UV lamps. The sensor shall measure only the germicidal portion of the light emitted by the UV lamps. The sensor shall be factory calibrated.
- B. Intensity of the bank of UV lamps shall be indicated in mW/cm^2 .
- C. The sensor shall provide a 4 - 20 mA analog output signal for local indication of the UV intensity in the UV bank.

2.11 Power Distribution Center (PDC)

- A. A PDC shall be provided for every channel of lamps. The PDC supplies power to the lamp racks and contains power distribution, electronic ballasts, control and monitoring equipment. The PDC is a wall mounted enclosure (floor mounted stand optional) fabricated from Type 304 stainless steel. The PDC shall be designed to comply with NEMA 4X (IP65) ratings.
- B. Each PDC shall include its own main breaker. This will allow maintenance personnel to perform any service work per local safety regulations.
- C. The PDC shall be equipped with the necessary components to allow each bank of lamps to be controlled in either the Remote (Automatic) or Local (Manual) mode. Each PDC shall have a Control Card and Operator Station used to control and monitor the bank(s) of lamps.
- D. The electrical supply to each PDC shall be 240VAC, 1 Phase, 60Hz. The power consumption shall be a maximum of 1.7 kW.

2.12 Ballasts

- A. Electronic ballasts shall be of the pre-heat start type. The electronic ballast system will provide a minimum power factor of 98%.
- B. The ballast input voltage shall be single phase 240 VAC, 60 Hz.

- C. The lamp current crest factor shall not exceed 1.45.
- D. Each ballast shall drive one low pressure high output amalgam lamp for increased redundancy.
- E. The ballast shall be capable of providing variable output to the lamp. The variable output shall be a continuous function and not a step function.
- F. Each ballast shall provide a lamp failure alarm signal for the lamp they drive.
- G. The ballast shall be a modular, plug-in device allowing for easy replacement in the field by operators without the need for special equipment.

2.13 Control and Instrumentation

A. General

1. The UV Control and Monitoring System integrated into each PDC shall include provisions for local indication of the following system parameters:
 - a. Individual lamp status
 - b. Communications status
- c. Bank UV intensity (mW/cm²)
- d. Bank ON/OFF status
- e. Bank elapsed time (h)
- f. Cleaning motor status
- g. Bank lamp current (%)
- h. Time before next cleaning cycle (h)
2. The UV Control and Monitoring System shall provide an alarm mode that allows the operator to view up to 20 of the most recent alarms that are still active or have yet to be acknowledged. The alarms displayed shall be common alarms for each UV lamp rack as well as system alarms. Minor and major alarms are defined below.
 - a. Minor Alarms
 1. Individual lamp failure
 2. Cleaning motor overload
 3. Bank UV intensity low alarm
 4. High cabinet temperature alarm
 - b. Major Alarms
 1. Bank UV intensity low-low alarm
 2. Adjacent Lamp Failure
 3. Multiple Lamp Failure
 4. Circuit breaker/GFI trip alarm
 5. Effluent low level
 6. Loss of UV intensity signal in Remote mode
 3. The control system shall provide elapsed time indication for individual banks with a non-resettable timer and shall be displayed when prompted.
 4. Lamp on/off cycling is protected by introducing delays to compensate for brief flow fluctuations and to keep energized banks in service for a defined period of time.

5. The dose pacing control scheme is enabled when both the flow and UV intensity signals are present and the system is in Remote mode. Dose is calculated on a per bank basis and is totaled for the system. The total dose received by the effluent is called the Received Dose. This value is the Process Variable (PV) and the PID compares the PV to the Applied Dose (Setpoint) and adjusts the Ballast Output Current accordingly so that the Received Dose follows the Applied Dose.

6. For a two bank system in Remote mode and with dose pacing enabled, the output of the lead bank is adjusted such that the Received Dose follows the Applied Dose. If the Received Dose cannot attain the Applied Dose then the lag bank is energized and after the warm-up period the Bank Output Current of both banks is adjusted such that the Received Dose follows the Applied Dose. The reverse is also true; if the Received Dose is greater than the Applied Dose then the lag bank is de-energized after a 30 minute delay.

7. In Remote mode the lead bank is always energized. The UV Control and Monitoring System shall energize the lag bank under the following conditions:

1. if the Received Dose cannot attain the Applied Dose in dose pacing mode,
2. a major alarm condition is detected in the lead bank,
3. the operator manually rotates the lead bank.

The lag bank delay off timer is set to 30 minutes to prevent unnecessary on/off cycling based on changing process conditions.

8. A form C (normally open (NO) or closed (NC)) dry contact rated for 5A (NO)/3A (NC) at 125 VAC shall be provided as follows:

- a. Minor common alarm condition
- b. Major common alarm condition
- c. Bank 'A' status
- d. Bank 'B' status, if configured

2.14 Cleaning System

A. Mechanical cleaning system with an automatically controlled and manually initiated cleaning cycle. UV systems that do not have automatic cleaning shall not be accepted.

B. The cleaning mechanism (scraper) shall be driven by an electric motor. UV systems that incorporate hydraulic or pneumatic cleaning systems shall not be accepted due to increased components and complexity. UV systems utilizing chemicals shall also not be accepted.

- C. The cleaning system shall be fully operational without requiring the lamp rack to be placed out of service.
- D. The cleaning cycle intervals shall be field adjustable from once every hour to once every 999 hours.

2.15 Safety Equipment

- A. The UV system manufacturer shall provide one (1) suitable face shield which will block UV light with wavelengths between 200 and 400 nm from low pressure mercury lamps.

2.16 Spare Parts (Optional) and Accessories

- A. The following spare parts shall be furnished;

- | | | |
|----|------------------------------|---|
| 1. | One (1) - UV Lamp | (10% of the total supplied in the system) |
| 2. | One (1) - Quartz Sleeve | (10% of the total supplied in the system) |
| 3. | One (1) - End Seal | (10% of the total supplied in the system) |
| 4. | One (1) - Electronic Ballast | (10% of the total supplied in the system) |
| 5. | One (1) - Service Trolley | (One) |

PART 3 EXECUTION

3.1 Equipment Installation

A. The ultraviolet disinfection system shall be installed in accordance with the manufacturer's drawings, written instructions and recommendations. The manufacturer shall provide adequate services as required for proper installation.

B. The manufacturer shall issue a certificate to the Engineer indicating that the system has been properly installed after an inspection and testing of the system.

3.2 Manufacturer's Representative

- A. The manufacturer shall provide the services of a qualified field representative to perform field services including commissioning and instruction of the Owner's personnel in the operation and maintenance of equipment furnished.

3.3 Field Training

A. The manufacturer shall provide the services of a qualified representative to train operation and maintenance personnel. Training shall be provided for a total of one person day after commissioning of the system. Field training shall cover all of the items contained in the operation and maintenance manual.

End of Section

SECTION 11600 - FLOW MEASURING EQUIPMENT

PART 1. GENERAL

1.1 Work Included

Furnish and install a Parshall flume and open channel ultrasonic flow meter to measure, indicate, totalize, and record flow.

1.2 Related Work Specified Elsewhere

- A. Section 03300 - Cast-in-Place Concrete
- B. Section 16045 - Electrical Related Work
- C. Section 11602 - Sewage Sampling Devices

1.3 Submittals

A. Shop Drawings. Submit for review shop drawings showing complete description in sufficient detail to permit an item comparison with the specification, dimensions and installation requirements, descriptive information including catalog cuts and manufacturers specifications for all components and electrical schematics and layouts.

B. Operation and Maintenance. Provide manufacturer's operation and maintenance manuals.

PART 2. PRODUCTS

2.1 Primary Devices

A Parshall flume shall be used for flow measurement. The Parshall flume shall be fiberglass reinforced polyester flume with three inch throat width, cast in a concrete channel. Flume shall be as manufactured by Plasti-Fab, Inc. or approved equal.

2.2 Ultrasonic Flow Meter

An ultrasonic flow meter shall be installed to measure, indicate, totalize, and record flow in the flume. Flow meter shall be Isco Model 4210, American Sigma Model 980, or approved equal.

2.3 Data Management and Analysis Software

Provide flow meter manufacturer's current data management and analysis software.

PART 3. EXECUTION

3.1 Installation

A. Install flow measurement devices in accordance with contract drawings, and manufacturer's shop drawings and instructions.

3.2 Manufacturer's Services

Furnish the services of an experienced and qualified manufacturer's representative for supervision of equipment installation, system startup and operational adjustment.

End of Section

SECTION 11602 - SEWAGE SAMPLING DEVICES

PART 1. GENERAL

1.1 Work Included

Furnish and install two automatic samplers to sample wastewater.

1.2 Related Work Specified Elsewhere

- A. Section 11600 - Flow Measuring Equipment
- B. Section 16045 - Electrical Related Work

1.3 Quality Assurance

A. Manufacturer. Sampling equipment shall be Isco, Inc. Model 6700FR, or American Sigma, Inc. 900 MAX All Weather Refrigerated Multiple Bottle/Composite Sampler, or approved equal.

B. Deviations or Exceptions. Provide a statement by the equipment manufacturer listing any deviations or exceptions taken to these specifications.

1.4 Submittals

A. Shop Drawings. Submit for review shop drawings showing the following:

1. Complete description in sufficient detail to permit an item comparison with the specification.
2. Dimensions and installation requirements.
3. Descriptive information including catalog cuts and manufacturers specifications for all components.
4. Electrical schematics and layouts.
5. Experience documentation.

B. If other equipment is proposed, the Contractor shall demonstrate that all requirements of materials, performance, and workmanship have been met or exceeded by the equipment proposed.

PART 2. PRODUCTS

2.1 Sampling Equipment

A. General. The refrigerated samplers shall be capable of representative collection of conventional and toxic pollutants. The samplers shall be capable of both timed and flow proportional interval sampling. A high speed peristaltic pump shall be utilized for collection of the sample liquid. The liquid shall be under continuous pumped flow from the stream inlet to the sample container and shall not pass through any metering chamber, valves, or distribution plate. The pump shall purge the intake line before and after each sample. The duration of the purge shall be automatically adjusted for varying intake line lengths. The pump tubing shall have a minimum inside diameter of 3/8".

All electromechanical components shall be protected from humidity and corrosive gases within a sealed, injection molded ABS plastic housing conforming to NEMA 4X,6 standards for submersible, water tight, dust tight, corrosion and ice resistant operation. All receptacles shall be sealed and shall not require capping to be water tight. The electronics housing shall contain silica gel desiccant and shall incorporate an indicator for relative humidity within the controller housing.

The controller shall have a hermetically sealed 21 key multiple function key pad and self prompting 8 line by 40 character liquid crystal graphics display. The controller shall be capable of storing up to five complete sampling programs/routines in memory. A software program lock shall be provided to prevent

tampering by unauthorized personnel. The sampler shall incorporate a solid state real time clock which indicates time and date. The program shall include a delay function. The delay format shall be selectable as real time/date, or time/day of week.

The display shall provide program status including the time/date the program started, minutes or flow pulses remaining until the next sample, bottle number, and a review of all program settings. The display shall also indicate all logged data in both tabular and graphical formats.

The controller shall have an RS232 serial interface for transfer of all logged data to an IBM/compatible PC. Serial port data transfer rate shall be at least 19,200 baud. The base memory shall hold up to 18,000 data values.

B. Sampling. For timed interval sampling, the interval between samples shall be adjustable in one minute increments from 1 to 9,999 minutes. In the flow mode, the interval shall be adjustable in one pulse increments from 1 to 9,999 flow pulses.

The sample volume shall be set directly in milliliters. The controller shall have two non-contact liquid sensors whereby pump flow rate is determined with each collection cycle. The pumping time shall be automatically adjusted for repeatable sample volume with changing suction lifts. To prevent overflow, the controller shall automatically reject program entries for sample volume and the number of samples per bottle, the combination of which would exceed the container volume. With any rejected entry, the controller shall compute and display the closest acceptable entry.

The program shall be capable of assigning any number of bottles as "trouble bottles". In the event a measured parameter (pH, temperature, dissolved oxygen, level, flow rate, etc.) falls outside the user selectable limit, the distributor will advance to the assigned trouble bottle(s) and deposit a sample. The "trouble sample" volume shall be selectable independent of the normal program sample volume. A history log of all measured parameters and the time/dates of all collected normal and trouble samples shall be stored in the sampler solid state memory.

The sampler shall be capable of rinsing the intake line with the source liquid immediately prior to sample collection. If enabled, the program shall accommodate up to three rinses. Also if enabled, the sampler shall be capable of initiating up to three sample collection retries in the event the sample is not successfully collected on the initial cycle. The time/date of any missed samples shall be logged in memory and indicated during the program review. The sampler shall be capable of collecting a manually initiated sample, independent of the program in progress.

To permit sampling during specific periods (work shifts, long weekends, etc.), the sampler shall be programmable for up to 12 start/stop intervals. The sampler shall also have the capability for entering up to 99 independent intervals between samples.

The sample container(s) shall be located in a refrigerated compartment. The refrigerator shall have front ventilation for zero clearance installation. The compartment shall be insulated with 1.5" rigid foam with a food grade ABS plastic interior. The cabinet shall be constructed of grade 304 stainless steel. The refrigeration system shall have a 120 CFM condenser fan and the compartment temperature shall be maintained at 4 degrees C in ambient temperatures up to 120 degrees F. The refrigerator door shall have a magnetic gasket seal. All refrigeration components and copper plumbing shall be coated with a phenolic resin coating for corrosion resistance.

As a further precaution to prevent over flow, the sampler shall be equipped with an automatic full bottle shut off switch.

The sampler shall be equipped with an integral ultrasonic open channel flow meter. The sampler shall be capable of collecting samples at time intervals independent of flow measuring/logging, and shall also be capable of collecting flow proportional samples when paced by the integral flow meter. The flow

interval between samples shall be user selectable and the flow units shall include gallons, liters, cubic meters, acre feet, and cubic feet.

The sampler shall have an optically isolated 4-20 mA output. The output shall be field assignable to level, flow rate, or other measured value.

2.2 Parts

The following items shall be provided in the quantities indicated:

- (2) 6 Gallon Polyethylene Container with Cap
- (2) 3/8" x 25 feet Vinyl Intake Tubing
- (2) Strainer, Teflon/Stainless Steel, for 3/8" ID Intake Tubing
- (2) Permanent, Nonadjustable Mounting Bracket for ultra sonic sensor (suitable for wall mounting)

PART 3. EXECUTION

3.1 Installation

A. Install sewage sampling devices in accordance with contract drawings, and manufacturer's shop drawings and instructions.

3.2 Manufacturer's Services

Furnish the services of an experienced and qualified manufacturer's representative for supervision of equipment installation, system startup and operational adjustment.

End of Section

SECTION 11821 - SLUDGE DRYING BED MEDIA

PART 1. GENERAL

1.1 Work Included

Sludge drying bed media shall be furnished and installed. The media shall be Wedgewater Filter Bed System as manufactured by Gravity Flow Systems, Inc., or Microwedge Sludge Dewatering Block, as manufactured by Roberts Water Technologies, Inc., or approved equal.

PART 2. PRODUCTS

2.1 Media

The filter media shall consist of interlocking polyurethane panels. Panels shall be protected against UV deterioration. Panels shall measure 2" high by 12" by 12". Panels shall have sufficient structure to support 125 psi live load. Panels shall be designed to withstand an approximate gross vehicle weight of 4,000 pounds. The panels shall have a solid area of 88% formed by the molding of triangular cross-sections measuring 0.105" wide by 0.170" high tapered at 13 degrees per side. The triangular sections shall be separated by an open area of 12% consisting of 0.015" wide and 1.00" long slots. Panels shall incorporate male and female dovetails for interlocking and shall be designed to allow any panel to be removed without disturbing adjacent panels.

PART 3. EXECUTION

3.1 Installation

Install the plates in as shown on the drawings and in accordance with manufacturer's instructions.

End of Section

SECTION 11540
POLYMER FEED SYSTEM SPECIFICATIONS

PART 1 GENERAL

1.01 DESCRIPTION

- A. The polymer system shall be the standard equipment of the supplier involved in the manufacture of similar type equipment and shall be the Dynablend™ MODEL L12S-12000-P60-A-I3 as manufactured by UGSI Chemical Feed, Inc. or qual.
- B. Equipment included with the polymer system includes:
 - 1. Hydraulic mixing chamber.
 - 2. Primary water controls. Post dilution water controls if applicable per manufacturers design.
 - 3. Neat polymer pump
 - 4. System Controls
- C. The polymer system shall be a skid mounted system with interconnecting piping and wiring complete within skid limits.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Non-Mechanical Hydrodynamic Multi-Zone Mixing Chamber:

Non-Mechanical Mixing Chamber

- 1. A non-mechanical hydrodynamic blending mechanism specifically designed to dilute and activate emulsion, dispersion and solution type polymer with viscosities up to 75,000 cps. and active contents up to 75%, shall be provided. Systems without a proven track record with all types of polymers described above will not be considered.
- 2. The moment of initial polymer wetting shall be a 70 feet/second water jet that is normal to the point of polymer mix chamber entry to maximize mixing energy. Chamber designs that do not minimize the distance of the water jet to the polymer inlet or where the water jet strikes the polymer at an angle less than 90° shall not be considered equal.

3. The volume of the mixing chamber shall be a minimum of 15 gallons to provide sufficient residence time for activating and hydrating polymer.
4. The liquid polymer activation chamber's mixing energy shall be staged such that it provides for high, non-damaging mixing energy over the full operating range of the system which then dissipates through concentric chambers. The integral water control device, which shall also produce mixing energy by creating a pressure drop across its orifice, shall be constructed of stainless steel and shall be designed to allow orifice replacement without disassembly of any other part of the system. The system shall be designed for use with either potable or non-potable dilution water. Chlorine residuals shall not exceed 3 ppm.
5. A mixing chamber drain valve with 1/2" fitting shall be provided and plumbed to the nearest floor drain. The mixing chamber shall have a maximum rated pressure of 150 psi.
6. Provide a bronze, adjustable-range pressure relief valve on mixing chamber with a range of 50 to 175 psi.
7. Provide a neat polymer check valve specifically designed to isolate neat polymer from dilution water. The valve shall be designed with an open, unobstructed path to the valve seat. The valve body shall be constructed of PVC or stainless steel and the ball shall be stainless steel. The valve shall be readily accessible for cleaning and shall be easily disassembled. Conventional check valves, and or check valves that are installed inside the mixing chamber, or which require mixing chamber disassembly for servicing will not be accepted.

B. Dilution Water Control

1. The dilution water flow rate shall be monitored by a Rotameter type flow meter. Unions shall be provided on the inlet and outlet of the Rotameter to allow easy removal for cleaning.
 - a. Rotameter accuracy shall be 4% of full scale flow.
 - b. Materials of Construction:
 - Metering Tube: Machined Cast Acrylic
 - Internal Components: 316L Stainless Steel
 - Fitting: PVC
 - Elastomers: Buna-N
2. Unit shall have a motor operated PVC ball valve for on/off control of total dilution water flow.
3. The dilution water flow rate shall be manually adjusted through a flow control valve connected directly to the mixing chamber. Valve shall be constructed of SS body, SS needle, and SS seat.

4. Dilution water differential pressure shall be monitored by an industrial duty differential pressure switch rated NEMA 4X with a range of 0-90 psig. Pressure switches with plastic construction or fittings and mechanically actuated flow switches shall not be acceptable. Differential pressure switch shall be United Electric or equal

C. Pump

1. Unit shall have a neat polymer metering pump.
 - a. Pump shall be positive displacement, progressing cavity type.
 - b. Rotor shall be 316 stainless steel.
 - c. Stator shall be Viton.
 - d. Pump shall have mechanical or packing seals. Rotor speed shall not exceed 500 rpm.
2. Pump shall be driven by a 1 HP, TEFC totally enclosed, AC or 90 V DC motor.
 - a. Variable speed shall be provided by a VFD or SCR controller.
 - b. Motor shall be direct-coupled to a gear reducer.
 - c. Pump shall be direct-coupled to gear reducer.
3. For systems not having a pressure relief valve on the mixing chamber, the pump shall include a pressure relief valve located on the discharge side of the pump and piped to the pump suction. Pressure relief valve shall be PVC construction with Viton seals.
4. A suitably-sized calibration cylinder shall be mounted to the frame with PVC isolation ball valves. Cylinder shall be calibrated in mL and GPH sized for a 1-minute drawdown and be constructed of clear PVC with slip on cap and ½ inch NPT vent connection.

D. Controls

1. System shall be supplied with a NEMA 4X control enclosure. Unit shall be powered through an on-off-remote circuit controlled by a three-position switch.
 - a. In the remote switch position, the unit shall accept a run signal.
 - b. Unit is manually powered in the on position.
2. System Running indicator:
3. A VFD or SCR shall be supplied to vary pump speed:
 - a. VFD Pump Controls
 - i. A keypad shall be mounted on the motor control enclosure for VFD control and display.
 - ii. VFD shall accept 4-20 mA input signal to vary pump speed in automatic mode.

- iii. Up/Down arrows shall control motor speed in manual mode.
 - b. SCR Pump Controls
 - i. Input Voltage: 115/230 VAC
 - ii. Output Voltage: 0-90 VDC or 0-180 VDC
 - iii. HP Rating: 1/8-1 @ 90 VDC, 1/4-2 @ 180 VDC
 - iv. Signal Input: 4-20mA or 0-10VDC, selectable
 - v. 3% linearity through 60:1 speed range
 - vi. LED display of pump speed, 0-100%
- 4. Unit shall accept a 4-20 mA analog signal to pace the polymer metering pump.
 - a. The controller shall also have manual motor speed control via a 10-turn potentiometer or touchpad.
- 5. Unit shall detect loss of water flow, sensing that water flow has been interrupted for any reason, will place the polymer pump and mix chamber on standby and will restart it automatically when flow is restored.
- 6. An integral timer shall monitor loss of flow and energize contacts indicating alarm after 15 seconds of continuous loss.

2.02 TECHNICAL DATA

A. Connections – Plumbing

- 1. Hydraulic Activation Equipment
 - i. Dilution water inlet, 3" FNPT
 - ii. Neat polymer inlet, 1" FNPT
 - iii. Solution discharge, 3" FNPT

B. Connections – Electrical

- 1. Door mounted rotary disconnect switch – 120 / 1 / 60, 15 Amps.
- 2. Terminal blocks – 4-20 mA signal input
- 3. Terminal blocks – dry contact input for remote start
- 4. Terminal blocks – dry contact alarm output
- 5. Terminal blocks – dry contact run output

C. Dimensions

- 1. Frame:
 - a. 44" wide x 36" deep x 68" high

- b.
- D. Materials of Construction
 - 1. Structural frame – 304 stainless steel
 - 2. Plumbing – PVC, nylon, stainless steel
 - 2. Mixing chamber –Type B Stainless Steel
- E. Performance
 - 1. Dilution water – 2,100 – 21,000 gph.
 - 2. Metering pump – 11 - 110 gph

PART 3 EXECUTION

3.01 INSTALLATION

- A. The equipment shall be installed per the contract documents and manufacturer's recommendations.

3.02 WARRANTY

- A. The standard warranty extends for a period of twelve (12) months from the date of start-up by an authorized UGSI technician or eighteen (18) months from the date of shipment, whichever occurs first.
- B. Stainless-steel mixing chamber shall be covered by a *LIFETIME* warranty covering the repair or replacement of the mixing chamber or any part of the mixing chamber which fails for any reason, excluding weather related or over-pressure failures. In addition, the stainless-steel mixing chamber shall be warranted against plugging for any reason. If plugging occurs the stainless-steel mixing chamber shall be repaired or replaced at no cost to the owner.
- C. Damage due to makeup water particulates will not be considered as a warranty defect and will be the responsibility of the owner.

PART 4 OPTIONAL ACCESSORIES

- A. A neat polymer thermal loss of flow switch shall be supplied on the discharge of the neat polymer metering pump to detect absence of polymer flow. Thermal flow switch assembly shall include sensor, flow block and controls including panel mounted alarm indicator and manual reset pushbutton. Alarm output contacts shall be supplied for the plant control system after adjustable time delay. Neat polymer flow must be greater than 0.25 gph for switch to function.

- B. Spare parts kit: Spare parts kit shall include mechanical seal (if required by manufacturer), mixing chamber o-rings, injection check valve, and pump stator.

SECTION 15010 - BASIC MECHANICAL REQUIREMENTS

PART 1. GENERAL

1.1 Work Included

A. The Instructions to Bidders, General and Special Conditions and all other Contract Documents apply to these branches of work as well as to all other branches. The Mechanical Contractor(s) shall be governed by any alternate and unit prices called for in the Form of Proposal insofar as they affect his part of the work.

B. The work in this section shall include all labor, materials, equipment and services required to construct and install the complete and operable mechanical systems. The omissions of express reference to any parts or work necessary for or reasonably incidental to a complete installation shall not be construed as releasing the Contractor from providing such parts or work as may be required.

1.2 Coordination Between Trades

Each Contractor is expressly directed to read the General Conditions and all detailed sections, etc., of these specifications for all other trades and to study all drawings applicable to his work including Architectural and Structural Drawings, to the end that complete coordination between trades will be affected. Special attention shall be given to points where ducts or piping must cross other ducts or piping, where lighting fixtures must be recessed in ceilings, and where ducts, piping and conduit must fit into walls and columns. It shall be the responsibility of each Contractor to leave the necessary room for other trades. No extra compensation will be allowed to cover the cost of removing piping, conduit, ducts, etc., or equipment found encroaching on space required by others.

1.3 Substitution of Materials and Equipment

A. When a Contractor requests approval of substitute materials or equipment, and also when under formal alternate proposal, it shall be understood and agreed that such substitution, if approved, will be made without cost to the Owner, regardless of change in connections, spacing electrical service, etc. In all cases where substitutions affect other trades, the Contractor offering substitutions shall remunerate all affected Contractors for all necessary changes in work.

B. Notwithstanding any reference in the specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; and the individual Contractor, in such cases may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Engineer expressed in writing is equal to that specified.

1.4 Substitution

A. Each Contractor shall personally supervise the work or have a competent superintendent, satisfactory to the Engineer and Owner, on the work at all times during progress with full authority to act for him. Each Contractor shall lay out his work and be responsible for all necessary lines, levels, elevations and measurements. He must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from his failure to do so. All work at the site of the project shall be observed by the Engineer.

1.5 Materials and Workmanship

A. All equipment, materials, and articles incorporated in the work shall be new and of comparable quality as specified. All workmanship shall be first-class and shall be performed by mechanics skilled and regularly employed in their respective trades. The Contractor(s) shall determine that equipment he

proposed to furnish can be brought into building and installed in space available. Install equipment so all parts are readily accessible for inspection and maintenance. Extra compensation will not be allowed for dismantling equipment to obtain entrance into building.

B. Material shall bear Underwriters label where such standard has been established and listed by Underwriter's Laboratories, Inc.

1.6 Protection of Equipment and Materials

A. Each Contractor shall provide suitable protection from dampness, damage, dirt, etc., for all equipment and materials during construction until final acceptance by Owner. Such protection shall be by a means acceptable to the Engineer and as may be specified under other sections of these specifications. All rough-in soil, waste, vent and storm piping, shall be properly plugged or capped in a manner approved by the Engineer.

1.7 Shop Drawings

A. In accordance with the Special Conditions, the Contractor shall submit to the Engineer, within thirty days after the date of the contract, one bound and labeled package containing the stipulated minimum sets of Shop Drawings and manufacturer's descriptive literature. The Shop Drawings shall have the proper notation indicated on them and shall be clearly referenced to the specifications, schedules, fixture numbers, etc., so that the Engineer may readily determine the particular item the Contractor proposes to furnish. All data and information scheduled, noted or specified shall be noted on the submittals. The Contractor shall make any corrections or changes required and shall re-submit for final approval as outlined above. Approval of such drawings, descriptive literature or schedules shall not relieve the Contractor from responsibility of deviation from drawings or specifications unless they have, in writing, directed the Engineer's attention to such deviations at the time of submission of drawings, descriptive literature and schedules. The term "as specified" will not be acceptable as Shop Drawings must be submitted on all equipment.

1.8 Cutting, Patching and Repairing

Do all cutting, patching and repairing required for the installation of the mechanical work with personnel skilled in the trade involved. Accurately locate all chases, sleeves, inserts for hangers, supports and fastenings in advance of new construction so as to avoid needless cutting. Structural members shall not be cut without prior written approval of the Engineer.

1.9 Ceiling, Wall and Floor Plates (Escutcheons)

Provide cover plates where piping or raceways pass through floor, ceilings or walls and are exposed in finished rooms. Flanges are to fit snugly and be sized to cover the openings, including insulation where pipes are covered. All escutcheons shall be chromium plated wing type. Unless otherwise indicated, plates shall be Ritter Beaton and Cadwell, Carpenter and Patterson, Elcen, Fee and Mason, or equal and similar to Ritter No. 3A or No. 36A for piping and Carpenter and Patterson No. 182 for hanger rods. Hanger rods in finished ceilings will be provided with chromium plated plates or rod ceiling buttons.

1.10 Cleaning

A. The Contractor(s) shall at all times keep the construction site and the surrounding areas presentable to the public, clean of rubbish caused by the Contractor's operations; and at the completion of the work shall remove all the rubbish, all of his tools, equipment, temporary work and surplus materials, from and about the premises, and shall leave the work clean and ready for use. If the Contractor does not attend to such cleaning immediately upon request, the Owner may cause cleaning to be by others and charge the cost of the same to the Contractor. This Contractor will be responsible for all damage from fire which originates in, or is propagated by, accumulations of rubbish or debris from his work.

B. After completion of all work and before final acceptance of the work, each Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of piping, equipment and all associated fabrication.

1.11 Operating and Maintenance Instructions

The Contractor(s) shall deliver to the Engineer three copies of the complete operating and maintenance instructions for the equipment furnished and installed by him.

1.12 Guarantee

The Contractor(s) shall guarantee all equipment, apparatus, materials, and workmanship entering into this contract to be the best of its respective kind and shall replace all parts at his own expense, which have been proven defective within one year from final acceptance of the work by the Engineer. Items of equipment which may have longer guarantees such as clarifiers, pumps, etc., shall have warranties and guarantees completed, in order, and in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Owner with such warranties and guarantees at the time of final acceptance of the work. Date of acceptance shall be date of voucher for final payment. Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Use of equipment by Owner shall in no way invalidate guarantee except that Owner shall be liable for any damage to equipment during this period due to negligence of his operator or other employees.

1.13 Testing and Balancing

A. All fans, motors, pump bearings, etc. shall be checked and lubricated as required. All automatic, pressure regulating and control valves shall be adjusted. Excessive noise or vibration shall be eliminated.

B. All fan speeds shall be adjusted as well as diffusers, supply and exhaust registers to obtain the design quantities indicated on the Drawings. The balance of the systems shall be performed by persons skilled in this work. The systems will be balanced as often as is deemed necessary to obtain proper results.

PART 2. PRODUCTS

Not Used

PART 3. EXECUTION

Not Used

End of Section

SECTION 16010 - BASIC ELECTRICAL REQUIREMENTS

PART 1. GENERAL

1.1 Work Included

This section includes all necessary materials, tools, labor, equipment and related items required to install a complete and fully operable wiring system as indicated on the drawings and including, but not limited to, the enumerated list below and according to specifications hereinafter included. All outlets, fixtures and equipment shall be fully connected to proper sources or current supply and left ready for use.

Equipment and/or systems included within the scope of these specifications include the following:

Motor Controllers/Control Center

Branch circuit panelboards

Conduit, raceway systems for power, control telephone, and lighting systems.

Wiring devices, their installation and connection.

Lighting

Fuses

Disconnects

Wiring - Plant Control System

1.2 General Requirements

A. Drawings. It will be noted that the plans are generally diagrammatic and the actual final locations of wiring extensions and outlets are subject to building and structural conditions; therefore, the Contractor shall familiarize himself with other trades engaged in the general construction. The Engineer reserves the right to make minor changes in outlet locations any time prior to roughing-in of the electrical work without incurring any additional cost. The Contractor is advised that the "General Conditions" included elsewhere in these specifications are governing and cover areas of jurisdiction errors and omissions, and conflicts addenda, change orders, etc.

B. Grounding. The entire wiring system shall be grounded in accordance with the rules of the National Electrical Code, Article 250 and as specifically noted on the drawings.

C. Tests. Following completion of all wiring installation, test the individual systems and eliminate any existing grounding of potential conductors, short circuits, other faults, etc. At the time of testing, all feeders, branches, panels and outlets shall be connected and the wiring system complete from points of service connection. Test insulation resistance of systems.

All panels shall be provided with ground buss.

1.3 Submittals

Shop drawings shall be submitted prior to equipment shipment for all equipment as follows:

Lighting Fixtures - Submit descriptive literature, voltage, finish.

Motor Control Center - Submit line diagram, specifications, equipment schedule and dimensions.

Branch Circuit Panels - Submit breaker data, breaker schedule.

Fuses - Submit time-current characteristic curves and peak let-thru charts for each size and type fuse specified. Time-current curves shall indicate the full band from minimum melting time to total clearing time. Average total clearing time-current characteristic curves alone shall not be acceptable.

Wiring Devices - Submit complete list indicating manufacturer, voltage/ampere characteristics and color. Include finish and type for all wiring device cover plates.

Included shall be any additional information required by the individual subsections.

Operating Instructions - Provide instructions and operation manuals for each system as follows:

Give complete oral and printed instructions to operating personnel, who will verify to Engineer that they are fully aware of operation of equipment.

Furnish three (3) bound copies of Operation and Service Manual for each system to Engineer. Submit manuals for approval and make all corrections. Include operating instructions, wiring and schematic diagrams of equipment, one-line diagram of system, complete servicing data, part numbers and voltage charts, including internal wiring diagrams of component equipment. Instructions shall also include manufacturer's recommended maintenance schedule.

1.4 Coordination

Cooperate with other trades to obtain most practical arrangement of work.

Make known to other trades intended positioning of materials and equipment and intended order of work. Coordinate work with other trades and proceed with installation to assure no delays to other trades. Determine intended locations of work of other trades and intended order of installation.

Examine drawings and specifications of all trades and determine exact locations and sizes of equipment, roughing-in requirements and equipment to be connected.

Agree to most practical arrangement of all work within requirements of contract and consult with Engineer when there are reasons for deviations from drawings or specifications, difference of opinion between contractors, or questions as to intent of drawings or specifications.

1.5 Identification

Equipment, disconnect switches, motor starters, pushbutton stations, panels, switchgear, and similar equipment shall be clearly marked. Size of lettering and marking shall be hereinafter specified.

All branch circuit distribution panels shall be marked with engraved lamacoid plates, giving panel designation in one-half inch letters and voltage in one-quarter inch letters centered above door on exterior trim. Mark equipment mounted remotely from source of power with equipment number, source of power and starter locations. Where starters re remotely mounted, marking shall include equipment name, number and location.

Provide typewritten directories in panels and where otherwise required with clear plastic protection shields mounted in card holders.

All marking shall be engraved lamacoid plates. Attach each plate with nuts and bolts. Align plates on equipment being marked in center near top.

PART 2. PRODUCTS

Not used

PART 3. EXECUTION

3.1 Concrete Work

Provide four-inch high steel reinforced concrete pads under floor mounted electrical equipment.

Concrete pads and foundations shall have one-half inch diameter reinforcing rods on eight-inch centers in both directions. Set rods approximately three inches from surface. concrete surface troweled smooth, exposed edges shall have three-quarter inches chamfer.

3.2 Cutting

Provide necessary cutting to install work to correct faulty work and inaccurate installations.

Do no more cutting than necessary. Cutting of structural members shall not be allowed. Cut all conduit openings in concrete slabs with core drill.

3.3 Cleaning, Testing and Adjusting

Clean all equipment and conduit systems.

All systems shall be tested under normal operating conditions and it must be demonstrated that all parts are functioning properly.

Test complete electric system for grounds and short circuit before final acceptance in accordance with Code and Utility Company requirements.

3.4 Debris

Remove dirt, boxes, cartons, paper and other debris from premises and maintain in a clean and orderly condition at all times.

3.5 Keys

Provide three (3) sets of keys for each key operated device furnished under this division. Equipment of same kind shall be keyed alike.

Mark keys with tags and deliver to Owner.

3.6 Guarantee

The Contractor shall guarantee all labor and materials entering into contract for a period of one (1) year from date of acceptance. Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance and use of equipment by Owner in no way invalidates guarantee except the Owner shall be liable for any damage to equipment during this period due to negligence of his operator or other employees.

End of Section

SECTION 16045 - ELECTRICAL RELATED WORK

PART 1. GENERAL

1.1 Work Included

The Contractor shall furnish all required materials and equipment, and perform all work required to install a complete and approved installation.

The Contractor shall furnish all labor, materials, equipment and apparatus for the complete installation of the electrical work as shown on the Drawings and specified herein as follows:

Furnish and install all conduits, wires and cables, grounds disconnects (including final connections) to all equipment, such as motor starters.

Furnish and install underground and overhead services to exterior equipment.

Furnish and install flood lighting and area lighting equipment on the exterior.

Furnish and install control panel, circuitry and all automatic controls as hereinafter specified.

Furnish and install motor starters, alternators and remote controls.

Furnish all labor and equipment for test required by the Architect/Engineer.

1.2 Drawings

Where details are not given, the drawings are diagrammatic and shall be varied in detail as conditions require, without additional cost to the Owner but only as approved by the Architect/Engineer. Where discrepancies arise between the plans and specifications, the specifications shall supersede the plans for items included in this section. The make, type and finish of all materials and equipment, together with wiring diagrams, must be approved by the Architect/Engineer before the Contractor orders same from the manufacturer, and the Contractor shall submit five (5) copies of working drawings of all equipment to the Architect/Engineer for approval before installation. In addition, before starting the work, the Contractor shall furnish to the Architect/Engineer for approval, three (3) copies of a complete list of materials he proposes to use in the work. Each item shall be numbered and shall contain such information as makes, manufacturer, catalog numbers, descriptive literature, photographs, and samples, if required by the Architect/Engineer. The Architect/Engineer's approval of such drawings, descriptive literature and/or schedules shall not relieve the Contractor from responsibility for deviation from the drawings and specifications, unless he has, in writing, called the Architect/Engineer's attention to such deviation at the time of submission of the drawings, descriptive literature and schedules, nor shall it relieve him from responsibility for errors of any sort in shop drawings, descriptive literature and/or schedules.

1.3 Permits, Codes, Inspection and Approvals

A. Permits. The Contractor shall arrange for and acquire at his own expense all permits certificates of inspection, etc., as may be required by any authority having jurisdiction.

B. Codes. The installation shall comply with all laws applying to electrical installation in effect, and with the regulations of the National Electrical Code where such regulations do not conflict with the laws in effect.

C. Inspection. Inspection shall be for both rough and finished work. The Contractor shall notify the inspector immediately upon the start of the work and a copy of the notification shall be sent to the Architect/Engineer.

Approval. All materials used, and all workmanship of every kind and description entering into any and all of the work described in these specifications and/or shown on the contract drawings must conform with the National Electrical Code and the requirements of the local Inspection Bureau and the Utility as well as all other authorities having jurisdiction. After the Architect/Engineer's approval of all work and materials, final approval and payment for work included in these specifications and the contract drawings will not be made until a final certificate of inspection and approval has been issued by the local Inspection Bureau and/or all authorities having jurisdiction.

It shall be the Contractor's duty to arrange for inspections by other authorities.

After completion of the work, there shall be furnished to the Owner, a certificate of final approval in three (3) copies, from the inspection bureau having jurisdiction pursuant to all electrical work. Any costs in connection with the furnishing of certificates of final inspection shall be paid by the Contractor.

The Contractor shall make all necessary arrangements with the Utility and the Owner to insure that the work may proceed when required, and so shall arrange the service entrances as to be satisfactory to and have the approval of the Utility and the Owner.

1.4 Safety

The Contractor shall be aware of current standard safety practices and shall use tools and equipment which are in good operating conditions. All applicable State and Federal Occupation Safety and Health Act requirements shall be met. All temporary connections shall be in strict accordance with the NEC and shall be utilized only when absolutely necessary.

1.5 Standards

All materials used shall at least meet the minimum standards established by the NEC and/or Underwriters Laboratories, Inc., wherever applicable. All materials used shall be approved by the Architect/Engineer prior to being purchased and/or installed by the Contractor. Equipment tests shall be submitted as called for in these specifications for the Architect/Engineer's approval. All equipment shall be subject to field testing and conform to at least the minimum conditions specified. Failure to meet these minimum conditions will be cause for removal of said equipment from the job. Materials used throughout, except when otherwise specified or noted on the drawings, shall be new and the best of respective kind. No substitute other than those specified shall be used, unless approved by the Architect/Engineer. All work shall be executed with a maximum speed consistent with safety and good workmanship.

1.6 Equivalent Materials

In certain instances, the material and equipment described herein has been specified according to a particular trade name or make. However, the Contractor has the right to substitute other material and equipment in lieu of that specified, providing such material and equipment meets all of the requirements of those specified and is approved by the Architect/Engineer. Proof of "equality" shall lie with the Contractor.

1.7 Handling

All work, equipment, and materials shall be protected against dirt, water, or other injury during the period of construction. Sensitive electrical equipment such as motor starters, controls and panelboards delivered to the job site, shall be protected against injury or corrosion due to atmospheric conditions or physical damage by other means. Protection is interpreted to mean that equipment shall be stored under roof, in a structure properly heated in cold weather and ventilated in hot weather. The stored equipment shall be inspected periodically and if it is found that the protection is inadequate, further protective measures shall be employed.

Electrical equipment other than gang boxes and conduit shall not be installed in a new structure until the structure is under roof with doors and windows installed. Only equipment which has been properly protected shall be incorporated into the work. Equipment which shows signs of damage resulting from any cause whatever shall be rejected and if installed shall be removed and replaced without additional cost to the Owner. In addition, no light fixtures or device plates shall be hung or installed until after painting is completed, however, temporary lighting shall be provided by the Contractor.

1.8 Errors or Omissions

Necessary changes or revisions in electrical work to meet any code or power company requirements shall be made by the Contractor without additional charge.

Should pump suppliers furnish a motor size larger than shown on the plans, it will be the responsibility of the Contractor to furnish the proper size wire, conduit, and control equipment at no extra cost to the Owner.

It is the intent of these specifications to provide for an electrical system installation complete in every respect, to operate in the manner and under conditions as shown on the drawings or in the specifications. The Contractor shall notify the Architect/Engineer, in writing, of any omission or error before bidding the work. In the event of the Contractor's failure to give such notice, he shall be required to correct work and/or furnish items omitted without additional cost.

1.9 Services By Manufacturers

After the installation of automatic control equipment has been completed, service Architect/Engineer of the manufacturers of such equipment shall be present for the necessary length of time to supervise its adjustment and to instruct the operating personnel in making said adjustment and in the proper use of the equipment.

1.10 Temporary Power

The Contractor shall be responsible for obtaining temporary power service for use during construction. The Contractor shall pay all power bills for current used in the completion of the project. Owner shall be responsible for owner bills after acceptance of the project and after the meter account is transferred from Contractor to Owner. However, Owner may require payment for current used by the Contractor to make corrections during the guarantee period.

1.11 Underground Conduit

Excavation for conduits shall be of sufficient width to allow for proper jointing and alignment of the type conduit used. Minimum cover over conduits shall be 24 inches. Conduit shall be bedded on original ground.

Where conduit is in solid rock, a 6-inch earth cushion must be provided. Trench depth in this case shall be 24 inches. Conduits shall be laid in straight lines between pull boxes and/or structures unless otherwise noted on the plans. The cost of solid rock excavation shall be included in the lump sum bid for the structure to which this work is subsidiary with no extra pay allowed.

Backfill shall be hand placed, loose granular earth for a height of 6 inches over the top of the largest conduit. This material shall be free of rocks over 2 inches in size. Above this, large rocks may be included but must be mixed with sufficient earth to fill all voids.

Underground conduit shall be SCH 40 PVC or approved equal, and shall so be laid as to be self draining. Conduit shall be minimum of 1" diameter.

1.12 Sleeves and Chases

Sleeves shall be required at all points where exposed conduits pass through concrete walls, slabs or masonry walls. Installation of conduits shall be as detailed in the Standard Details and in these Specifications. Sleeves installed below grade or where subject to high water conditions shall be installed water tight.

Wiring chases shall be provided where shown on the drawings. The Contractor shall have the option of installing chases below panelboards provided all structural requirements are met. During the construction of all walls or partitions the Contractor shall set all supports and make all provisions for work or devices located in these walls.

It is the Contractor's responsibility to leave openings to allow installation of the complete, operational electrical system. Openings required but not left shall be installed by cutting and patching. Cutting and patching shall be held to an absolute minimum and such work shall be done only under the direction of the Architect/Engineer or the Owner. The Contractor shall be responsible for and shall pay for all openings that may be required in the walls, and he shall be responsible for putting said walls back in their original condition.

1.13 Wiring

Voltage, phase, and number of wires shall be made with approved pressure connectors. After connection has been made, all taps and splices shall be protected with approved moisture resistant tape. All splices shall be made in accordance with conductor manufacturer's recommendations.

Protective devices shall be of the size and type shown on the plans and in accordance with good practice. Grounding shall utilize the metallic water pipe system. The ground system shall be continuous with all structures on a common ground. This can be accomplished by bonding all conduits together and bonding to the ground but at each motor control center. Bonding jumpers shall be stranded copper wire. Jumpers shall be required at all pull boxes.

Ground resistance between round and absolute earth shall not exceed 3 ohm. Ground resistance shall be measured in the presence of the Architect/Engineer before equipment is placed into operation. Resistance shall be measured at each panelboard, control center and large motor (15 horsepower and over).

All wire and cable shall conform to the latest requirements of the current edition of the NEC and shall meet all ASTM specifications. Wire and cable shall be new; shall have size, grade of installation, voltage and manufacturer's name permanently marked on the outer covering at regular intervals. Wire and cable shall be as manufactured by the Anaconda Wire and Cable Company, or equal.

Wire and cable shall be suitably protected from weather and damage during storage and handling and shall be in first class condition when installed. Conductors shall be soft drawn copper with Type THHN insulation. Conductor shall be stranded. Wire shall be factory color coded for each phase and neutral. Green color coding is required for the NEC for conductors used for grounding.

No conductor shall be drawn into conduits until all work which may cause cable is completed. Only approved cable lubricants shall be used.

The ampacity of all power feeders shall be such that when fully loaded, the loss of potential shall in no case exceed 5 per cent (5%) from the service drop to any motor. Power wiring and conduits shall not be of less size than indicated on the drawings. For lighting and small motor, or similar single phase circuits, the loss of potential shall not exceed three per cent (3%).

Conduit work shall be all exposed unless otherwise noted. No open wiring shall be allowed.

Exposed conduit may be aluminum or rigid steel providing the requirements as outlined under these specifications are followed. Minimum conduit size shall be 3/4 inch.

To provide for drainage of accumulated moisture in raceways, conduit runs, junction boxes, outlet boxes, enclosures, etc., the Contractor shall drill a 1/8" diameter hole at the lower end of vertical risers, and/or at the lowest surface of the lowest junction box, outlet, enclosure, etc.

Conduits shall be securely fastened to all sheet metal outlets, junction and pull boxes with double galvanized locknuts and insulating bushings. Conduit crossings in insulating roof fill will require both conduits to be secured to the roof deck, and these crossings can only be made where the insulating fill is a minimum of 3 inches deep. runs of exposed conduit shall be securely braced, capped (wooden plugs are prohibited), and fastened to the forms to prevent dislodgment during vibration and pouring of concrete. During construction, all conduit work shall be protected to prevent lodgment of dirt, plaster or trash in conduits, fittings or boxes. Conduits which have been plugged shall be entirely freed of accumulations or be replaced. All conduits in floors or below grade shall be swabbed free of debris and moisture before wires are pulled. Crushed or deformed conduit shall not be permitted.

1.14 Circuits

All feeders are of the secondary type, below 600 volts. Secondary feeder voltage shall be 208 volts, 3 phase, 3 wire for power and general lighting. The Contractor shall furnish and install all feeders from the distribution panel to each of the other structures as shown on the drawings. Feeders shall be of the type and size as called for herein and/or on the plans or in accordance with good practice and shall be installed in rigid steel conduit. As far as practical, all feeder cables shall be continuous from origin to panel termination without running splices in intermediate pull boxes. All cable terminals taps and splices shall be made with solderless, pressure type connectors. The Contractor shall furnish and install all hangers, racks, cable cleats and supports required to make a neat and substantial installation.

1.15 Equipment Connection

The Contract shall furnish and install all conduit, wire disconnect switches, and miscellaneous material to make all electrical connections to all motors, heaters, thermostats, and other equipment furnished by others, except as otherwise specified.

A. Aluminum conduit shall be extruded from alloy 6063 and shall be the rigid type non-toxic, corrosion resistant and non-staining. It shall carry the Underwriters Laboratory seal of approval. Aluminum conduit shall be Kaiser Aluminum, or equal.

Wire pulling shall be facilitated by the use of a UL approved pulling compound in pulls over 30 feet in length or where there are two or more 90 degrees bends. Only plastic hemp pulling ropes will be permitted.

Special protection of aluminum conduit is required in concrete walls or where it is subjected to excessive moisture. In these cases, conduit shall be painted with zinc chromate paint before placing. Aluminum conduit must be installed in strict accordance with the manufacturer's standards.

Fittings, boxes and accessories used in conjunction with aluminum conduit shall be of the "die-cast, copper free" type. They shall be resistant to both chemical and galvanic corrosion. All covers shall have neoprene gaskets.

B. Rigid steel conduit shall be zinc coated and shall meet in all respects, Underwriters Laboratories, Inc., Standards for Rigid Steel Conduit. The conduit shall be metalized galvanized, electro-galvanized, sheradized, or approved equal. It shall be of the rigid thick wall type.

C. Underground conduit shall be SCH 40 PVC, or approved equal.

D. All conduit shall be installed in a first class workmanship manner.

Fittings or symmetrical bends shall be required wherever right angle turns are made in exposed work. Bends and offsets shall be avoided wherever possible, but where necessary, they shall be made with an approved conduit bending machine. All conduit joints shall be cut square, reamed smooth and drawn up tight. The final section of conduit connection each motor 15 horsepower and smaller, shall be of the flexible type UA, neoprene covered, with fittings to match.

Equipment connections shall be made with flexible or rigid conduit as required. Controllers for motors, disconnect switches, and all control, protective, and signal devices for motor circuits, except where such apparatus is furnished mounted and connected integrally with the motor driven equipment, shall be installed, connected, and left in operating condition. The number and size of conductors between motors and control or protective apparatus shall be as required to obtain the type of operation described in these specifications and/or by the plans and shall meet the requirements of the National Electrical Code.

1.16 Clean-up

Clean-up shall be completed as soon as possible after the electrical installation is complete. All fixtures, outlets, switches, controllers and other electrical equipment shall be free of tags, stickers, etc. All painted equipment shall be left free of scratches or other blemishes, such as splattered paint, blistered paint, etc.

After the wiring system is completed, and at such time as the Architect/Engineer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of this specification. The test shall be performed in the presence of the Architect/Engineer or his authorized representative. The Contractor shall furnish all instruments and personnel required for the tests, as well as the necessary electric power.

Before energizing the system, the Contractor shall check all connections and set all relays and instruments for proper operation. He shall obtain necessary clearances, approvals, and instructions from the serving utility company prior to placing power on the equipment.

Tests shall be performed to show the insulation resistance of any selected circuit or group of circuits selected by the Architect/Engineer.

1.17 Guarantee

The Contractor shall guarantee all work including equipment materials and workmanship. This guarantee shall be against all defects of any of the above and shall run for a period of one (1) year from the date of acceptance of the work, concurrent with the one year guarantee period designated for the general construction contract under which electrical work is performed.

Any defective work, equipment, materials and/or workmanship that develops within the guarantee period, which is not caused by ordinary water or abuse by other persons, shall be replaced by the Contractor without cost to the Owner.

Repair and maintenance for the guarantee period is the responsibility of the Contractor and shall include all repairs and maintenance other than that which is considered as routine. (That is replacement of lamps, oiling, greasing, etc.). The Architect/Engineer shall be the judge of what should be considered as routine maintenance.

PART 2. PRODUCTS

Not Used.

PART 3. EXECUTION

Not Used.

End of Section