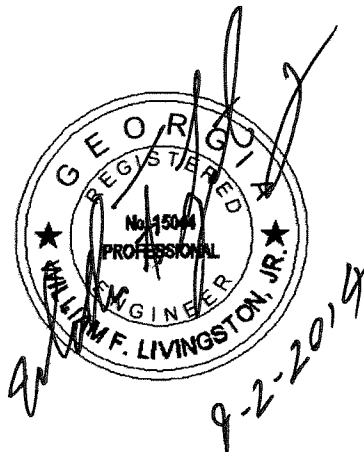


**CHEROKEE COUNTY WATER
& SEWERAGE AUTHORITY
HOLLY SPRINGS DOWNTOWN
SANITARY SEWER SYSTEM**

**CHEROKEE COUNTY WATER
& SEWERAGE AUTHORITY
HOLLY SPRINGS DOWNTOWN
SANITARY SEWER SYSTEM**

OCTOBER, 2014



ATKINS

192 Anderson Street, Suite 150
Marietta, Georgia 30060
Phone: 770-422-1902
Fax: 770-426-5316
Atkins Project No.: 100034005

CCWSA_2014_002-Holly Springs Downtown SS Project

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ADVERTISEMENT FOR BIDDERS

Sealed bids will be received by the **Cherokee County Water & Sewerage Authority**, herein referred to as the Owner, at the main office of the Cherokee County Water and Sewerage Authority located at 140 West Main Street, Canton, Georgia, 30114 until:

Tuesday, October 7, 2014, 10:00 A.M., Local Time

for the furnishing of all materials, labor, tools, skills, equipment and incidentals necessary for the construction of:

HOLLY SPRINGS DOWNTOWN SANITARY SEWER SYSTEM

at which time and place the bids will be publicly opened and read aloud. Bids received after the designated time will not be considered.

The principal items of construction are the following:

Sanitary Sewer Lift Station
100 L.F. 16" Steel Casing 0.250" W.T.
4,455 L.F. 8" Sanitary Sewer Pipe
5,000 L.F. 6" DIP Force Main
33 Each Standard Manholes

Bidders shall inform themselves concerning Georgia Law and comply with same.

Plans, specifications and contract documents are open to public inspection at both the main office of the Cherokee County Water and Sewerage Authority located at 140 West Main Street, Canton, Georgia, 30114, and the office of ATKINS North America located at 192 Anderson Street, Suite 150, Marietta, Georgia, 30060. One contract will be awarded covering all the work. Maximum time for substantial completion shall not exceed 240 consecutive calendar days and maximum time for final completion shall not exceed 270 consecutive calendar days. See Section 00100.7 of the specifications for further time period information.

Plans and contract documents may be obtained by bidders from ATKINS North America, 192 Anderson Street, Suite 150, Marietta, Georgia 30060, upon payment of \$250.00. No Refund. The check or money order shall be made payable to **Atkins North America**. A street address must also be provided to ensure prompt delivery. Only a bid submitted by a Contractor on record with the Design Engineer as having received plans and specifications from the Design Engineer will be opened.

Each bid must be accompanied by a cashier's check or certified check on a duly organized bank made payable to Cherokee County Water and Sewerage Authority or a bidding bond executed by the bidder, and a surety company authorized to transact business in the State of Georgia, in the sum of not less than five percent (5%) of the total amount of the bid.

All bids must be made out on the bid form furnished with the contract documents, in accordance with the instructions in the information for bidders. No interlineations, additions or deletions shall be made in the bid form by the Bidder. The successful bidder will be furnished, free of charge, four (4) sets of plans and contract documents.

No bid may be withdrawn after the scheduled closing time for receiving bids for a period of one hundred twenty (120) days.

These bid documents include a Contractor Qualification Statement and Questionnaire. Contractors must meet minimum qualifications for this construction project. In addition, any subcontractor performing more than 20 percent of the work must also meet minimum qualifications for this project. The Contractor's Qualification Statement and Questionnaire and the Sub contractor's Qualification Statement and Questionnaire, all of which must be fully completed and submitted with the bid, will be used by the Owner and the Engineer to evaluate the apparent low bidder's submittal.

The apparent low bidder must demonstrate the following:

- i. Demonstrate the ability to obtain insurance coverage via an Insurance Company authorized to transact business in Georgia rated "A" or better by AM Best.
- ii. Demonstrate ability of obtain Workers Compensation of Statutory Limits together with Employer's Liability of at least \$500,000 per accident or claim.
- iii. Demonstrate the ability to obtain General Liability Insurance in the amount of \$2,000,000 general aggregate.
- iv. Demonstrate compliance with "Georgia Security and Immigration Compliance Act".
- v. Demonstrate your qualifications to perform the service to be bid upon by providing at least five (5) owner or engineer of record references of similar projects completed on time and on budget within the last five (5) years. Each reference shall include a description of the project, the project budget, contact information of the owner (including address, contact name, current phone number and e-mail) and date project completed. (CCWSA references are acceptable.) For purposes hereof similar services shall mean similar in cost, scope, duration, location, type of service, unique job requirements.
- vi. Provide a detailed listing of litigation, arbitration and other administrative proceedings in the last 5 years.
- vii. Provide a list of subcontractors the bidder intends to utilize on the project.
- viii. Provide credit history for the previous 3 years.
- ix. Demonstrate the appropriate licensure for the project to be bid upon.

Failure to demonstrate the ability to meet the minimum requirements will result in disqualification and rejection of said bid with next lowest bid selected for evaluation. The disqualified Contractor may discuss with the Owner the reasons for the disqualification, but the decision of the Owner is final.

Any Contractor intending to submit a bid for this project must attend a mandatory pre-bid meeting. The pre-bid meeting will be held at the main CCWSA office located at 140 West Main Street, Canton, GA on Monday, September 29, 2014 at 2:00 PM Local Time.

The Owner reserves the right to reject any or all Bids, to waive formalities, re-advertise, and to reduce or add to the contract from time to time.

Any questions or comments concerning this Request for Bids should be addressed in writing to the Engineer of Record at the address as set forth hereinabove. All questions must be submitted by Tuesday, September 30, 2014 by 5:00 PM.

The successful bidder will be required to furnish performance and payment bonds with the executed Agreement meeting the requirements of the Contract Documents and executed on the forms included in these specifications. The terms and time for payment are set forth in the Agreement.

Each bidder agrees to waive any claim it has or may have against the Owner, the Engineer, and their respective employees, arising out of or in conjunction with the administration, evaluation, or recommendation for award of any bid. The Owner reserves the right to reject any or all bids; to waive formalities; re-advertise; and to reduce or add to the contract from time to time.

CHEROKEE COUNTY WATER AND SEWERAGE AUTHORITY

Tom Heard, General Manager

ATKINS NORTH AMERICA - Marietta Georgia

Project 100034005

SECTION 00100

INFORMATION FOR BIDDERS

1. RECEIPT AND OPENING OF BIDS

The CHEROKEE COUNTY WATER & SEWERAGE AUTHORITY (hereinafter called the Owner), invites bids on the form attached hereto, all blanks of which must be appropriately filled in. Bids will be received by the Owner at the main office of Cherokee County Water & Sewerage Authority at 140 West Main Street, Canton, Georgia, 30114 until Tuesday, October 7, 2014, 10:00 A.M., Local Time and then at said office publicly opened and read aloud. The envelope containing the bids must be sealed and designated as bid for construction of:

CHEROKEE COUNTY WATER & SEWERAGE AUTHORITY
HOLLY SPRINGS DOWNTOWN SANITARY SEWER SYSTEM

The Owner may consider informal any bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities to reject any and all bids. Any bid may be withdrawn prior to the above scheduled time for 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 120 days after the actual date of the opening thereof.

2. PREPARATION OF BID

Each bid must be submitted on the prescribed form. All blank spaces for bid prices must be filled in, in ink or typewritten, in both words and numerals. The unit prices and the total prices shall be shown in numerals in the spaces provided. The unit price shall also be shown in words on the line provided below the numerals. In case of discrepancies, words will take precedence over numerals and totals will take precedence over unit prices.

All Bidders are encouraged to examine all mathematical computations to assure that totals reflected are accurate and free from computational errors. Bidders are referred to O.C.G.A. § 13-10-22, which provides the only remedy to address erroneous bid submittals. Generally, bidders may withdraw a submitted bid, which contains mathematical errors, within 48 hours of the bid opening by written request. In the event a bidder fails to withdraw an erroneous bid as proscribed by O.C.G.A. § 13-10-22, the bidder will be required to adhere to the bid grand total or forfeit the bid security ("bid bond").

Each bid must be submitted in a sealed envelope bearing on the outside the name of the bidder, his Georgia Utility Contractor's License Number, his address, and the name of the project for which the bid is submitted. If forwarded by mail, the sealed envelope containing the bid must be enclosed in another envelope addressed as specified in the bid form. Any bid which is not properly prepared and accompanied by required certifications may be rejected by the Owner.

3. MODIFICATION OF BID

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

4. QUALIFICATIONS OF BIDDERS

All pipeline contractors are invited to submit a bid to the CCWSA for this project; Prequalification is not required. However, with each bid submitted, each bidder shall submit a qualification package containing the information described in the CCWSA Construction Qualification Policy and Procedure.

Included herein is a **Contractor Qualification Statement and Questionnaire**. Contractors must meet minimum qualifications for this construction project. In addition, any subcontractor performing more than 20 percent of the work must also meet minimum qualifications for this project. The Contractor's Qualification Statement and Questionnaire and the Subcontractor's Qualification Statement and Questionnaire, all of which must be fully completed and submitted with the bid, will be used by the Owner and the Engineer to evaluate the bid submittals.

The CCWSA's policy requires bidders to:

- i. Demonstrate the ability to obtain insurance coverage via an Insurance Company authorized to transact business in Georgia rated "A" or better by AM Best. Please note that full insurance requirements are described herein in Section 00600.
- ii. Demonstrate the ability to obtain Workers Compensation of Statutory Limits together with Employer's Liability of at least \$500,000 per accident or claim.
- iii. Demonstrate the ability to obtain General Liability Insurance in the amount of \$2,000,000 general aggregate.
- iv. Demonstrate compliance with "Georgia Security and Immigration Compliance Act".
- v. Demonstrate qualifications to perform the service to be bid upon by providing at least five (5) owner or engineer of record references of similar projects completed on time and on budget within the last five (5) years. Each reference shall include a description of the project, the project budget, contact information of the owner (including address, contact name, current phone number and e-mail) and date project completed. (CCWSA references are acceptable.) For purposes hereof similar services shall mean similar in cost, scope, duration, location, type of service, unique job requirements.

- vi. Provide a detailed listing of litigation, arbitration and other administrative proceedings in the last 5 years.
- vii. Provide a list of subcontractors the bidder intends to utilize on the project.
- viii. Provide credit history for the previous 3 years.
- ix. Submit proof of the appropriate licensure for the project to be bid upon.

Failure to demonstrate the ability to meet the minimum requirements will result in disqualification and rejection of said bid with next lowest bid selected for evaluation. The disqualified Contractor may discuss with the Owner the reasons for the disqualification, but the decision of the Owner is final.

After the opening of the bid submittals, the Authority or their designated representative shall review the qualification package submitted by the Contractor submitting the lowest cost bid. If the qualification package is omitted from the bid submittal, the bid shall be rejected as non-responsive. If any individual portion of the qualification package is omitted from the bid submittal, the bid may be rejected as non-responsive. If the Authority's review of the qualification package results in a decision that the lowest cost bidder is not qualified, the bid will be rejected and the package submitted by the next lowest bidder will be reviewed. This procedure will continue until the evaluation process determines the bidder that has submitted the lowest cost bid who is also deemed to be qualified to complete the project. If the contract is awarded, it will be awarded to the lowest bidder whose evaluation by the CCWSA indicates to the CCWSA that the award will be in the best interests of the project. The Authority shall have complete discretion in making this determination. Bidders have the right to appeal decisions made by the Authority in accordance with the CCWSA Construction Qualification Policy and Procedure – Section V.

By submission of his Bid, the Bidder acknowledges the right of the Owner to make such investigations, to contact references and utilize this information as a basis of determining award of the contract. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligations of the contract and to complete the work contemplated therein. Conditional bids will not be accepted.

Each bidder agrees to waive any claim it has or may have against the Owner, the Engineer, and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any bid. The Owner reserves the right to reject any or all bids; to waive formalities; re-advertise; and to reduce or add to the contract from time to time.

5. BID SECURITY

Each bid must be accompanied by a certified check or bid bond prepared on the form of bid bond attached hereto, duly executed by the bidder as principal and having as surety thereon a surety company approved by the Owner, in the amount of 5% of the bid.

6. LIQUIDATED DAMAGES AND FAILURE TO ENTER INTO CONTRACT

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

7. TIME OF COMPLETION AND LIQUIDATED DAMAGES

Bidder must agree to commence work on or before a date to be specified in a written "Notice to Proceed" of the Owner and to substantially complete the project within 240 consecutive calendar days thereafter, and to achieve final completion of the project within 270 consecutive calendar days thereafter. The Lift Station Start-Up Date shall be set at this same date defined as final completion, 270 consecutive calendar days after the Notice to Proceed Date.

Bidders must agree also to pay as liquidated damages the sum of \$1,000 per each consecutive calendar day thereafter, for failure to meet either the substantial completion deadline or the final completion deadline. Substantial completion is hereby defined as having all proposed sewer mains, force mains, manholes, service laterals and other facilities installed under this contract fully installed, tested, accepted and placed into service. Substantial completion shall also include the completion of construction and testing of the proposed lift station and force main. Final completion, as required above within 270 calendar days after the Notice to Proceed date, shall include all property restoration items and permanent grassing. The extra 30 days given between the end of substantial completion and final completion is time allotted primarily for the establishment of grassing to the 70% stabilization level so that a Notice of Termination can be submitted to the EPD. The establishment of grassing and property restoration items that are not related to the function of the sanitary sewer system can be completed during this last 30 days.

8. CONDITION OF WORK

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

9. ADDENDA AND INTERPRETATIONS

Oral interpretations of the meaning of plans, specifications or other contract documents shall not be binding over written material. Any and all questions or comments concerning this Request for Bids should be addressed in writing to: William Livingston, PE, Atkins North America, 192 Anderson Street, Suite 150, Marietta, GA, 30060. All questions must be submitted by Tuesday, September 30, 2014 by 5:00 PM.

Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications, which, will be mailed to all prospective bidders. Failure of any bidder to receive any such addendum or interpretations shall not relieve such bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the contract documents.

10. SECURITY FOR FAITHFUL PERFORMANCE

Simultaneously with his delivery of the executed contract, the Contractor shall furnish a surety bond or bonds as security for faithful performance of his contract and for the payment of all persons performing labor on the project under this contract, and furnishing materials in connection with his contract, as specified in the General Conditions included herein. 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.

11. POWER OF ATTORNEY

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

12. NOTICE OF SPECIAL CONDITIONS

Attention is particularly called to those parts of the contract documents and specifications which are identified subsequently under Special Conditions.

13. LAWS AND REGULATIONS

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

14. METHOD OF AWARD

If the Contract is awarded, it will be awarded to the lowest Bidder whose evaluation by Owner indicates to Owner that the award will be in the best interests of the project. The Owner shall have complete discretion in making this determination and may consider factors such as, but not limited to the following:

- (a) Unit bid prices of various items as they relate to total bid price.
- (b) Proximity of the Bidder's permanent place of business as it may relate to Bidder's responsiveness in carrying out the contract.
- (c) Litigation record of the Bidder.
- (d) Satisfactory completion of similar projects.
- (e) Resources pertaining to management, personnel and equipment.
- (f) Financial history, credit rating and current resources.

15. OBLIGATION OF BIDDER

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

16. CORRELATION AND INTENT OF DOCUMENTS

The contract documents are complementary, and what is called for by one shall be as binding as if called for by all. The intent of the documents is to describe in detail all construction entailed in this project. The contractor will furnish all labor, materials, equipment, transportation, tools and appurtenances such as may be reasonably required under the terms of the contract to make each part of the work complete.

The drawings are intended to conform and agree with the specifications. If, however, discrepancies occur, the Engineers will decide which shall govern. Special specifications stated on the drawings govern that particular piece of construction and have equal weight and importance as the printed specifications. In the event of any discrepancies between the drawings and the figures written thereon, the figures are to be taken as correct.

17. CLAIMS

The Owner reserves the right to refuse to issue any voucher and to direct that no payment shall be made the contractor in case they have reason to believe that said contractor has neglected or failed to pay any subcontractor, material dealer, worker or employee for work performed on or about the project including work as set forth in these specifications, until the Owner is satisfied that such subcontractors, material dealers, worker, or employees have been fully paid. However this provision shall not obligate the Owner to intervene in any claim.

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

18. ORDER OF WORK

The work shall be started at such points as the Engineer shall designate and shall be prosecuted in the order he directs. This applies to both location and items of construction.

19. SUBCONTRACTS

All bids submitted to the Owner must include a list of all Subcontractors and other persons and organizations proposed for portions of the Work. If the Owner, after due investigation, has reasonable objection to any proposed Subcontractor, other person or organization, the Owner may before giving the Notice of Award request

the apparent Successful Bidder to submit an acceptable substitute without an increase in Bid price. If the apparent Successful Bidder declines to make any such substitution, the contract shall not be awarded to such Bidder, but his declining to make any such substitution will not constitute grounds for sacrificing his Bid Security. Any Subcontractor, other person or organization so listed and to whom Owner or Engineer does not make written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer. Please note the requirements of Section 00100.4 above regarding bid submittals related to subcontractors.

20. TIMELY EXECUTION

When Owner gives a Notice of Award to the Successful Bidder, it will be accompanied by at least five unsigned counterparts of the Agreement and all other Contract Documents. Within ten days thereafter, Contractor shall sign and deliver at least five counterparts of the Agreement to Owner with all other Contract Documents attached. Within twenty days thereafter, Owner will deliver two sets of fully signed counterparts to Contractor.

21. BALANCED BID

Bids that are unbalanced **may** be rejected at the Owner's option. A "balanced bid" is defined as a bid in which each of the unit prices and total amount bid for each of the items listed in the proposal reasonably reflects the value of that item with regard to the entire job. The unit prices for all of the items in the proposal should include as a bare minimum the materials and labor necessary to complete one unit of the item. The unit price need not include profit and/or overhead. The Bidder shall pay special attention to this provision and to the notes at the end of the proposal on page 00300-2, for should conditions make it necessary to revise the quantities, no limit shall be fixed for such increased or decreased quantities nor extra compensation allowed.

22. MANDATORY PRE-BID MEETING

Any Contractor intending to submit a bid for this project must attend a mandatory pre-bid meeting. The pre-bid meeting will be held at the main CCWSA office located at 140 West Main Street, Canton, GA on Monday, September 29, 2014 at 2:00 PM Local Time.

23. BID SUBMITTAL CONTENTS

Bids submitted to the Owner shall include at a minimum:

- a. Bid Bond Documentation (Section 00200).**
- b. Bid Form (Section 00300).**
- c. List of all Proposed Subcontractors (Included in Section 00360).**
- d. Georgia Security and Immigration Compliance Certifications and Affidavits, including the required affidavits for Contractor and all Subcontractors (Section 00360).**
- e. Complete Qualification Statement and Questionnaire for Contractor and all Subcontractors (Sections 00301 and 00302).**

SECTION 00200

BID BOND
(Five Percent of Bid)

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned _____
_____ as Principal and _____
_____ as Surety, are hereby held firmly bound unto the
CHEROKEE COUNTY WATER & SEWERAGE AUTHORITY, as Owner in the penal
sum of _____ Dollars
(\$ _____) for the payment of which, well and truly to be made, we hereby
jointly and severally bind ourselves, our heirs, executors, administrators, successors and
assigns.

The condition of the above obligation is such that whereas the Principal has submitted, to
the CHEROKEE COUNTY WATER AND SEWERAGE AUTHORITY, a certain bid
attached hereto and hereby made a part hereof to enter into a contract in writing for the con-
struction of:

CHEROKEE COUNTY WATER & SEWERAGE AUTHORITY
HOLLY SPRINGS DOWNTOWN SANITARY SEWER SYSTEM

NOW, THEREFORE,

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

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

BID BOND
(Continued)

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

Name of Contracting Firm

Principal's Printed Name and Title

Principal's Signature

SEAL

Printed Name of Surety Firm

Surety Representative Printed Name and Title

SEAL

Surety Representative' Signature

SECTION 00300

BID FORM

Place _____

Date _____

Bid of _____ (hereinafter called "Bidder") a contractor organized and existing under the laws of the State of _____, * an individual, a corporation, or a partnership doing business as _____

TO: CHEROKEE COUNTY WATER & SEWERAGE AUTHORITY (Hereinafter called "Owner")

Gentlemen:

The Bidder, in compliance with your invitation for bids for the construction of CHEROKEE COUNTY WATER & SEWERAGE AUTHORITY, HOLLY SPRINGS DOWNTOWN SANITARY SEWER SYSTEM, having examined the plans and specifications with related documents and the site of the proposed work, and being familiar with all of the conditions surrounding the construction of the proposed project, including the availability of materials and labor, hereby proposes to furnish all labor, materials, and supplies, and to construct the project in accordance with the contract documents, within the time set forth herein, and at the prices stated below. These prices are to cover all expenses incurred in performing the work required under this contract, of which this proposal is a part.

Bidder hereby agrees to commence work under this contract on or before a date to be specified in a written "Notice to Proceed" of the Owner and to fully complete the project within TWO HUNDRED AND SEVENTY (270) consecutive calendar days thereafter as stipulated in the specifications. Bidders further agree to pay as liquidated damages the sum of \$1,000.00 for each consecutive calendar day thereafter as hereinafter provided in the General Conditions under "Change of Contract Time for Completion and Liquidated Damages."

Bidder acknowledges receipt of the following addenda:

*Strike out inapplicable terms

CHEROKEE COUNTY WATER AND SEWERAGE AUTHORITY
 HOLLY SPRINGS DOWNTOWN SANITARY
 SEWER SYSTEM
 CONSTRUCTION BID FORM

ITEM NO.	DESCRIPTION	EST. QTY.	UNIT	UNIT PRICE	TOTAL AMOUNT
1.	SANITARY SEWER LIFT STATION	1	L.S.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
2.	16" STEEL CASING (0.250" W.T.) INSTALLED BY DRY BORE AND JACK THROUGH SOIL AND PENETRABLE ROCK	100	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
3.	ADDITIONAL FEE PER LINEAR FOOT ADDED TO FEE IN ITEM 2 ABOVE FOR JACK AND BORE THROUGH SOLID ROCK	100	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
4.	8" D.I.P. SANITARY SEWER INSTALLED IN CASING	100	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
5.	8" D.I.P. SANITARY SEWER (0' - 6' DEPTH OF CUT)	190	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
6.	8" D.I.P. SANITARY SEWER (6' - 8' DEPTH OF CUT)	450	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
7.	8" D.I.P. SANITARY SEWER (8' - 10' DEPTH OF CUT)	620	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					

CHEROKEE COUNTY WATER AND SEWERAGE AUTHORITY
 HOLLY SPRINGS DOWNTOWN SANITARY
 SEWER SYSTEM
 CONSTRUCTION BID FORM

ITEM NO.	DESCRIPTION	EST. QTY.	UNIT	UNIT PRICE	TOTAL AMOUNT
8.	8" D.I.P. SANITARY SEWER (10' - 12' DEPTH OF CUT)	230	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
9.	8" D.I.P. SANITARY SEWER (12' - 14' DEPTH OF CUT)	165	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
10.	8" D.I.P. SANITARY SEWER (14' - 16' DEPTH OF CUT)	180	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
11.	8" D.I.P. SANITARY SEWER (16' - 18' DEPTH OF CUT)	160	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
12.	8" D.I.P. SANITARY SEWER (18' - 20' DEPTH OF CUT)	80	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
13.	8" D.I.P. SANITARY SEWER (20' - 22' DEPTH OF CUT)	105	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
14.	8" D.I.P. SANITARY SEWER (22' - 24' DEPTH OF CUT)	45	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					

CHEROKEE COUNTY WATER AND SEWERAGE AUTHORITY
 HOLLY SPRINGS DOWNTOWN SANITARY
 SEWER SYSTEM
 CONSTRUCTION BID FORM

ITEM NO.	DESCRIPTION	EST. QTY.	UNIT	UNIT PRICE	TOTAL AMOUNT
15.	8" D.I.P. SANITARY SEWER (24' - 26' DEPTH OF CUT)	30	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
16.	8" D.I.P. SANITARY SEWER (26' - 28' DEPTH OF CUT)	40	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
17.	8" D.I.P. SANITARY SEWER (28' - 30' DEPTH OF CUT)	60	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
18.	8" PVC SANITARY SEWER (0' - 6' DEPTH OF CUT)	300	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
19.	8" PVC SANITARY SEWER (6' - 8' DEPTH OF CUT)	580	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
20.	8" PVC SANITARY SEWER (8' - 10' DEPTH OF CUT)	1,080	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
21.	8" PVC SANITARY SEWER (10' - 12' DEPTH OF CUT)	40	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					

CHEROKEE COUNTY WATER AND SEWERAGE AUTHORITY
 HOLLY SPRINGS DOWNTOWN SANITARY
 SEWER SYSTEM
 CONSTRUCTION BID FORM

ITEM NO.	DESCRIPTION	EST. QTY.	UNIT	UNIT PRICE	TOTAL AMOUNT
22.	6" D.I.P. FORCE MAIN	5,000	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
23.	8" X 6" WYE	10	EA.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
24.	6" 1/8 BEND	10	EA.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
25.	6" PVC SANITARY SEWER SERVICE	200	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
26.	SANITARY SEWER SERVICE CLEAN-OUT	10	EA.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
27.	STANDARD MANHOLE (0' - 6' IN DEPTH)	33	EA.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
28.	EXTRA-DEPTH STANDARD MANHOLE (6' - 12' IN DEPTH)	150	V.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					

CHEROKEE COUNTY WATER AND SEWERAGE AUTHORITY
 HOLLY SPRINGS DOWNTOWN SANITARY
 SEWER SYSTEM
 CONSTRUCTION BID FORM

ITEM NO.	DESCRIPTION	EST. QTY.	UNIT	UNIT PRICE	TOTAL AMOUNT
29.	EXTRA-DEPTH STANDARD MANHOLE (12'+ IN DEPTH)	70	V.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
30.	6" X 3/4" WATER SERVICE TAP, INCLUDING TAP, CORP STOP, 3/4" COPPER SERVICE FROM 6" WATER MAIN TO LIFT STATION, CURB STOP AND METER BOXES	1	L.S.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
31.	CONNECT TO EXISTING SEWER MANHOLE	1	EA.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
32.	SUBGRADE STABILIZER STONE	850	TON	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
33.	SOLID ROCK EXCAVATION	1,300	C.Y.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
34.	MISCELLANEOUS CONCRETE BLOCKING	30	C.Y.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
35.	MISCELLANEOUS DIP FITTINGS FOR FORCE MAIN	2,400	LB.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					

CHEROKEE COUNTY WATER AND SEWERAGE AUTHORITY
 HOLLY SPRINGS DOWNTOWN SANITARY
 SEWER SYSTEM
 CONSTRUCTION BID FORM

ITEM NO.	DESCRIPTION	EST. QTY.	UNIT	UNIT PRICE	TOTAL AMOUNT
36.	1" A&V VALVE ASSEMBLY	1	EA.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
37.	CONCRETE DITCHCAP	120	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
38.	1 1/2" TYPE "F" ASPHALT TOPPING	800	S.Y.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
39.	PROVISION, INSTALLATION AND MAINTENANCE OF 2" DIA. PVC PIPE ON TOP OF FORCE MAIN FOR PURPOSE OF GPS AS-BUILT DATA COLLECTION	125	EA.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
40.	REMOVE AND REPLACE STORAGE BUILDING	1	EA.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
41.	REMOVE AND REPLACE CONCRETE FLUME (DITCH)	120	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
42.	REMOVE AND REPLACE IRON PINS/PROPERTY MARKERS	12	EA.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					

CHEROKEE COUNTY WATER AND SEWERAGE AUTHORITY
 HOLLY SPRINGS DOWNTOWN SANITARY
 SEWER SYSTEM
 CONSTRUCTION BID FORM

ITEM NO.	DESCRIPTION	EST. QTY.	UNIT	UNIT PRICE	TOTAL AMOUNT
43.	REMOVE AND REPLACE ASPHALT DRIVEWAY	660	S.Y.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
44.	REMOVE AND REPLACE CONCRETE DRIVEWAY	480	S.Y.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
45.	REMOVE AND REPLACE GRAVEL DRIVEWAY	240	S.Y.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
46.	REMOVE AND REPLACE CONCRETE SIDEWALK	80	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
47.	REMOVE AND REPLACE CULVERT (ALL TYPES AND SIZES)	100	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
48.	REMOVE AND REPLACE FENCING	300	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
49.	REMOVE AND REPLACE HEADWALL	2	EA.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					

CHEROKEE COUNTY WATER AND SEWERAGE AUTHORITY
 HOLLY SPRINGS DOWNTOWN SANITARY
 SEWER SYSTEM
 CONSTRUCTION BID FORM

ITEM NO.	DESCRIPTION	EST. QTY.	UNIT	\$	UNIT PRICE	\$	TOTAL AMOUNT
50.	REMOVE AND REPLACE POWER POLE	2	EA.	\$	_____	\$	_____
					Numerals		Numerals

					Unit Price in Words		
51.	REMOVE AND REPLACE CONCRETE CURB AND GUTTER	180	L.F.	\$	_____	\$	_____
					Numerals		Numerals

					Unit Price in Words		
52.	DOUBLE ROW OF TYPE "C" SILT FENCE	6,620	L.F.	\$	_____	\$	_____
					Numerals		Numerals

					Unit Price in Words		
53.	SINGLE ROW OF TYPE "C" SILT FENCE	3,200	L.F.	\$	_____	\$	_____
					Numerals		Numerals

					Unit Price in Words		
54.	HAY BALE CHECKDAMS (Cd-HB)	10	EA.	\$	_____	\$	_____
					Numerals		Numerals

					Unit Price in Words		
55.	CONSTRUCTION EXITS (Co)	6	EA.	\$	_____	\$	_____
					Numerals		Numerals

					Unit Price in Words		
56.	STREAM BANK STABILIZATION	8	EA.	\$	_____	\$	_____
					Numerals		Numerals

					Unit Price in Words		

CHEROKEE COUNTY WATER AND SEWERAGE AUTHORITY
 HOLLY SPRINGS DOWNTOWN SANITARY
 SEWER SYSTEM
 CONSTRUCTION BID FORM

ITEM NO.	DESCRIPTION	EST. QTY.	UNIT	UNIT PRICE	TOTAL AMOUNT
57.	TURBIDITY BARRIER	480	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
58.	EROSION CONTROL MATTING (Mb)	4,000	S.Y.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
59.	STORM DRAIN OUTLET PROTECTION (St)	12	EA.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
60.	DUST CONTROL (Du)	1	L.S.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
61.	STORM WATER MONITORING	9	MO.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
62.	TREE PROTECTION FENCING	4,500	L.F.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					
63.	TEMPORARY MULCHING (Ds1)	34,900	S.Y.	\$ _____ Numerals	\$ _____ Numerals

Unit Price in Words					

CHEROKEE COUNTY WATER AND SEWERAGE AUTHORITY
 HOLLY SPRINGS DOWNTOWN SANITARY
 SEWER SYSTEM
 CONSTRUCTION BID FORM

ITEM NO.	DESCRIPTION	EST. QTY.	UNIT	UNIT PRICE	TOTAL AMOUNT
64.	TEMPORARY GRASSING (SEEDED)	34,900	S.Y.	\$ _____ Numerals	\$ _____ Numerals
				_____ Unit Price in Words	
65.	PERMANENT GRASSING (SEEDED) (Ds3)	34,900	S.Y.	\$ _____ Numerals	\$ _____ Numerals
				_____ Unit Price in Words	
66.	PERMANENT GRASSING (SODDED) (Ds4)	4,000	S.Y.	\$ _____ Numerals	\$ _____ Numerals
				_____ Unit Price in Words	
67.	LANDSCAPING	1	L.S.	\$ _____ Numerals	\$ _____ Numerals
				_____ Unit Price in Words	
GRAND TOTAL				_____ Grand Total in Numerals	
				_____ Grand Total in Words	

All Bidders are encouraged to examine all mathematical computations to assure that totals reflected are accurate and free from computational errors. Bidders are referenced to OCGA 13-10-22, which provides the only remedy to address erroneous bid submittals. Generally, bidders may withdraw a submitted bid which contain mathematical errors, within 48 hours of the bid opening by written request. In the event a bidder fails to withdraw an erroneous bid as prescribed by OCGA 13-10-22, the bidder will be required to adhere to the bid total or forfeit the bid security ("Bid Bond").

BID FORM (Continued)

Unit prices shall be shown in both words and numerals. Total prices for each item shall be shown in numerals only. Grand Total for the bid shall be shown in both words and numerals. In case of discrepancy, the amount shown in words will govern. Please note the requirements detailed in Section 00100.2.

The above prices shall include all labor, materials, removal, overhead, profit, insurance, etc., to cover the finished work of the several kinds called for.

Bidder understands that the Owner reserves the right to reject any or all bids and to waive any informalities in the bidding.

The Bidder agrees that this bid shall be good and may not be withdrawn for a period of 120 calendar days after the scheduled closing time for receiving bids.

The undersigned further agrees that, in case of failure on his part to execute said contract and bond within ten (10) days after the award thereof, the check or bond accompanying his bid and the money payable thereon shall become the property of the Owner; otherwise, the check or bond accompanying this proposal shall be returned to the Bidder.

The Bidder declares that he understands that the quantities shown on the proposal are subject to adjustment by either increase or decrease, and that should the quantities of any of the items of work be increased, the undersigned proposes to do the additional work at the unit prices stated herein; and should the quantities be decreased, he also understands that payment will be made on actual quantities at the unit price bid and will make no claim for anticipated profits for any decrease in the quantities and that actual quantities will be determined upon completion of work, at which time adjustment will be made to the contract amount by direct increase or decrease.

Attached hereto is a bid bond or certified check on the _____ of _____
_____ in the amount of _____

according to conditions under "Information For Bidders" and the provisions therein.

The full name and residence of persons or parties interested in the foregoing bids, as principals, are named as follows:

BID FORM (Continued)

Dated at:

The ___ day of _____, 20___

Bid Submitted By:

Firm

By _____

Printed Name

By _____

Signature

Title: _____

SECTION 00301

**CONTRACTOR'S QUALIFICATION
STATEMENT AND QUESTIONNAIRE**

NAME OF PROJECT: **HOLLY SPRINGS DOWNTOWN SANITARY SEWER
SYSTEM**

NAME OF OWNER: **CHEROKEE COUNTY WATER AND SEWERAGE
AUTHORITY**

**NAME OF PROPOSED
CONTRACTOR:**

_____ **Name of Firm**

I. INSTRUCTIONS

- A. ALL QUESTIONS ARE TO BE ANSWERED IN FULL, WITHOUT EXCEPTION. IF COPIES OF OTHER DOCUMENTS WILL ANSWER THE QUESTION COMPLETELY, THEY MAY BE ATTACHED AND CLEARLY LABELED. IF ADDITIONAL SPACE IS NEEDED, ADDITIONAL PAGES MAY BE ATTACHED AND CLEARLY LABELED.

- B. THE OWNER, THE CHEROKEE COUNTY WATER AND SEWERAGE AUTHORITY (HEREINAFTER "OWNER"), ITS AGENTS AND REPRESENTATIVES, SHALL BE ENTITLED TO CONTACT EACH AND EVERY REFERENCE LISTED IN RESPONSE TO THIS QUESTIONNAIRE, AND EACH ENTITY REFERENCED IN ANY RESPONSE TO ANY QUESTION IN THIS QUESTIONNAIRE. THE CONTRACTOR, _____, (HEREINAFTER "CONTRACTOR"), BY COMPLETING THIS QUESTIONNAIRE, EXPRESSLY AGREES THAT ANY INFORMATION CONCERNING THE CONTRACTOR IN POSSESSION OF SAID ENTITIES AND REFERENCES MAY BE MADE AVAILABLE TO THE OWNER.

- C. ONLY COMPLETE AND ACCURATE INFORMATION SHALL BE PROVIDED BY THE CONTRACTOR. THE CONTRACTOR HEREBY WARRANTS THAT, TO THE BEST OF ITS KNOWLEDGE AND BELIEF, THE RESPONSES CONTAINED HEREIN ARE TRUE, ACCURATE, AND COMPLETE. THE CONTRACTOR ALSO ACKNOWLEDGES THAT THE OWNER IS RELYING ON THE TRUTH AND ACCURACY OF THE RESPONSES CONTAINED HEREIN. IF IT IS LATER DISCOVERED THAT ANY MATERIAL INFORMATION GIVEN IN RESPONSE TO A QUESTION WAS PROVIDED BY THE CONTRACTOR, KNOWING IT WAS FALSE, IT SHALL CONSTITUTE GROUNDS FOR IMMEDIATE TERMINATION OR

RESCISSION BY THE OWNER OF ANY SUBSEQUENT AGREEMENT BETWEEN THE OWNER AND THE CONTRACTOR. THE OWNER SHALL ALSO HAVE AND RETAIN ANY OTHER REMEDIES PROVIDED BY LAW.

- D. IF THERE ARE ANY QUESTIONS CONCERNING THE COMPLETION OF THIS FORM, THE CONTRACTOR IS ENCOURAGED TO CONTACT THE PROJECT ENGINEER, William Livingston, PE, Atkins North America, at 770-422-1902, 192 Anderson Street, Suite 150, Marietta, GA, 30060.
- E. THE COMPLETED FORM SHALL BE SUBMITTED TO THE OWNER WITH THE BID SUBMITTAL.
- F. THIS FORM, ITS COMPLETION BY THE CONTRACTOR, AND ITS USE BY THE CONTRACTOR, AND ITS USE BY THE OWNER, SHALL NOT GIVE RISE TO ANY LIABILITY ON THE PART OF THE OWNER TO THE CONTRACTOR OR ANY THIRD PARTY OR PERSON.

II. **GENERAL BACKGROUND**

- A. CURRENT NAME AND ADDRESS OF CONTRACTOR:

- B. PREVIOUS NAME OR ADDRESS OF CONTRACTOR, IF ANY:

- C. CURRENT PRESIDENT OR CHIEF EXECUTIVE OFFICER: _____

Years in that position _____

- D. NUMBER OF EMPLOYEES:
(Permanent) _____

E. NAME AND ADDRESSES OF
CURRENT AFFILIATED
COMPANIES (PARENT,
SUBSIDIARY, DIVISIONS):

III. **FINANCIAL STATUS**

A. PLEASE ATTACH FINANCIAL STATEMENTS FOR THE PAST THREE YEARS FOR WHICH THEY ARE COMPLETE. IF SUCH STATEMENTS ARE NOT AVAILABLE, PLEASE FURNISH THE FOLLOWING INFORMATION:

1. **LAST COMPLETE FISCAL YEAR:**

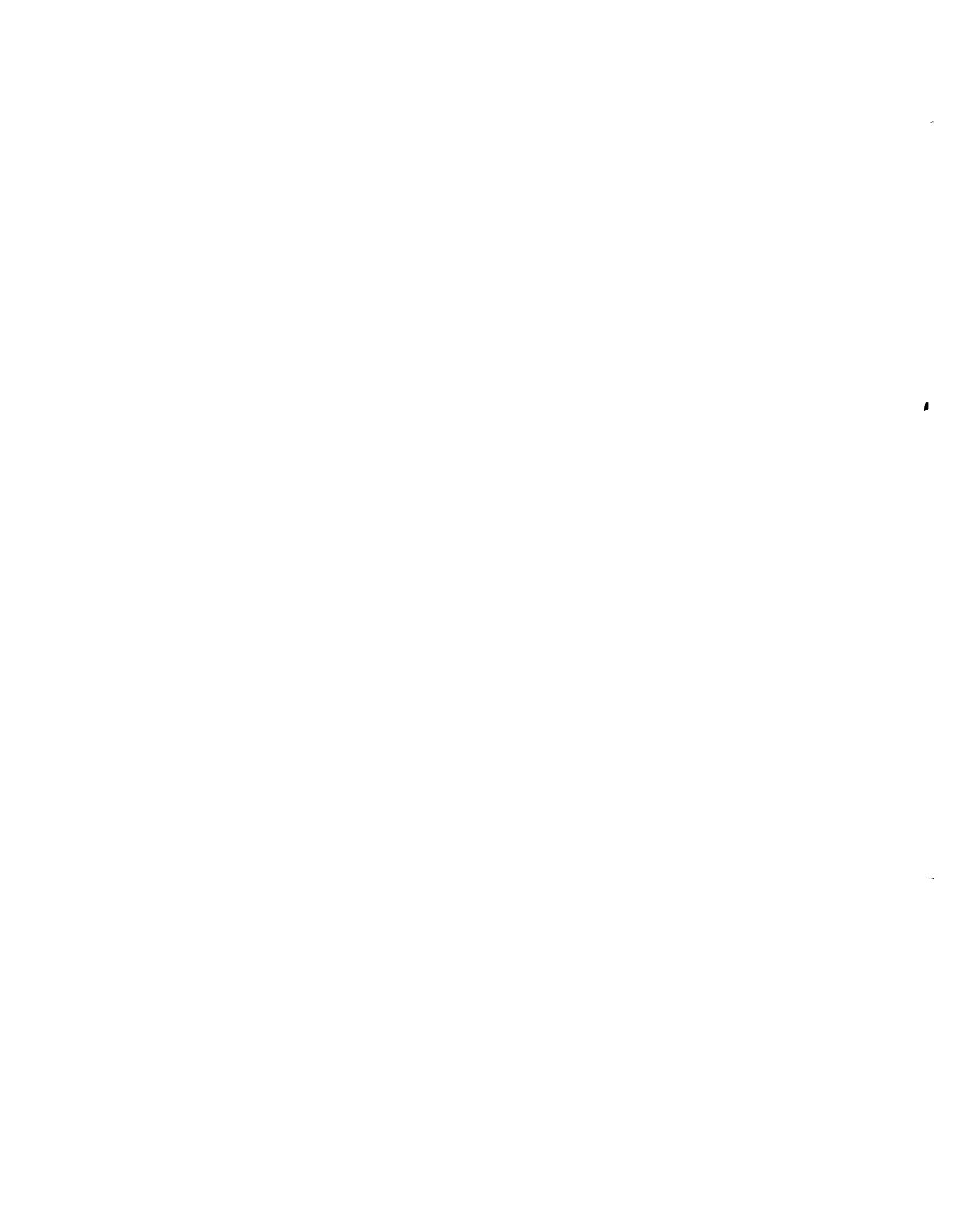
a. Revenues (Gross) _____
b. Expenditures (Gross) _____
c. Overhead & Admin. Cost (Gross) _____
d. Profit (Gross) _____

2. **YEAR PRIOR TO "1" ABOVE:**

a. Revenues (Gross) _____
b. Expenditures (Gross) _____
c. Overhead & Admin. Cost (Gross) _____
d. Profit (Gross) _____

3. **YEAR PRIOR TO "2" ABOVE:**

a. Revenues (Gross) _____
b. Expenditures (Gross) _____
c. Overhead & Admin. Cost (Gross) _____
d. Profit (Gross) _____



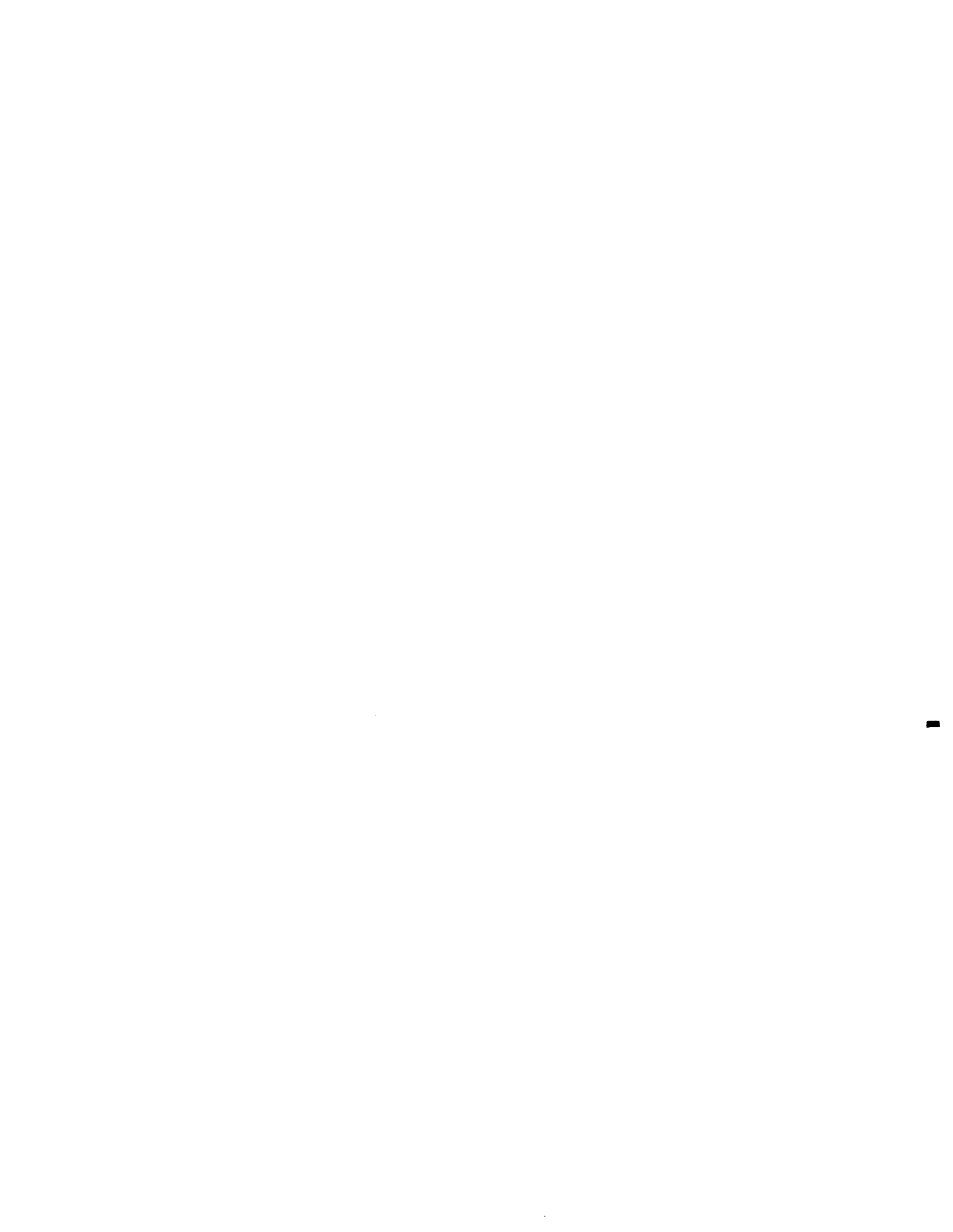
B. BANKRUPTCIES

1. Has the Contractor, or any of its parents or subsidiaries, ever had a Bankruptcy Petition filed in its name, voluntarily or involuntarily? (If yes, specify date, circumstances, and resolution).

2. Has any Majority Shareholder ever had a Bankruptcy Petition filed in his/her name, voluntarily or involuntarily? (If yes, specify date, circumstances, and resolution).

C. LOANS

1. Is this Contractor currently in default on any loan agreement or financing agreement with any bank, financial institution or other entity? (If yes, specify details, circumstances, and prospects for resolution).



D. BONDING

1. What is the Contractor's current bonding capacity with a contract surety company?

2. Please identify the Contractor's surety company and the current line of bonding credit that company has extended to the Contractor.

3. Please give the name, address, and telephone number of your current surety agent or underwriting contact.

4. Have Performance or Payment Bond claims ever been made to a surety for Contractor on any project, past or present?

5. If the answer to (4) is yes, please describe the claim, the name of the company or person making the claim, and the resolution of the claim.

6. In the past five years, has any surety company refused to bond the Contractor on any project? (If answer is yes, specify the reasons given for such refusal, and the name and address of the surety company that refused to bond).

7. In the past five years, has any surety company refused to bond the Contractor's parent, or subsidiaries, on any project? (If answer is yes, please specify the reasons given for such refusal, and the name and address of the surety company that refused to bond).

E. MERGERS AND ACQUISITIONS

1. State whether or not the Contractor has been the subject of a corporate merger within the preceding three years. If so, please identify all parties to such merger, provide the date of same, and a brief description of the transaction.

2. State whether or not the Contractor has acquired any other companies or entities in the preceding three years. If so, please identify all companies or entities acquired, provide the date of acquisition, and a brief description of the business of the company or entity acquired.

IV. **PROPOSED PROJECT PERSONNEL**

A. **PROPOSED PROJECT MANAGER**

1. List the name, qualifications and background of your proposed project manager for this Project. (Include the names and addresses of companies he/she has been affiliated with in the last five years).

2. List at least three projects, by size, type and duration, that the proposed project manager has supervised in the last five years for the Contractor, or for any other company.

B. **PROPOSED SUPERINTENDENT**

1. List the qualifications and background of your proposed job superintendent (if different than the project manager) and include the names and addresses of any companies he/she has been affiliated with in the last five years.

2. List at least three projects, by size, type, and duration, that the proposed job superintendent has supervised in the last five years for the Contractor, or for any other company.

B. LAWSUITS

List all construction-related lawsuits (other than labor or personal injury litigation) filed by, or against, the Contractor in the last five years, and identify the nature of the claim, the amount in dispute, the parties, and the ultimate resolution of the lawsuit.

C. OTHER PROCEEDINGS

1. Identify any lawsuits, administrative proceedings, or hearings initiated by the National Labor Relations Board or similar state agency in the past seven years concerning any labor practices of the Contractor. Identify the nature of any proceeding and its ultimate resolution.

2. Identify any lawsuits, administrative proceedings, or hearings initiated by the Occupational Safety and Health Administration concerning the project safety practices of the Contractor in the last seven years. Identify the nature of any proceeding and its ultimate resolution.

3. Identify any lawsuits, administrative proceedings, or hearings initiated by the Internal Revenue Service, or any state revenue department, concerning the tax liability of the Contractor (other than audits) in the last seven years. Identify the nature of any proceeding and its ultimate resolution.

4. Have any criminal proceedings or investigations been brought against the Contractor in the last ten years? (If the answer is yes, please attach a complete and detailed report of the facts and circumstances concerning all such proceedings or investigations with your responses to this Questionnaire)

VII. **REFERENCES**

(ALL REFERENCES MUST BE CURRENT, I.E., ENTITIES WITH WHOM YOU HAVE DONE BUSINESS IN THE PRECEDING TWELVE MONTHS.)

A. **BANKS**

Bank #1

Name: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

Bank #2

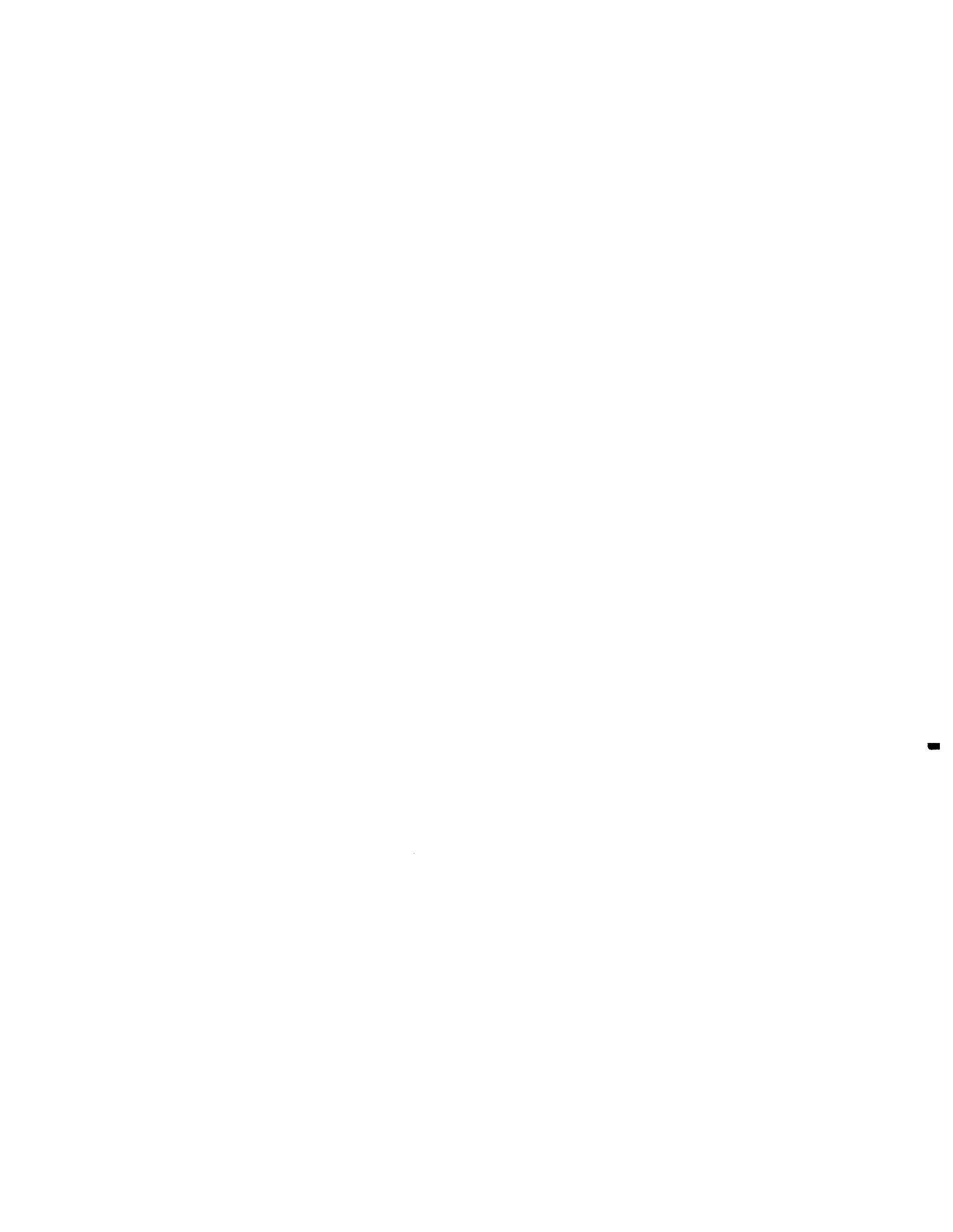
Name: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____



B. MAJOR SUBCONTRACTORS

Subcontractor #1

Name: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

Subcontractor #2

Name: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

C. MAJOR SUPPLIERS

Major Supplier #1

Name: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

Major Supplier #2

Name: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

D. **OWNERS**

Project #1

Name: _____

Location: _____

Contract Price: _____

Owner: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

Arch/Eng: _____

Contact/Phone: _____

Project #2

Name: _____

Location: _____

Contract Price: _____

Owner: _____
Address: _____
City/State: _____
Contact: _____
Phone: _____
Arch/Eng: _____
Contact/Phone: _____

Project #3

Name: _____
Location: _____
Contract Price: _____
Owner: _____
Address: _____
City/State: _____
Contact: _____
Phone: _____
Arch/Eng: _____
Contact/Phone: _____

Project #4

Name: _____
Location: _____
Contract Price: _____
Owner: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

Arch/Eng: _____

Contact/Phone: _____

Project #5

Name: _____

Location: _____

Contract Price: _____

Owner: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

Arch/Eng: _____

Contact/Phone: _____

VIII. COMMENTS

Please list any additional information that you believe would assist the Owner in evaluating the possibility of using the Contractor on this Project. You may attach such additional information as an Exhibit to this Statement and Questionnaire.



I certify to the Owner that the information and responses provided on this Questionnaire are true, accurate and complete. The Owner, or its designated representative, may contact any entity or reference listed in this Questionnaire. Each entity or reference may make any information concerning the Contractor available to the Owner or its designated representative.

Dated _____, 2014.

CONTRACTOR: _____

By: _____

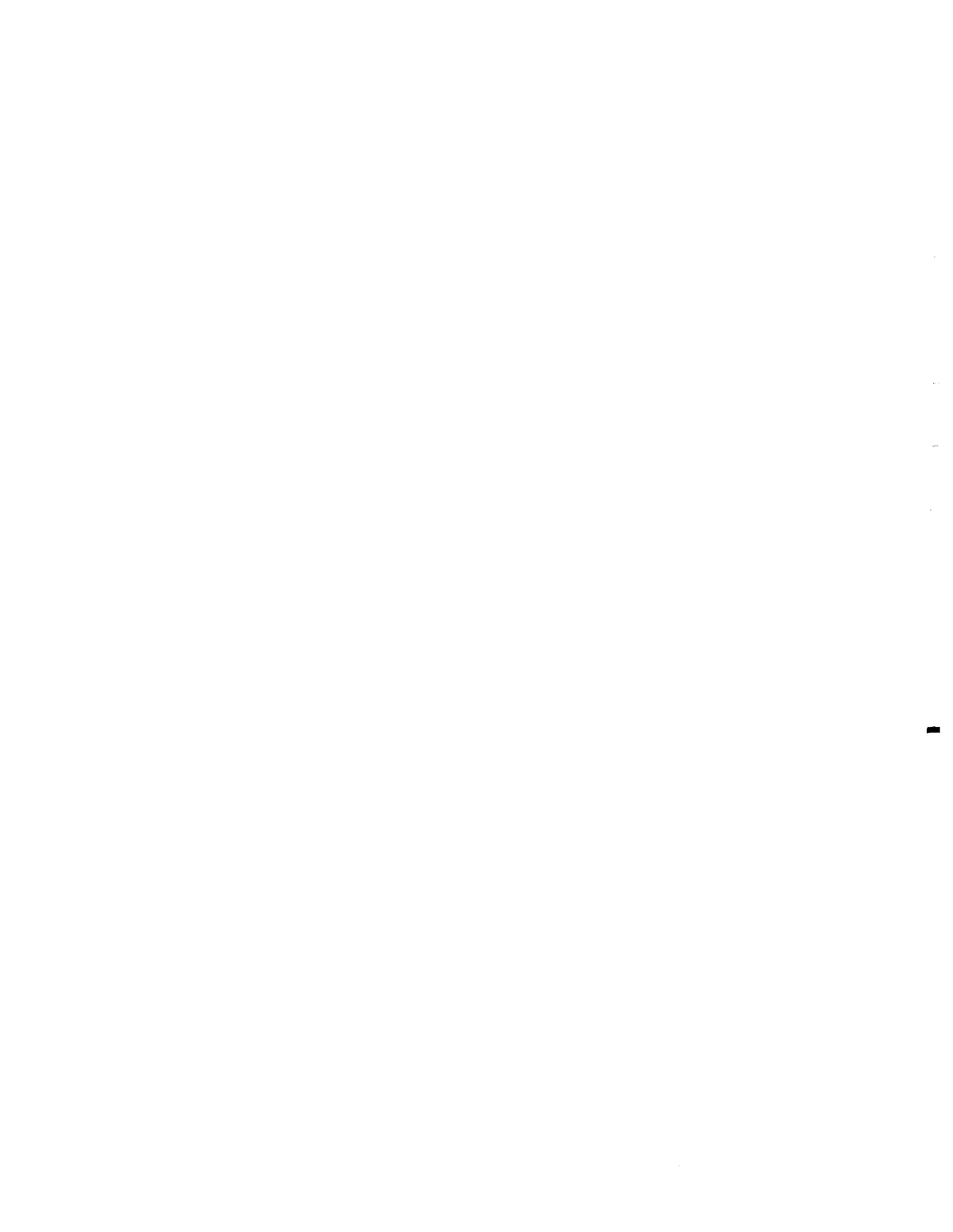
Title: _____

Date: _____

Sworn to and subscribed
before me this _____ day of _____, 2014

Notary Public

My Commission Expires _____



SECTION 00302

**SUBCONTRACTOR'S QUALIFICATION
STATEMENT AND QUESTIONNAIRE**

**NAME OF PROJECT: HOLLY SPRINGS DOWNTOWN SANITARY
SEWER SYSTEM**

**NAME OF OWNER: CHEROKEE COUNTY WATER AND SEWERAGE
AUTHORITY**

NAME OF CONTRACTOR:

NAME OF PROPOSED SUBCONTRACTOR:

I. INSTRUCTIONS

- A. ALL QUESTIONS ARE TO BE ANSWERED IN FULL, WITHOUT EXCEPTION. IF COPIES OF OTHER DOCUMENTS WILL ANSWER THE QUESTION COMPLETELY, THEY MAY BE ATTACHED AND CLEARLY LABELED. IF ADDITIONAL SPACE IS NEEDED, ADDITIONAL PAGES MAY BE ATTACHED AND CLEARLY LABELED.
- B. THE OWNER, AS WELL AS THE CONTRACTOR, THEIR AGENTS AND REPRESENTATIVES, SHALL BE ENTITLED TO CONTACT EACH AND EVERY REFERENCE LISTED IN RESPONSE TO THIS QUESTIONNAIRE, AND EACH ENTITY REFERENCED IN ANY RESPONSE TO ANY QUESTION IN THIS QUESTIONNAIRE. THE SUBCONTRACTOR, _____, (HEREINAFTER "SUBCONTRACTOR"), BY COMPLETING THIS QUESTIONNAIRE, EXPRESSLY AGREES THAT ANY INFORMATION CONCERNING THE SUBCONTRACTOR IN POSSESSION OF SAID ENTITIES AND REFERENCES MAY BE MADE AVAILABLE TO THE OWNER AND THE CONTRACTOR.
- C. ONLY COMPLETE AND ACCURATE INFORMATION SHALL BE PROVIDED BY THE SUBCONTRACTOR. THE SUBCONTRACTOR HEREBY WARRANTS THAT, TO THE BEST OF ITS KNOWLEDGE AND BELIEF, THE RESPONSES CONTAINED HEREIN ARE TRUE, ACCURATE, AND COMPLETE. THE SUBCONTRACTOR ALSO ACKNOWLEDGES THAT THE OWNER AND THE CONTRACTOR ARE RELYING ON THE TRUTH AND ACCURACY OF THE

RESPONSES CONTAINED HEREIN. IF IT IS LATER DISCOVERED THAT ANY MATERIAL INFORMATION GIVEN IN RESPONSE TO A QUESTION WAS PROVIDED BY THE SUBCONTRACTOR KNOWING IT WAS FALSE, IT SHALL CONSTITUTE GROUNDS FOR IMMEDIATE TERMINATION OR RESCISSION BY THE CONTRACTOR OF ANY SUBSEQUENT AGREEMENT BETWEEN THE CONTRACTOR AND THE SUBCONTRACTOR. THE OWNER AND THE CONTRACTOR SHALL ALSO HAVE AND RETAIN ANY OTHER REMEDIES PROVIDED BY LAW.

- D. IF THERE ARE ANY QUESTIONS CONCERNING THE COMPLETION OF THIS FORM, THE SUBCONTRACTOR IS ENCOURAGED TO CONTACT THE CONTRACTOR'S REPRESENTATIVE, _____, AT _____, TELEPHONE: _____.
- E. THE COMPLETED FORM IS DUE IN THE OFFICE OF THE CONTRACTOR NO LATER THAN _____.
- F. THIS FORM, ITS COMPLETION BY THE SUBCONTRACTOR, AND ITS USE BY THE SUBCONTRACTOR, AND ITS USE BY THE OWNER AND THE CONTRACTOR, SHALL NOT GIVE RISE TO ANY LIABILITY ON THE PART OF THE OWNER OR THE CONTRACTOR TO THE SUBCONTRACTOR OR ANY THIRD PARTY OR PERSON.

II. **GENERAL BACKGROUND**

- A. CURRENT NAME AND ADDRESS OF SUBCONTRACTOR:

- B. PREVIOUS NAME OR ADDRESS OF SUBCONTRACTOR, IF ANY:

C. CURRENT PRESIDENT
OR CHIEF EXECUTIVE
OFFICER: _____

Years in that position _____

D. NUMBER OF EMPLOYEES:
(Permanent) _____

E. NAME AND ADDRESSES OF
CURRENT AFFILIATED
COMPANIES (PARENT,
SUBSIDIARY, DIVISIONS):

III. **COMPANY EXPERIENCE - SIMILAR PROJECTS**

A. List all projects of reasonably similar nature, scope, and duration (similar to the Owner's Project) performed by your company in the last FIVE years, specifying, where possible, the name and last known address of the General Contractor of such projects. Attach extra sheets as necessary.

B. Of the projects listed in response to Subsection (A), identify any which was the subject of a substantial claim or lawsuit by, or against, the Subcontractor. Please identify in your response the nature of such claim or lawsuit, the court in which the case was filed, and the details of its resolution.

IV. **REFERENCES**

(ALL REFERENCES MUST BE CURRENT, I.E., ENTITIES WITH WHOM YOU HAVE DONE BUSINESS IN THE PRECEDING TWELVE MONTHS.)

A. **GENERAL CONTRACTORS**

Project #1

Name: _____

Location: _____

Contract Price: _____

General Contractor: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

Arch/Eng: _____

Contact/Phone: _____

Project #2

Name: _____

Location: _____

Contract Price: _____

General Contractor: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

Arch/Eng: _____

Contact/Phone: _____

Project #3

Name: _____

Location: _____

Contract Price: _____

General Contractor: _____

Address: _____

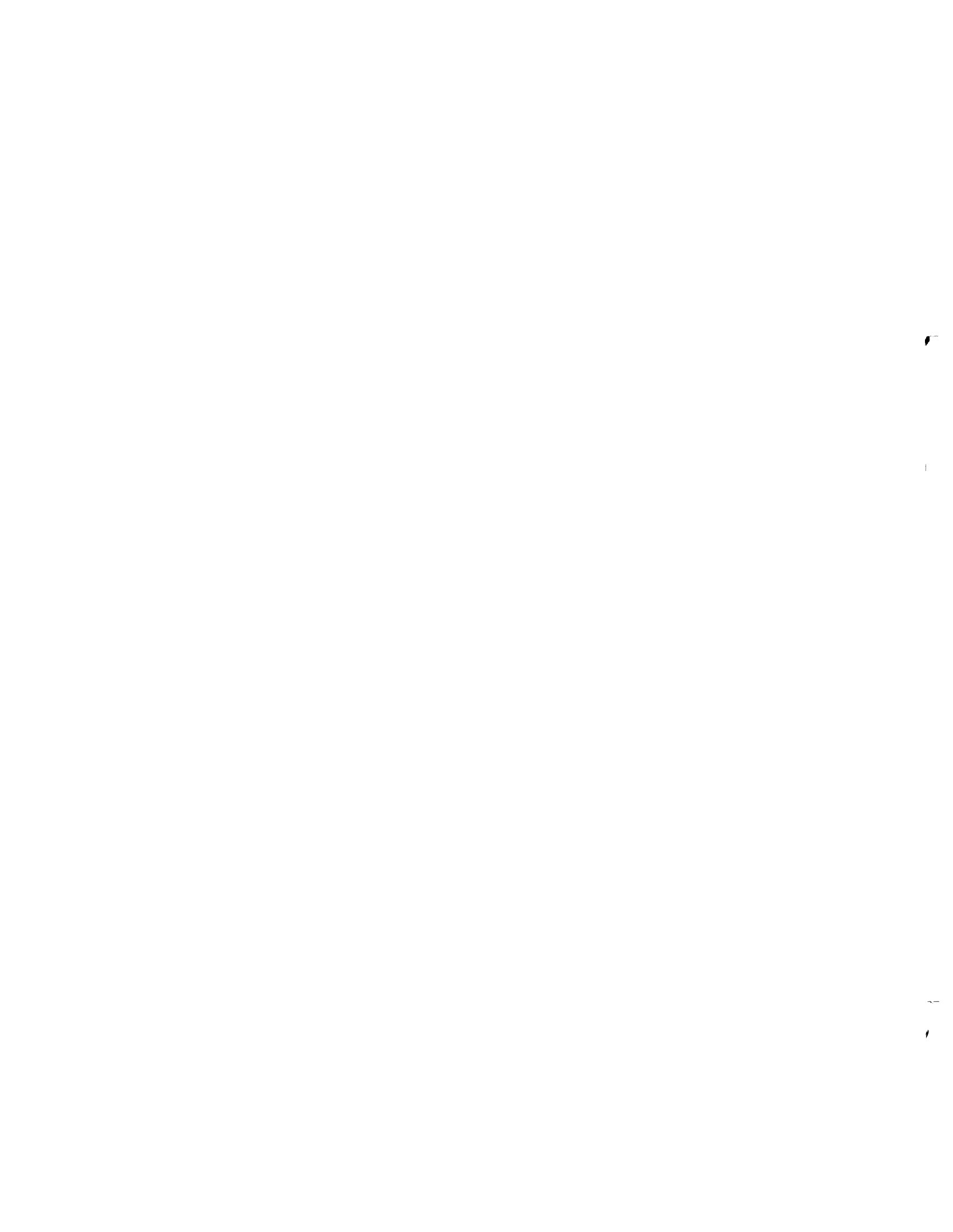
City/State: _____

Contact: _____

Phone: _____

Arch/Eng: _____

Contact/Phone: _____



Project #4

Name: _____

Location: _____

Contract Price: _____

General Contractor: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

Arch/Eng: _____

Contact/Phone: _____

D. **OWNERS**

Project #1

Name: _____

Location: _____

Contract Price: _____

Owner: _____

Address: _____

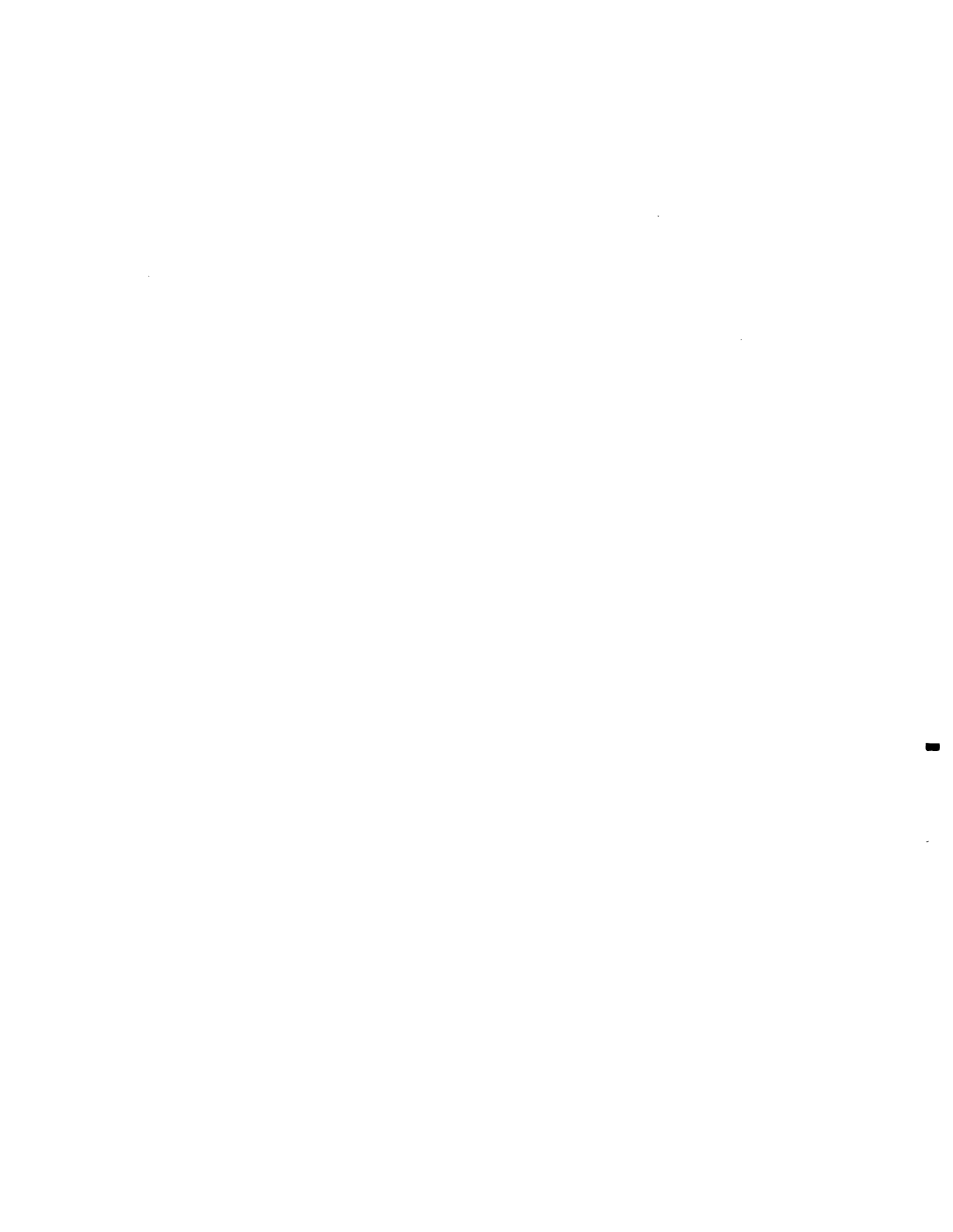
City/State: _____

Contact: _____

Phone: _____

Arch/Eng: _____

Contact/Phone: _____



Project #2

Name: _____

Location: _____

Contract Price: _____

Owner: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

Arch/Eng: _____

Contact/Phone: _____

Project #3

Name: _____

Location: _____

Contract Price: _____

Owner: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

Arch/Eng: _____

Contact/Phone: _____

Project #4

Name: _____

Location: _____

Contract Price: _____

Owner: _____

Address: _____

City/State: _____

Contact: _____

Phone: _____

Arch/Eng: _____

Contact/Phone: _____

VIII. **COMMENTS**

Please list any additional information that you believe would assist the Contractor in evaluating the possibility of using the Subcontractor on this Project.

I certify to the OWNER AND CONTRACTOR that the information and responses provided on this Questionnaire are true, accurate and complete. The OWNER AND THE CONTRACTOR, or their designated representatives, may contact any entity or reference listed in this Questionnaire. Each entity or reference may make any information concerning the Subcontractor available to the OWNER OR THE CONTRACTOR or their designated representatives.

Dated _____, 2014.

SUBCONTRACTOR: _____

By: _____

Title: _____

Date: _____

Sworn to and subscribed
before me this _____ day of _____, 2014

Notary Public

My Commission Expires _____

SECTION 00310

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS:

That _____ as Principal hereinafter called Contractor, and _____ a corporation organized and existing under the laws of the State of _____, as Surety, hereinafter called Surety, are held and firmly bound unto CHEROKEE COUNTY WATER & SEWERAGE AUTHORITY, as obligee, hereinafter called Owner, in the amount of _____ Dollars (\$ _____) in lawful money of the United States, for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated _____, 20____, entered into a contract with Owner for:

CHEROKEE COUNTY WATER & SEWERAGE AUTHORITY
HOLLY SPRINGS DOWNTOWN SANITARY SEWER SYSTEM

in accordance with drawings and specifications prepared by ATKINS, MARIETTA, GEORGIA which contract is by reference made a part hereof, and is hereinafter referred to as the contract.

NOW, THEREFORE, the condition of this obligation is such that, if Contractor shall promptly and faithfully perform said contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

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

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

- (1) Complete the contract in accordance with its terms and conditions, or

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

No action can be instituted on this bond after one year from the completion of the contract and the acceptance by Owner of the work thereunder.

In witness whereof, this instrument is executed in five (5) counterparts, each one of which shall be deemed an original this _____ day of _____ 20__ :

_____ Witness as to Principal _____ _____ Witness as to Surety _____	_____ Principal By _____ <div style="text-align: right;">Seal</div> _____ Surety By _____ <div style="text-align: center;">Attorney-in-Fact</div> Address: _____ _____
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Note: Date of Bond must not be prior to date of contract.

SECTION 00320

LABOR AND MATERIAL PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS:

That _____ as Principal, herein-after called Principal, and _____, a corporation organized and existing under the laws of the State of _____, as Surety, hereinafter called Surety, are held and firmly bound unto the CHEROKEE COUNTY WATER & SEWERAGE AUTHORITY as obligee, hereinbelow defined, in the amount of _____ Dollars (\$ _____) for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Principal has by written agreement dated _____, 20____, entered into a contract with the Owner for:

CHEROKEE COUNTY WATER & SEWERAGE AUTHORITY
HOLLY SPRINGS DOWNTOWN SANITARY SEWER SYSTEM

in accordance with drawings and specification prepared by Atkins, 192 Anderson Street, Suite 150, Marietta, Georgia, 30060 which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, the condition of this obligation is such that if the Principal shall promptly make payment to all claimants as hereinbelow defined, for all labor and materials used or reasonably required for use in the performance of the Contract, then this obligation shall be void; otherwise it shall remain in full force and effect, subject, however, to the following conditions:

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

LABOR AND MATERIAL PAYMENT BOND

- (2) The above-named principal and surety hereby jointly and severally agree with the Owner that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work or labor was done or performed, or materials were furnished by such claimant, may sue on this bond for the use of such claimant, prosecute the suit to final judgment for such sum or sums as may be justly due claimant, and have execution thereon. The Owner shall not be liable for the payment of any costs or expenses of any such suit.
- (3) No suit or action shall be commenced hereunder by any claimant,
 - (a) Unless claimant, other than one having a direct contract with the Principal, shall have given written notice to any two of the following: The Principal, the Owner, or the Surety above-named, within (90) days after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the Principal, Owner or Surety, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer.
 - (b) After one year from the completion of the Contract and the acceptance by Owner of the work thereunder, it being understood, however, that if any limitation embodied in this bond is prohibited by any law controlling the construction hereof such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.
 - (c) Other than in a state court of competent jurisdiction in and for the county or other political subdivision of the State in which the project, or any part thereof, is situated, or in the United States District Court for the district in which the project, or any part thereof, is situated and not elsewhere.
- (4) The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder inclusive of the payment by Surety or mechanics' liens which may be filed of record against improvement, whether or not claim for the amount of such lien be presented under and against this bond.
- (5) This payment bond is intended for all persons furnishing work or material for the public improvement and the contract is to be construed so as to be in accordance with applicable statutes.

LABOR AND MATERIAL PAYMENT BOND

Signed and sealed this ____ day of _____, 20 ____.

(Witness)

Principal SEAL

By _____

(Witness)

Surety SEAL

By _____

This bond is issued simultaneously with performance bond in favor of the Owner conditioned on the full and faithful performance of the Contract.

Note: Date of Bond must not be prior to date of contract.

SECTION 00360

GEORGIA SECURITY AND IMMIGRATION
COMPLIANCE ACT OF 2006
CERTIFICATIONS AND AFFIDAVITS

All Bids submitted to the Owner must include the signed following affidavits from the Contractor and any proposed sub-contractors, plus the indication of the number of employees employed.

Effective July 1, 2007, the following language is required to be included in all contracts entered into for the physical performance of services:

- A. Pursuant to the Georgia Security and Immigration Compliance Act of 2006, the Contractor understands and agrees that compliance with the requirements of O.C.G.A. § 13-10-91 and Georgia Department of Labor Rule 300-10-1-.02 are conditions of this Agreement. The Contractor further agrees that such compliance shall be attested by the Contractor through execution of the contractor affidavit required by Georgia Department of Labor Rule 300-10-1-.07, or a substantially similar contractor affidavit. The Contractor's fully executed affidavit is attached hereto and is incorporated into this Agreement by reference herein.
- B. By initialing in the appropriate line below, the Contractor certifies that the following employee-number category as identified in O.C.G.A. § 13-10-91 is applicable to the Contractor:
1. _____ 500 or more employees;
 2. _____ 100 or more employees;
 3. _____ Fewer than 100 employees.
- C. The Contractor understands and agrees that, in the event the Contractor employs or contracts with any subcontractor or subcontractors in connection with this Agreement, the Contractor shall:
1. Secure from each such subcontractor an indication of the employee-number category as identified in O.C.G.A. § 13-10-91 that is applicable to the subcontractor;
 2. Secure from each such subcontractor an attestation of the subcontractor's compliance with O.C.G.A. § 13-10-91 and Georgia Department of Labor Rule 300-10-1-.02 by causing each such subcontractor to execute the subcontractor affidavit required by Georgia Department of Labor Rule 300-10-1-.08, or a substantially similar subcontractor affidavit. The Contractor further understands and agrees that the Contractor shall require the executed subcontractor affidavit to become a part of the agreement between the Contractor and each such subcontractor. The Contractor agrees to maintain records of each subcontractor attestation required hereunder for inspection by the Department at any time.

STATE OF GEORGIA
_____ COUNTY

CONTRACTOR AFFIDAVIT AND AGREEMENT

Contracting Company's Name: _____

Owner's Name: Cherokee County Water and Sewerage Authority

Purchase Order No. (if Applicable): _____

COMES NOW before me, the undersigned officer duly authorized to administer oaths, the undersigned contractor, who, after being duly sworn, states as follows:

1.

By executing this affidavit, the undersigned contractor verifies its compliance with O.C.G.A. § 13-10-91 and Georgia Department of Labor Rule 300-10-1-.02, stating affirmatively that the individual, firm, or corporation which is contracting with the Cherokee County Water and Sewerage Authority has registered with and is participating in a federal work authorization program* in accordance with the applicability provisions and deadlines established in O.C.G.A. § 13-10-91 and Georgia Department of Labor Rule 300-10-1-.02.

2.

The undersigned contractor further agrees that, should it employ or contract with any subcontractor(s) in connection with the physical performance of services pursuant to the contract with the Cherokee County Water and Sewerage Authority of which this affidavit is a part, the undersigned contractor will secure from such subcontractor(s) similar verification of compliance with O.C.G.A. § 13-10-91 and Georgia Department of Labor Rule 300-10-1-.02 through the subcontractor's execution of the subcontractor affidavit required by Georgia Department of Labor Rule 300-10-1-.08 or a substantially similar subcontractor affidavit. The undersigned contractor further agrees to maintain records of such compliance and provide a copy of each such verification to the Cherokee County Water and Sewerage Authority at the time the subcontractor(s) is retained to perform such service.

EEV / E-Verify User Identification Number: _____

FURTHER AFFIANT SAYETH NOT.

Contractor Name (Company Name – Printed)

Date

Title of Authorized Officer or Agent of Contractor

Printed Name of Authorized Officer or Agent

Signature of Authorized Officer/ Agent

Sworn to and subscribed before me
This ____ day of _____, 20 ____

Notary Public

My commission expires: _____

* Any of the electronic verification of work authorization programs operated by the United States Department of Homeland Security or any equivalent federal work authorization program operated by the United States Department of Homeland Security to verify information of newly hired employees, pursuant to the Immigration Reform and Control Act of 1986 (IRCA), P.L. 99-603. As of the effective date of O.C.G.A. § 13-10-91, the applicable federal work authorization program is the “EEV / E-Verify Program” operated by the U.S. Citizenship and Immigration Services Bureau of the U.S. Department of Homeland Security, in conjunction with the Social Security Administration (SSA).

IMMIGRATION AND SECURITY FORM
GEORGIA SECURITY AND IMMIGRATION COMPLIANCE ACT AFFIDAVIT

Primary Contracting Company's Name: _____

Owner's Name: Cherokee County Water and Sewerage Authority

Purchase Order No. (if Applicable): _____

ADDITIONAL INSTRUCTIONS TO CONTRACTOR:

Identify all subcontractors used to perform under the CCWSA contract. In addition, you must attach a signed and notarized affidavit from each of the subcontractors listed below. The contractor is responsible for providing a signed and notarized affidavit to the Cherokee County Water and Sewerage Authority within five (5) days of the addition of any new subcontractor used to perform under the identified contract.

Primary Contractor's Name: _____

Subcontractors: _____

STATE OF GEORGIA
_____ COUNTY

SUBCONTRACTOR AFFIDAVIT

Contracting Company's Name: _____

Sub-Contractor's Name: _____

Owner's Name: Cherokee County Water and Sewerage Authority

Purchase Order No. (if Applicable): _____

COMES NOW before me, the undersigned officer duly authorized to administer oaths, the undersigned Subcontractor, who, after being duly sworn, states as follows:

By executing this affidavit, the undersigned Subcontractor verifies its compliance with O.C.G.A. § 13-10-91 and Georgia Department of Labor Rule 300-10-1-.02, stating affirmatively that the individual, firm, or corporation which is engaged in the physical performance of services under a contract with _____ (name of Contractor) on behalf of the Cherokee County Water and Sewerage Authority has registered with and is participating in a federal work authorization program* in accordance with the applicability provisions and deadlines established in O.C.G.A. § 13-10-91 and Georgia Department of Labor Rule 300-10-1-.02.

EEV / E-Verify User Identification Number: _____

FURTHER AFFIANT SAYETH NOT.

Sub-Contractor Name (Company Name – Printed)

Date

Title of Authorized Officer or Agent of Sub-Contractor

Printed Name of Authorized Officer or Agent

Signature of Authorized Officer/ Agent

Sworn to and subscribed before me
This ____ day of _____, 20____

Notary Public
My commission expires: _____

* Any of the electronic verification of work authorization programs operated by the United States Department of Homeland Security or any equivalent federal work authorization program operated by the United States Department of Homeland Security to verify information of newly hired employees, pursuant to the Immigration Reform and Control Act of 1986 (IRCA), P.L. 99-603. As of the effective date of O.C.G.A. § 13-10-91, the applicable federal work authorization program is the "EEV / E-Verify Program" operated by the U.S. Citizenship and Immigration Services Bureau of the U.S. Department of Homeland Security, in conjunction with the Social Security Administration (SSA).

STATE OF GEORGIA
_____ COUNTY

SUBCONTRACTOR AFFIDAVIT

Contracting Company's Name: _____

Sub-Contractor's Name: _____

Owner's Name: Cherokee County Water and Sewerage Authority

Purchase Order No. (if Applicable): _____

COMES NOW before me, the undersigned officer duly authorized to administer oaths, the undersigned Subcontractor, who, after being duly sworn, states as follows:

By executing this affidavit, the undersigned Subcontractor verifies its compliance with O.C.G.A. § 13-10-91 and Georgia Department of Labor Rule 300-10-1-.02, stating affirmatively that the individual, firm, or corporation which is engaged in the physical performance of services under a contract with _____ (name of Contractor) on behalf of the Cherokee County Water and Sewerage Authority has registered with and is participating in a federal work authorization program* in accordance with the applicability provisions and deadlines established in O.C.G.A. § 13-10-91 and Georgia Department of Labor Rule 300-10-1-.02.

EEV / E-Verify User Identification Number: _____

FURTHER AFFIANT SAYETH NOT.

Sub-Contractor Name (Company Name – Printed)

Date

Title of Authorized Officer or Agent of Sub-Contractor

Printed Name of Authorized Officer or Agent

Signature of Authorized Officer/ Agent

Sworn to and subscribed before me

This ____ day of _____, 20____

Notary Public

My commission expires: _____

* Any of the electronic verification of work authorization programs operated by the United States Department of Homeland Security or any equivalent federal work authorization program operated by the United States Department of Homeland Security to verify information of newly hired employees, pursuant to the Immigration Reform and Control Act of 1986 (IRCA), P.L. 99-603. As of the effective date of O.C.G.A. § 13-10-91, the applicable federal work authorization program is the "EEV / E-Verify Program" operated by the U.S. Citizenship and Immigration Services Bureau of the U.S. Department of Homeland Security, in conjunction with the Social Security Administration (SSA).

SECTION 00400

CONTRACT

THIS AGREEMENT made this the ____ day of _____, 20____, by
and between the CHEROKEE COUNTY WATER & SEWERAGE AUTHORITY,
hereinafter called "Owner", _____ a contractor doing
business as an individual, a partnership, or a corporation* of the City of _____,
County of _____, and State of _____ hereinafter called "Contractor".

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned, to be made and performed by the Owner, the Contractor hereby agrees to commence and complete the construction described as follows:

CHEROKEE COUNTY WATER & SEWERAGE AUTHORITY
HOLLY SPRINGS DOWNTOWN SANITARY SEWER SYSTEM

as more particularly described in the Bid documents in Section 00100 "Information for Bidders" and Sections 00200-00500 "Contract Documents", of which this contract is a part, hereinafter called the "Project", for the sum of _____, (\$ _____) and all extra work in connection therewith, under the terms as stated in the Contract Documents, and at his (its or their) own proper cost and expense to furnish all materials, supplies, machinery, equipment, tools, superintendence, labor, insurance and other accessories and services necessary to complete the said project in accordance with the conditions and prices stated in the proposal, the General Conditions of the Contract, the plans, which include all explanatory matter thereof, the specifications and contract documents therefore as prepared by Atkins, here entitled the "Engineers" and as enumerated in Paragraph 2 of the General Conditions, all of which are incorporated herein by reference and made a part hereof and collectively constitute the Contract.

The Contractor hereby agrees to commence work under this contract on or before a date to be specified in a written "Notice to Proceed" of the Owner and to substantially complete the project within two hundred and forty (240) consecutive calendar days thereafter, and to achieve final completion of the project within two hundred and seventy (270) consecutive calendar days thereafter. (See Section 00100.7.) The Contractor further agrees to pay, as liquidated damages, the sum of \$1,000 for each consecutive calendar day thereafter for failure to meet either deadline as provided in the General Conditions. If the Owner does not issue its "Notice to Proceed" within 6 months of the award of the bid, the Contractor may terminate this contract by giving written notice to Owner at any time after said 6 month period, before or after Owner issues its Notice to Proceed; however, should Owner issue it Notice to Proceed before Contractor gives notice of termination, Contractor has 5 business days following receipt thereof to give notice of termination or Contractor loses said right of termination.

The Owner agrees to pay the Contractor in current funds for the performance of the contract, subject to additions and deductions as provided in the General Conditions of the Contract, and to make payments on account thereof as provided in "Payments to Contractor," of the General Conditions.

IN WITNESS WHEREOF, the parties to those presents have executed this contract in five (5) counterparts, each of which shall be deemed an original, in the year and day first above mentioned.

Execution by Owner is not authorized without prior execution of the Certificate of Owner's Attorney immediately following this page.

CHEROKEE COUNTY WATER &
SEWERAGE AUTHORITY

By: _____
General Manager (Seal)

ATTEST:

Secretary

Witness

Contractor: _____

By: _____
(Seal)

ATTEST:

Secretary

Witness

Secretary of Owner should attest. If Contractor is corporation, secretary should attest.

Give proper title of each person executing contract.

SECTION 00500

CERTIFICATION OF OWNER'S ATTORNEY

I, the undersigned _____, the duly authorized and acting legal representative of the Cherokee County Water & Sewerage Authority, do hereby certify as follows:

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

Attorney's Signature

Date: _____

SECTION 00600

GENERAL CONDITIONS

1. CONTRACT AND CONTRACT DOCUMENTS

The Contract Documents as hereinafter enumerated in Paragraph 2 of the General Conditions, shall form this Contract and the provisions thereof shall be as binding upon the parties hereto as if they were fully set forth. The Table of Contents, Titles, Headings, Running Headlines and Marginal Notes contained herein and in said documents are solely to facilitate reference to various provisions of the Contract Documents and in no way effect, limit or cast light on the interpretation of the provisions to which they refer.

2. DEFINITIONS

The following terms as used in this contract are respectively defined as follows:

- (a) Contractor - A person, firm or corporation with whom the contract is made by the Owner.
- (b) Contract Documents - The Contract Documents are composed of the Advertisement for Bids; Instructions to Bidders; Form of Proposal, General Conditions, Supplementary Conditions, Detail Specifications, Form of Contract, Form of Bond(s), Addenda and the drawings including all changes incorporated herein before their execution.
- (c) Engineers - Refers to Atkins North America (Marietta, Georgia), the Engineers appointed by the Owner as representatives of the Owner, and to their properly authorized agents, limited to the particular duties entrusted to them.
- (d) Project Representative - Refers to the authorized representative of the Engineers, who is assigned to the site or any part thereof.
- (e) Owner - The party of the First Part in the accompanying Contract, and meaning the Cherokee County Water & Sewerage Authority.
- (f) Subcontractor - A person, firm or corporation supplying labor and materials or only labor for work at the site of the project for, and under separate contract or agreement with the contractor for performance of a part of the work at the site.
- (g) Work on (at) the Project - Work to be performed at the location of the project, including the transportation of materials and supplies to or from the location of the project by employees of the Contractor and any Subcontractor.

3. CORRELATION AND INTENT OF DOCUMENTS

The contract documents are complementary, and what is called for by any one shall be as binding as if called for by all.

The intent of the documents is to describe all construction entailed in this project. The contractor will furnish all labor and materials, equipment, transportation, tools and appurtenances such as may be reasonably required under the terms of the contract to make each part of the work complete.

The Drawings are intended to conform and agree with the Specifications; if, however, discrepancies occur, the Engineers will decide which shall govern. Special specifications stated on the Drawings govern that particular piece of construction and have equal weight and importance as the printed specifications. In the event of any discrepancies between the Drawings and the figures written thereon, the figures are to be taken as correct.

4. ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS

The Contractor will be furnished additional instructions and detail drawings as necessary to carry out the work included in the contract. The additional drawings and instructions thus supplied to the Contractor will coordinate with the Contract Documents and will be so prepared that they can be reasonably interpreted as part thereof. The Contractor shall carry out the work in accordance with the additional detail drawings and instructions.

The Contractor and the Engineer will prepare jointly (a) a schedule, fixing the dates at which special detail drawings will be required, such drawings, if any, to be furnished by the Engineer in accordance with said schedule, and (b) a schedule fixing the respective dates for the submission of shop drawings, the beginning of manufacture, testing and installation of materials, supplies, and equipment, and the completion of the various parts of the work; each such schedule to be subject to change from time to time in accordance with the progress of the work.

5. SHOP OR SETTING DRAWINGS

The Contractor shall submit promptly to the Engineer six (6) copies of each shop or setting drawing prepared in accordance with the schedule predetermined as aforesaid. After examination of such drawings by the Engineer and the return thereof, the Contractor shall make such corrections to the drawings as have been indicated and shall furnish the Engineer with two corrected copies. If requested by the Engineer the Contractor must furnish additional copies. Regardless of corrections made in or approval given to such drawings by the Engineer, the Contractor shall nevertheless be responsible for the accuracy of such drawings and for their conformity to the Plans and Specifications at the time he furnishes such drawings.

6. MATERIALS, SERVICES AND FACILITIES

- (a) It is understood that except as otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, superintendence, temporary construction of every nature, and all other services and facilities of every nature whatsoever necessary to execute, complete, and deliver the work within the specified time.
- (b) Any work necessary to be performed by the Contractor to complete the project on time after regular working hours, on Sundays or Legal Holidays, shall be performed without additional expense to the Owner.

7. CONTRACTOR'S TITLE TO MATERIALS

No materials or supplies for the work shall be purchased by the Contractor or by any Subcontractor subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. The Contractor warrants that he has good title to all materials and supplies used by him in the work, free from all liens, claims and/or encumbrances.

8. MATERIALS FURNISHED BY THE CONTRACTOR

All materials used in the work including equipment shall be new and unused materials of a reputable U.S. Manufacturer conforming to the applicable requirements of the Specifications, and no materials shall be used in the work until they have been approved by the Engineer. The Contractor shall furnish all materials necessary except as otherwise specifically noted or specified.

9. INSPECTION AND TESTING OF MATERIALS

All materials and equipment used in the construction of the project shall be subject to adequate inspection and testing in accordance with accepted standards. The laboratory or inspection agency shall be selected by the Owner. Materials of construction, particularly those upon which the strength and durability of the structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for uses intended.

10. "OR APPROVED EQUAL" CLAUSE

Whenever a material, article or piece of equipment is identified on the plans or in the specifications by reference to manufacturer's or vendor's names, trade names, catalogue numbers, etc., it is intended merely to establish a standard; and any material, article, or equipment of other manufacturers and vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable provided the material, article, or equipment so proposed, is in the opinion of the Engineer, of equal substance and function. It shall not be purchased or installed by the Contractor without the Engineer's written approval.

11. PATENTS

- (a) The Contractor shall hold and save the Owner and its officers, agents, servants, and employees harmless from liability of any nature or kind, including cost and expenses for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the contract, including its use by the Owner, unless otherwise specifically stipulated in the Contract Documents.
- (b) License or Royalty Fees: License and/or Royalty Fees for the use of a process which is authorized by the Owner of the project must be reasonable, and paid to the holder of the patent, or his authorized licensee, direct by the Owner and not by or through the Contractor.
- (c) If the Contractor uses any design, device or materials covered by letters, patent or copyright, he shall provide for such use by suitable agreement with the Owner of such patented or copyrighted design, device or material. It is mutually agreed and understood, that, without exception, arising from the use of such design, device, or materials or in any way involved in the work, the Contractor and/or his Sureties shall indemnify and save harmless the Owner of the project from all claims for infringement by the reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with work agreed to be performed under this contract and shall indemnify the Owner for any cost, expense or damage which it may be obliged to pay by reason of such infringement at any time during the prosecution of the work or after completion of the work.

12. SURVEYS, PERMITS AND REGULATIONS

Unless otherwise expressly provided for in the Specifications, the Owner will furnish to the Contractor any control alignment and bench mark data from previous engineering surveys.

The Contractor shall procure and pay all permits, licenses and approvals necessary for the execution of his contract.

The Contractor shall comply with all laws, ordinances, rules, orders, and regulations relating to performance of the work, the protection of adjacent property, and the maintenance of passageways, guard fences or other protective facilities.

13. LINES AND GRADES

Bench marks and referenced horizontal control points will be shown on the plans. Construction staking will be done by the Contractor at no additional cost to the Owner.

The Contractor shall furnish all necessary materials and competent personnel, and shall be responsible for the adequacy and accuracy of construction staking.

The Contractor shall furnish the Engineer with an accurate record of the location of all underground pipes and other structures, and any changes from plans during construction.

14. CONTRACTOR'S OBLIGATIONS

The Contractor shall and will, in good workmanlike manner do and perform all work and furnish all supplies and materials, machinery, equipment, facilities and means, except as herein otherwise expressly specified, necessary or proper to perform and complete all the work required by this contract, within the time herein specified, in accordance with the plans and drawings covered by this contract any and all supplemental plans and drawings, and in accordance with the directions of the Engineer as given from time to time during the progress of the work. He shall furnish, erect, maintain and remove such construction plant and such temporary works as may be required. He alone shall be responsible for the safety, efficiency and adequacy of his plant, appliances, and methods, and for any damage which may result from their failure of their improper construction, maintenance, or operation.

The Contractor shall observe, comply with, and be subject to all terms, conditions, requirements, and limitations of the Contract and specifications, and shall do, carry on, and complete the entire work to the satisfaction of the Engineer and the Owner.

15. CONTRACTOR'S RESPONSIBILITY

The Contractor shall be responsible for all material and work until they are finally accepted by the Owner, and shall repair at his own expense any damage that they sustain before their final acceptance. The Contractor shall be responsible for all damages caused by him of whatever nature and must settle all claims arising from such damage without cost to the Owner; he shall act as defendant in, and bear the expense of each and every suit of any and every nature which may be brought against him or the Owner, by reason of, or connected with the work under the Contract. Should any claim arise, the Owner may hold back sufficient money to meet said claims or until the Contractor has satisfied the Owner that all claims against him as the result of his work have been adjusted. He must also show that there are no claims or liens whatsoever outstanding at the completion of his contract before final payment is made.

16. WEATHER CONDITIONS

In the event of temporary suspension of work, or during inclement weather, or whenever the Engineer shall direct, the Contractor will, and will cause his subcontractors to protect carefully his and their work and materials against damage or injury from the weather. If, in the opinion of the Engineer, any work or materials shall have been damaged or injured by reason of failure on the part of the Contractor or any of his subcontractors so to protect his work, such materials shall be removed and replaced at the expense of the Contractor.

17. SAFETY PROVISIONS

The Contractor shall comply with the Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596) and under Sec. 107 or the Contract Work Hours and Safety Standards Act (PL 91-54).

The Contractor shall be responsible for the Safety, efficiency, and adequacy of his plant, appliances and methods, and for any damage which may result from their failure of their improper construction, maintenance and operation.

The Contractor shall employ, when necessary, watchmen on the work and shall, when necessary, erect and maintain such strong and suitable barriers and such light as will effectually prevent the happening of any accident to health, limb or property.

18. USE OF EXPLOSIVES

When the use of explosives is necessary for the prosecution of the work, the Contractor shall use the utmost care not to endanger life or property, and whenever directed or otherwise indicated, the number and size of the charges shall be reduced. The Contractor shall notify the proper representatives of any public service corporation, any company, or any individual at least eight (8) hours in advance of any blasting which may endanger his or their property on, along, or adjacent to the site of the work. All explosives shall be stored in a secure manner and all storage places shall be marked clearly "DANGEROUS EXPLOSIVES", and shall be in care of competent watchmen at all times.

A pre-blast and post-blast survey will be done for all homes in the area of the blast. Photos or a video will be made of all structures and houses near to the blast showing existing cracks in walls, foundations, slabs, pavement or sidewalks, etc. Before blasting, a company with experience with vibration monitoring will place portable seismographs near structures to measure vibrations during all blasting. The seismograph monitors should record ground vibrations whenever they exceed PPV (Peak Particle Velocity) of 0.05 in/sec and record them on a printout.

The maximum allowable limit for construction vibration should be no more than 0.50 in/sec. A vibration monitoring report shall be done after that blasting is complete.

19. SANITARY PROVISIONS

The Contractor shall provide and maintain in a neat and sanitary condition such accommodations for the use of his employees as may be necessary to comply with the regulations of the State Board of Health and all local ordinances. No nuisance will be permitted.

20. PUBLIC CONVENIENCE AND SAFETY

Materials stored at the site of the work shall be so placed and the work shall, at all

times, be so conducted as to cause no greater obstruction to traffic than is considered permissible by the Engineer. No roadway shall be closed or opened except by express permission of the Engineer and the Contractor's proper notification of local fire and police departments. Precaution shall be exercised at all times for the protection of persons and property. The safety provisions of applicable laws, building and construction codes shall be observed. Machinery, equipment and other hazards shall be guarded in accordance with the safety provisions of the manual of Accident Prevention in Construction, published by the Associated General Contractors of America to extent that such provisions are not in contravention of applicable laws.

21. PROTECTION OF WORK AND PROPERTY - EMERGENCY

The Contractor shall at all times safely guard the Owner's property from injury or loss in connection with this contract. He shall at all times safely guard and protect his own work, and that of adjacent property from damage. The Contractor shall replace or make good any such damage, loss or injury unless such be caused directly by errors contained in the contract or by the Owner, or his duly authorized representative.

In case of an emergency which threatens loss or injury of property, and/or safety of life, the Contractor will be allowed to act, without previous instructions from the Owner in a diligent manner. He shall notify the Owner immediately thereafter. Any claim for compensation by the Contractor due to such extra work shall be promptly submitted to the Owner for approval.

Where the Contractor has not taken action but has notified the Owner of an emergency threatening injury to persons or damage to the work or any adjoining property, he shall act as instructed or authorized by the Owner.

The amount of reimbursement claimed by the Contractor on account of any emergency action shall be determined in the manner provided in Paragraph 27 of the General Conditions.

22. INSPECTION

The authorized representatives and agents of the Owner, shall be permitted to observe all work, materials, payrolls, records of personnel, invoices of materials and other relevant data and records.

23. REPORTS, RECORDS AND DATA

The Contractor shall submit to the Owner such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as the Owner may request concerning work performed or to be performed under this contract.

24. SUPERINTENDENCE BY CONTRACTOR

At the site of the work, the Contractor shall employ a construction superintendent or

foreman who shall have full authority to act for the Contractor. It is understood that such representative shall be acceptable to the Owner and the Engineer and shall be one who can be continued in that capacity for the particular job involved unless he ceases to be on the Contractor's payroll.

25. COMPETENT LABOR

The Contractor shall employ only competent and skilled workers on the project. The Contractor shall have a competent superintendent or foreman present at all times when the work is in progress and with authority to receive orders and execute the work.

The Contractor shall, upon demand from the Engineer, immediately remove any superintendent, foreman or worker whom the Engineer may consider incompetent or undesirable.

26. CONSTRUCTION EQUIPMENT

The Contractor shall provide all necessary equipment in good repair for the expeditious construction of the work. Any equipment not adapted for the work, in such repair as to be dangerous to the project or workers, shall not be used.

27. CHANGES IN THE WORK

27.1 Without invalidating the Agreement, the 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, the CONTRACTOR will 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 28. A Change Order signed by the CONTRACTOR indicates his agreement therewith.

27.2 The 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 the CONTRACTOR believes that any Field Order authorized by the ENGINEER entitles him to an increase in the Contract Price or extension of Contract Time, he shall inform the ENGINEER in writing of the amount of increased price or time associated with the Field Order, and he shall include reference to appropriate contract documents supporting the basis for the claim, and he shall not proceed with the work in question until a written decision has been rendered by the ENGINEER.

27.3 Any changes or additional work performed by the CONTRACTOR without authorization of a Change Order will not entitle him to an increase in the Contract Price or an extension of the Contract Time, except in the case of an emergency.

27.4 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 Price and the amount of the applicable bonds shall be adjusted accordingly. The CONTRACTOR will furnish proof of such adjustment to the OWNER.

27.5 The term Change Order is defined as a written order to the CONTRACTOR signed by the OWNER (or the ENGINEER acting as the OWNER'S agent) which authorizes a change in the work or the contract price or the contract time issued after execution of the Agreement.

27.6 The Contract Price constitutes the total compensation payable to the CONTRACTOR for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by the CONTRACTOR shall be at his expense without changing the Contract Price, except where authorized by Change Order.

28. CHANGE IN CONTRACT PRICE

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

28.1.1 Where the Work involved is covered by unit prices contained in the Contract Documents, by application of unit prices to the quantities of the items involved.

28.1.2 By mutual acceptance of a lump sum (which may include an allowance for overhead and profit not necessarily in accordance with paragraph 28.4.2.1).

28.1.3 On the basis of the Cost of the Work (determined as provided in paragraphs 28.4 and 28.5) plus a CONTRACTOR'S Fee for overhead and profit (determined as provided in paragraphs 28.4 and 28.5).

28.2 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 28.3.

28.2.1 Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the Work under schedules of job classifications agreed upon by OWNER and CONTRACTOR. 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 foremen 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.

28.2.2 Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and manufacturers' field services required in connection therewith.

28.2.3 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.

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

28.2.5 Supplemental costs including the following:

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

28.2.5.2 Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office and temporary facilities at the site and hand tools not owned by the 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.

28.2.5.3 Rentals of all construction equipment and machinery and the parts thereof whether rented from CONTRACTOR or others in accordance with rental agreements approved by OWNER with the advice of ENGINEER, and the costs of transportation, loading, unloading, installation, dismantling and removal 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.

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

28.2.5.5 Deposits lost for causes other than CONTRACTOR's negligence, royalty payments and fees for permits and licenses. Costs for permits and licenses must be shown as a separate item.

28.2.5.6 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.

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

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

28.2.5.9 Cost of premiums for additional Bonds and Insurance required because of changes in the Work.

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

28.3.1 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 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 28.2.1 - all of which are to be considered administrative costs covered by the CONTRACTOR's Fee.

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

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

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

28.3.5 Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraph 28.4.

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

28.4.1 a mutually acceptable firm fixed price; or if none can be agreed upon.

28.4.2 a fee based on the following percentages of the various portions of the Cost of the Work.

28.4.2.1 for costs incurred under paragraphs 28.2.1 and 28.2.2, the CONTRACTOR's Fee shall be fifteen percent.

28.4.2.2 for costs incurred under paragraph 28.2.3, the CONTRACTOR's Fee shall be five percent; and if a subcontract is on the basis of Cost of the Work Plus a Fee, the maximum allowable to CONTRACTOR on account of overhead and profit of all Subcontractors shall be fifteen percent:

28.4.2.3 no fee shall be payable on the basis of costs itemized under paragraphs 28.2.4, 28.2.5, and 28.3;

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

28.4.2.5 when both additions and credits are involved in any one change, the adjustment in CONTRACTOR's Fee shall be computed on the basis of the net change in accordance with paragraphs 28.4.2.1 through 28.4.2.4, inclusive.

28.5 Whenever the cost of any Work is to be determined pursuant to paragraph 28.2 or 28.3. CONTRACTOR will submit in form acceptable to ENGINEER an itemized cost breakdown together with supporting data.

29. CHANGE OF THE CONTRACT TIME

29.1 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 ten 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 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.

29.2 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 paragraph 29.1. 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.

29.3 All time limits stated in the Contract Documents are of the essence of the Agreement. The provisions of this Article 29 shall not exclude recovery for damages (including compensation for additional professional services) for delay by either party.

30. CORRECTION OF WORK

All work, all materials, whether incorporated in the work or not, all processes of manufacture, and all methods of construction shall be at all times and places subject to the review of the Engineer who shall be the final judge of the quality and suitability of the work, material, processes of manufacture and methods of construction for the purposes for which they are used. Should they fail to meet his approval, they shall be forthwith reconstructed, made good, replaced and/or corrected, as the case may be, by the Contractor at his own expense. Rejected material shall immediately be removed from the site. If, in the opinion of the Engineer, it is undesirable to replace any defective or damaged materials or to reconstruct or correct any portion of the work injured or not performed in accordance with the Contract Documents, the compensation to be paid to the Contractor hereunder shall be reduced by such amount as in the judgment of the Engineer shall be equitable. It is not intended that the Engineer should be liable for the Contractor's performance of the work nor for safety during construction.

31. EXISTING UNDERGROUND UTILITIES AND STRUCTURES

(a) The Owners and/or operators of private or public utilities shall have access to such utility at all times, for the installation, maintenance, adjustment, repair and operation of said utility. No extra compensation will be allowed because of the delay or interference caused by such work.

(b) In preparing the plan drawings there has not been an all-inclusive search for identifying existing underground utilities. Therefore any information pertaining to existing utilities is provided only for preliminary purposes and implies no guarantee as to accuracy or completeness. Prior to blasting or excavation the Contractor is responsible for contacting all utility owners in the area. Specifically, the Contractor shall contact the "one-call notification center" 72 hours in advance of blasting or excavation as required by Georgia Law.

(c) Wherever existing utilities are encountered which conflict in actual position and location with the proposed work, the contractor shall promptly notify the Engineer for resolution of the conflict.

(d) Temporary supports, beams or bridging for utilities shall be left in place during backfill operations unless otherwise directed by the Engineer.

(e) All costs in connection with supporting, protecting, relocating, removal, repair of damage, restoration and other work on affected existing utilities and other existing underground structures whether or not they are

shown on the plans, not borne by the Owner or Owners of the utilities, shall be borne by the Contractor. No separate payment will be made for any work performed as herein above specified unless otherwise stated in the proposal as a separate payment item. All costs in connection therewith shall be included in the contract price for the item to which the work pertains.

(f) The Contractor shall be solely and directly responsible to the Owner and/or other operator of such utility properties for any damage, injury, expense, loss, inconvenience or delay, or for any suits, actions, claims of any character brought on account of any injuries or damages which may result from the carrying out of the work.

32. SUBSURFACE CONDITIONS FOUND DIFFERENT

Should the Contractor encounter sub-surface and/or latent conditions at the site materially differing from those shown on the plans or indicated in the specifications, he shall immediately give notice to the Engineer of such conditions before they are disturbed. The Engineer will thereupon promptly investigate the conditions, and if he finds that they materially differ from those shown on the plans or indicated in the specifications, he will at once make such changes in the plans and/or specifications as he may find necessary, any increase or decrease of cost resulting from such changes to be adjusted in the manner provided in Paragraph 27 of the General Conditions.

33. CLAIMS FOR EXTRA WORK

No claim for extra work or cost shall be allowed unless the same was one in pursuance of a written order of the Engineer approved by the Owner, as aforesaid, and the claim presented with the first estimate after the changed or extra work is done. When work is performed under the terms of subparagraph 27.a,3 of the General Conditions, the Contractor shall furnish satisfactory bills, payrolls and vouchers covering all items of cost and when requested by the Owner, give the Owner access to accounts relating thereto.

34. RIGHT OF THE OWNER TO TERMINATE CONTRACT

In the event that any of the provisions of this contract are violated by the Contractor or by any of his Subcontractors, the Owner may serve written notice upon the Contractor and the surety of its intention to terminate the contract, such notices to contain the reasons for such intention to terminate the contract, and unless within ten (10) days after the serving of such notice upon the Contractor such violation or delay shall cease and satisfactory arrangement of correction be made, the contract shall, upon the expiration of said ten (10) days, cease and terminate. In the event of any such termination the Owner shall immediately serve notice thereof upon the Surety and the Contractor and the Surety shall have the right to take over and perform the contract; provided, however, that if the Surety does not commence performance thereof within ten (10) days from the date of the mailing to such Surety of notice of termination, the Owner may take over the work and prosecute the same to completion by contract or by force account for the account and at the expense of the

Contractor and the Contractor and his Surety shall be liable to the Owner for any excess cost occasioned the Owner thereby, and in such event the Owner may take possession of and utilize in completing the work, such materials, appliances and plant as may be on the site of the work and necessary therefore.

35. CONSTRUCTION SCHEDULE AND PERIODIC ESTIMATES

Immediately after execution and delivery of the contract, and before the first partial payment is made, the Contractor shall deliver to the Owner an estimated construction progress schedule in form satisfactory to the Owner showing the proposed dates of commencement and completion of each of the various subdivisions of work required under the contract documents and the anticipated amount of each monthly payment that will become due the Contractor in accordance with the progress schedule. The Contractor shall also furnish on forms to be supplied by the Owner, (a) a detailed estimate giving a complete breakdown of the contract price and (b) periodic itemized estimate of work done for the purpose of making partial payments thereon. The costs employed in making up any of these schedules will be used only for determining the basis of partial payments and will not be considered as fixing a basis for additions to or deductions from the contract price.

36. PAYMENTS TO CONTRACTORS

- (a) No later than thirty (30) days after submittal of a progress payment request the Owner shall make a progress payment to the Contractor on the basis of a duly certified and approved estimate of the work performed during the preceding calendar month under this contract, but to insure the proper performance of this contract, the Owner shall retain ten percent (10%) of the amount of each estimate (as retainage) until fifty percent (50%) of the work on the project has been completed. After 50% of work has been completed on time and in a manner satisfactory to the Owner, retainage on future payments will be discontinued. This will not affect the retained amounts on the first fifty percent (50%) of the work which may continue to be held to ensure satisfactory completion of the project. If after discontinuing the retention at fifty percent (50%) completion the Owner determines that the work is unsatisfactory or has fallen behind schedule, retainage may be resumed at the previous level.
- (b) At substantial completion of the work and as the Owner's authorized contract representative determines the work to be reasonably satisfactory, the Owner shall within 30 days after invoice and other appropriate documentation, as may be required by the contract documents are provided pay the retainage to the contractor. If at that time there are any remaining incomplete minor items, an amount equal to 200 percent (200%) of the value of each item as determined by the Owner's authorized contract representatives shall be withheld until such item or items are completed.
- (c) In preparing estimates the material delivered on the site and preparatory work done may be taken into consideration.

- (d) All material and work covered by partial payments made shall thereupon become the sole property of the Owner, but this provision shall not be construed as relieving the Contractor from the sole responsibility for the care and protection of materials and work upon which payments have been made or the restoration of any damaged work, or as a waiver of the right of the Owner to require the fulfillment of all of the terms of the contract.
- (e) The Contractor agrees that he will indemnify and save the Owner harmless from all claims growing out of the lawful demands of Subcontractors, laborers, workmen, mechanics, material men, and furnishers of machinery and parts thereof, equipment, power tools, and all supplies, including commissary incurred in the furtherance of the performance of this contract. The Contractor shall, at the Owner's request, furnish satisfactory evidence that all obligations of the nature hereinabove designated have been paid, discharged, or waived. If the Contractor fails to do so, then the Owner may, after having served written notice on the said Contractor, either pay unpaid bills, of which the Owner has written notice, direct, or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the Contractor shall be resumed, in accordance with the terms of this contract, but in no event shall the provisions of this sentence be construed to impose any obligations upon the Owner to either the Contractor or his Surety. In paying any unpaid bills of the Contractor, the Owner shall be deemed the agent of the Contractor, and any payment so made by the Owner shall be considered as a payment made under the contract by the Owner to the Contractor and the Owner shall not be liable to the Contractor for any such payments made in good faith.
- (f) If at any time the Owner shall determine that the amount of work completed at that time is lagging behind the expired contract time by more than 20 percent, the Owner may determine that the Contractor is not faithfully performing on the contract and therefore the Owner may elect to withhold all monies and refrain from making any additional payments to the Contractor until such time as the Owner determines the work to be progressing satisfactorily.
- (g) On all contracts relating to installation, extension, improvement, maintenance or repair of any water or sewer facility, retainage shall be invested at the current market rate and any interest earned on the retained amount shall be paid to the contractor when the project has been completed within the time limits specified and for the price specified in the contract, or in any amendments or change orders approved in accord with the terms of the contract.

Final payment of the retained amounts to the contractor under the contract to which the retained amounts relate shall be made after certification by the Engineer that the work has been, to the best of his knowledge, satisfactorily completed and is accepted.

37. ACCEPTANCE AND FINAL PAYMENT

When the project provided for under this contract shall have been completed by the Contractor, and all parts of the work have been approved by the Engineer according to the contract, the Engineer shall, within ten (10) days unless otherwise provided, make final inspection and advise the Contractor to prepare a final estimate, showing the value of work as soon as the necessary measurements and computations can be made. Contractor and Owner acknowledge that all progress certificates or estimates upon which payments shall have been made, will have been based on approximations only, and will be subject to correction in the final payment. Contractor shall prepare the final estimate and submit the same for payment within ninety (90) days of notification of final acceptance of the project by the Engineer. If Contractor fails to submit a final estimate and bill within said ninety (90) day period, the Contractor will be deemed to have conclusively waived, relinquished and forfeited any amounts remaining due under this contract, and the Owner may defund the project and reappropriate said funds with no further liability under this contract or otherwise to Contractor. The amount of the final estimate, less any sums that may have been deducted or retained under the provisions of this contract, will be paid to the Contractor within sixty (60) days after approval by the Engineer, provided that the Contractor has properly maintained and operated the project as specified under the attached specifications, and provided, that he has furnished to the Owner a sworn affidavit to the effect that all bills are paid and no suits are pending in connection with the work done or labor and material furnished under this contract.

38. PAYMENTS BY CONTRACTORS

The Contractor shall pay (a) for all transportation and utility services not later than the 20th day of the calendar month following that in which such services are rendered, (b) for all materials, tools, and other expendable equipment to the extent of 90 percent of the cost thereof, not later than the 20th day of the calendar month following that in which such materials, tools and equipment are delivered at the site of the project, and the balance of the cost thereof not later than the 30th day following the completion of that part of the work in or on which such materials, tools and equipment are incorporated or used, and (c) to each of his Subcontractors, not later than the 5th day following each payment to the Contractor, the respective amounts allowed the Contractor on account of the work performed by his Subcontractors to the extent of each Subcontractor's interest therein.

39. CONTRACTOR'S AND SUBCONTRACTOR'S INSURANCE

The Contractor shall not commence work under this Contract until he has obtained all the insurance required under this paragraph and such insurance has been reviewed by the Owner, nor shall the Contractor allow any Subcontractor to commence work on his subcontract until the insurance has been so obtained and reviewed.

- a. Contractor's Liability Insurance: Contractor shall purchase and maintain

such comprehensive general liability and other insurance as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the work and Contractor's other obligations under the Contract Documents, whether such performance is indirectly employed by any of them, or by anyone for whose acts any of them may be liable.

1. Claims under workers' or workmen's compensation, disability benefits and other similar employees benefit acts;
2. Claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;
3. Claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;
4. Claims for damages insured by personal injury liability coverage which are sustained (i) by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or (ii) by any other person for any other reason.
5. Claims for damages, other than to the work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom; and
6. Claims for damages because of bodily injury or death of any person or property damage arising out of the Ownership, maintenance or use of any motor vehicle.

The insurance required by this paragraph shall include the specific coverages and be written for not less than the limits of liability and coverages provided in these specifications, or required by law, whichever is greater. The comprehensive general liability insurance shall include completed operations insurance. All such insurance shall contain a provision that the coverage afforded will not be cancelled, materially changed or renewal refused until at least thirty days prior written notice has been given to Owner and Engineer. All such insurance shall remain in effect until final payment and at all times thereafter when Contractor may be correcting, removing or replacing defective work. In addition, Contractor shall maintain such completed operations insurance for at least one year after final payment and furnish Owner with evidence of continuation of such insurance at final payment. Renewal certificates shall be sent to the Owner 30 days prior to the expiration date of any policy required herein.

- b. Contractual Liability Insurance: The comprehensive general liability insurance required by paragraph (a) will include contractual liability insurance applicable to Contractor's obligations under separate contract and subcontracting.

- c. Unless otherwise provided in these Supplementary Conditions, Contractor shall purchase and maintain property insurance upon the work at the site to the full insurable value thereof (subject to such deductible amounts as may be provided in these supplementary conditions or required by law). This insurance shall include the interest of Owner, Contractor and Subcontractors in the work, shall provide "all risk" insurance for physical loss and damage including but not limited to fire, lightning, windstorms, hail, smoke, explosion, riot, aircraft, vehicles, falling objects, flood, earthquake, theft, vandalism, malicious mischief, collapse, water damage and other perils, and shall include damages, losses and expenses arising out of or resulting from any insured loss or incurred in the repair or replacement of any insured property (including fees and charges of engineers, architects, attorneys and other professionals). If not covered under the "all risk" insurance or otherwise provided in these Supplementary Conditions, Contractor shall purchase and maintain similar property insurance on portions of the work stored on and off the site or in transit when such portions of the work are to be included in an Application for Payment. The policies of insurance required to be purchased and maintained by Contractor in accordance with paragraphs c and d shall contain a provision that the coverage afforded will not be cancelled, materially changed or renewal refused until at least thirty days prior written notice has been given to the Owner.
- d. Contractor shall purchase and maintain such boiler and machinery insurance as may be required by these Supplementary Conditions or by law. This insurance shall include the interest of Owners, Contractor and Subcontractors in the work and shall provide coverage for all installed and functional mechanical equipment for the full replacement value of the equipment.
- e. Owner shall not be responsible for purchasing and maintaining any property insurance to protect the interests of Contractor or Subcontractors in the work to the extent of any deductible amounts that are provided in the supplemental conditions. If Contractor wishes property insurance coverage within the limits of such amounts, Contractor may purchase and maintain it at his own expense.
- f. If Owner has any objection to the coverage afforded by or other provisions of the insurance required to be purchased and maintained by Contractor in accordance with paragraphs a, b, c, and d, Owner will notify Contractor thereof within ten days of the date of delivery of such certificates, to Owner. Contractor will provide to the Owner such additional information in respect of insurance provided by him as Owner may reasonably request. The right of the Owner to review and comment on Certificates of Insurance is not intended to relieve the Contractor of his responsibility to provide insurance coverage as specified nor to relieve the Contractor of his liability for any claims which might arise.

g. Partial Utilization - Property Insurance: If Owner finds it necessary to occupy or use a portion or portions of the work prior to Substantial Completion of all the work, such use or occupancy may be accomplished provided that no such use or occupancy shall commence before the insurers providing the property insurance have acknowledged notice thereof and in writing effected the changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be cancelled or lapse on account of any such partial use or occupancy.

h. The Contractor shall carry and maintain Combined Excess Liability (Umbrella) Insurance for a limit of not less than the following:

Each Occurrence:	\$4,000,000
Aggregate:	\$4,000,000

i. The limits of liability for the insurance required by paragraph (a) of the General Conditions shall provide coverage for not less than the following amounts or greater where required by law:

For claims under paragraph 39.a.1 and 39.a.2, Worker's Compensation:

(1) State:	Statutory
(2) Federal:	Statutory
(3) Employer's Liability – Each Accident:	\$500,000
Employer's Liability – Disease – Each Employee:	\$500,000
Employer's Liability – Disease – Policy Limit:	\$500,000

For claims under 39.a.2 through 39.a.5 (General Liability),

General Liability Provided Per Occurrence

Each Occurrence (Bodily and Property Damage Included):	\$1,000,000
Damage to Rented Premises (Each Occurrence)	\$100,000
Medical Expense (Any One Person):	\$5,000
Personal and Adv Injury, With Employment Exclusion Deleted:	\$1,000,000
General Aggregate (Per Project):	\$2,000,000
Products and Completed Operations Aggregate:	\$2,000,000
Fire Damage – Any One Fire	\$50,000

Notes: Property Damage Liability Insurance will provide explosion, collapse and underground hazard coverages where applicable. Each detonation of blasting shall be considered a single occurrence. General Liability shall include Contractual Liability as stipulated in paragraph 39b above.

For claims under 39.a.6, Comprehensive Automobile Liability:

Combined Single Limit Per Occurrence, For
Any and All Autos, Including Bodily
Injury and Property Damage: \$1,000,000

j. Scope of Insurance and Special Hazards - The amounts stated in subparagraphs "h" and "i" above are minimum amounts of insurance to be carried. The Contractor shall carry such additional insurance as may be required to provide adequate protection of the Contractor and his Subcontractors, respectively, against any and all damage claims which may arise from operations under this Contract, whether such operations be by the insured or by anyone directly or indirectly employed by his and, also, against any of the special hazards which may be encountered in the performance of this Contract.

k. Certificate Holder should read:

Cherokee County Water & Sewerage Authority
140 West Main Street
Canton, Georgia 30114

The certificate holder and Owner, the Cherokee County WSA, shall be listed on the insurance certificate as an additional insured.

l. Insurance company must have an A.M. Best Rating of A or higher. Insurance company must be licensed to do business by the Georgia Secretary of State. Insurance company must be authorized to do business in the State of Georgia by the Georgia Insurance Department.

40. CONTRACT SECURITY

The Contractor shall furnish a performance bond in an amount at least equal to one hundred percent (100%) of the contract prices as security for the faithful performance of this contract and also a payment bond in an amount at least equal to one hundred percent (100%) of the contract price or in a penal sum not less than that prescribed by State, Territorial or local law, as security for the payment of all persons performing labor on the project under this contract and furnishing materials in connection with this contract. The performance bond and the payment bond may be in one or in separate instruments in accordance with local law.

41. ADDITIONAL OR SUBSTITUTE BOND

If at any time the Owner for justifiable cause shall be or become dissatisfied with any Surety or Sureties, then upon the Performance or Payment Bonds, the Contractor shall within five (5) days after notice from the Owner to do so, substitute an acceptable bond (or bonds) in such form and sum and signed by such other Surety or Sureties as may be satisfactory to the Owner. The premiums on such bond shall be paid by the Contractor. No further payments shall be deemed due nor shall be made until the new surety or sureties shall have furnished such an acceptable bond to the Owner.

42. LIEN

Neither the final payment nor any part of the retained percentage will become due until the Contractor, if required, shall furnish the Owner a complete release from any liens which may arise out of this contract, or receipts in full in lieu thereof, and if required in either case, an affidavit that insofar as he has knowledge or information, the release and receipts include all materials, for which a lien might be filed. The Contractor may, if any Subcontractor refuses to furnish a release or receipt in full, furnish a bond satisfactory to the Owner to indemnify it against any lien. If a lien shall remain unsatisfied after all payments are made, then the Contractor shall refund to the Owner all monies which the latter may be compelled to pay in discharging such lien, including all incidental costs and attorney's fees.

43. ASSIGNMENTS

The Contractor shall not assign the whole or any part of this contract or any money due to or to become due hereunder without written consent of the Owner. In case the Contractor assigns all or part of any money due or to become due under this contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assigned in and to any money due or to become due to the Contractor shall be subject to prior liens of all persons, firms and corporations for services rendered or materials supplied for the performance of the work called for in this contract.

44. MUTUAL RESPONSIBILITY OF CONTRACTORS

If through acts of neglect on the part of the Contractor, any other Contractor or subcontractor, shall suffer loss or damage on the work, the Contractor agrees to settle with such other Contractor or subcontractor by agreement or arbitration, if such other contractor or subcontractor will so settle. If such other Contractor or subcontractor shall assert any claim against the Owner on account of any damage alleged to have been so sustained, the Owner shall notify the Contractor, who shall indemnify and save harmless the Owner against any such claim.

45. COORDINATION WITH OTHER CONTRACTORS

The Contractor shall coordinate his operations with those of other contractors. Cooperation will be required in the arrangement for the storage of materials and in

the detailed execution of the work. The Contractor, including his Subcontractors shall keep informed of the progress and the detail work of other Contractors and shall notify the Engineer immediately of lack of progress or defective workmanship on the part of other contractors. Failure of a Contractor to keep informed of the work progressing on the site and failure to give notice of lack of progress or defective workmanship by others shall be construed as acceptance by him of the status of the work as being satisfactory for proper coordination with his own work.

46. SUBCONTRACTING

(a) The Contractor shall utilize the service of specialty subcontractor on those parts of the work which, under normal contracting practices, are performed by specialty Subcontractors. Provided - that if the Owner shall determine that the specialty work in question has been customarily performed by the Contractor's own organization and that such organization is presently competent to perform such work, the Contractor shall be permitted to do so. Provided, further - that if the Owner shall determine that the performance of any specialty work by specialty Subcontractors will result in materially increased costs or inordinate delays, the requirements of this paragraph shall not apply.

(b) The Contractor shall not be allowed to award work to any subcontractor prior to written approval of the Owner, which approval will not be given until the Contractor submits to the Owner, a written statement concerning the proposed award to the subcontractor, which statement shall contain such information as the Owner may require.

(c) The Contractor shall be as fully responsible to the Owner for the acts and omissions of his Subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

(d) The Contractor shall cause appropriate provisions to be inserted in all Subcontracts relative to the work to bind subcontractors to the Contractor by the terms of the General Conditions and other contract documents insofar as applicable to the work of subcontractors and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provision of the Contract Documents.

(e) Nothing contained in this contract shall create any contractual relation between any Subcontractor and the Owner.

47. ENGINEER'S AUTHORITY

The Engineer will have authority to disapprove or reject work which is defective, and will also have authority to require special inspection or testing of the work.

The Engineer will be the initial interpreter of the requirements of the Contract documents and judge of the acceptability of the work thereunder. Claims, disputes and other matters relating to the acceptability of the work or the interpretation of the

requirements of the Contract Documents pertaining to the execution and progress of the work shall be referred initially to Engineer in writing with a request for a formal decision in accordance with this paragraph, which the Engineer will render in writing within a reasonable time. Written notice of each such claim, dispute and other matter shall be delivered by the claimant to Engineer and the other party to the Agreement within fifteen days of the occurrence of the event giving rise thereto, and written supporting data will be submitted to the Engineer and the other party within forty-five days of such occurrence unless Engineer allows an additional period of time to ascertain more accurate data. In his capacity as interpreter and judge, Engineer will not show partiality to Owner or Contractor, and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

The Engineer may authorize minor changes in the work not involving an adjustment in the contract price or the contract time, which are consistent with the overall intent of the Contract Documents. These may be accomplished by a field order and shall be binding on Owner, and also on Contractor who shall perform the change promptly. If Contractor believes that a field order justifies an increase in the contract price or contract time, Contractor may make a claim therefore as provided in Article 27.

48. LIMITATIONS ON ENGINEER'S RESPONSIBILITIES

Neither the Engineer's authority to act under this contract, nor any decision made by the Engineer in good faith either to exercise or not exercise such authority shall give rise to any duty or responsibility of the Engineer to the Contractor, any Subcontractor, any manufacturer, fabricator, supplier or distributor, or any of their agents or employees or any other person performing any of the work.

Whenever in the Contract Documents the terms "as ordered", "as directed", "as required", "as allowed" or terms of like effect or import are used, or the adjectives "reasonable", "suitable", "acceptable", "proper" or "satisfactory" or adjectives of like effect or import are used, to describe requirements, direction, review or judgment of the Engineer as to the work, it is intended that such requirement, direction, review or judgment will be solely to evaluate the work for compliance with the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective never indicates that the Engineer shall have authority to supervise or direct performance 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 the Engineer 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 the Contractor or of any Subcontractors, or of the agents or employees of any Contractor or Subcontractor, or of any other persons at the site or otherwise performing any of the work.

49. USE OF PREMISES AND REMOVAL OF DEBRIS

The Contractor expressly undertakes at his own expense:

- (a) To take every precaution against injuries to persons or damage to property;
- (b) To store his apparatus, materials, supplies and equipment in such orderly fashion at the site of the work as will not unduly interfere with the progress of his work or the work of any other Contractors;
- (c) To place upon the work or any part thereof only such loads as are consistent with the safety of that portion of the work.
- (d) To clean up frequently all refuse, rubbish, scrap materials, and debris caused by his operations, to the end that at all times the site of the work shall present a neat, orderly and workmanlike appearance;
- (e) Before final payment to remove all surplus material, falsework, temporary structures, including foundations thereof, plant of any description and debris of every nature resulting from his operations, and to put the site in a neat orderly condition;
- (f) To effect all cutting, fitting or patching of his work required to make the same to conform to the plans and specifications and, except with the consent of the Engineer, not to cut or otherwise alter the work of any other Contractor.

50. QUANTITIES OF ESTIMATE

Wherever the estimated quantities of work to be done and materials to be furnished under this contract are shown in any of the documents including the proposal, they are given for use in comparing bids and the right is especially reserved except as herein otherwise specifically limited, to increase or diminish them as may be deemed reasonably necessary or desirable by the Owner to complete the work contemplated by this Contract, and such increase or diminution shall in no way vitiate this Contract, nor shall any such increase or diminution give cause for claims or liability for damages.

51. RIGHTS-OF-WAY AND SUSPENSION OF WORK

The Owner shall furnish all land and rights-of-way necessary for the carrying out of this contract and the completion of the work herein contemplated and will use due diligence in acquiring said land and rights-of-way as speedily as possible. But it is possible that all lands and rights-of-way may not be obtained as herein contemplated before construction begins, in which event the Contractor shall begin his work upon such land and rights-of-way as the Owner may have previously acquired, and no claim for damages whatsoever will be allowed by reason of the delay in obtaining

the remaining lands and rights-of-way. Should the Owner be prevented or enjoined from proceeding with the work, or from authorizing its prosecution, either before or after the commencement, by reason of any litigation, or by reason of its inability to procure any lands or rights-of-way for the said work, the Contractor shall not be entitled to make or assert claim for damage by reason of said delay, or, to withdraw from the contract except by consent of the Owner, but time for completion of the work will be extended to such time as the Owner determines will compensate for the time lost by such delay, such determination to be set forth in writing.

52. GUARANTY

- (a) All structures erected under this contract shall be fully guaranteed by the Contractor for a period of one year from the date of final inspection and acceptance by the Owner, defined as the date on the letter from the Engineer to the Owner recommending that final payment be made to the Contractor. The date that some or all of the sanitary sewer system is placed into service has no relation with the date that the guarantee begins. This guarantee shall cover any and all defects in workmanship or materials that may develop in this specified time, and any failure in such workmanship or materials shall be repaired or replaced to the satisfaction of the Owner by the Contractor at his own expense.
- (b) All equipment of whatever nature incorporated in the work covered by this contract shall carry the same guarantee as outlined above for construction. Failure of any equipment or part thereof within the specified time shall be corrected to the satisfaction of the Owner, at the Contractor's expense. This guarantee does not apply to manufacturing defects of equipment furnished by the Owner.

It is the intent of these specifications that all pipe lines, both underground and above ground, together with all appurtenances attached thereto and any driveways or other property restoration items, under this contract, shall be classified as structures.

Neither the final certificate of payment nor any provision in the contract documents nor partial or entire occupancy of the premises by the Owner shall constitute an acceptance of work not done in accordance with the contract documents or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship.

53. CONFLICTING CONDITIONS

Any provisions in any of the contract documents which may be in conflict or inconsistent with any of the paragraphs in these General Conditions shall be void to the extent of such conflict or inconsistency.

54. NOTICE AND SERVICE THEREOF

Any notice to any Contractor from the Owner relative to any part of this contract

shall be in writing and considered delivered and the service thereof completed, when said notice is posted, by certified or registered mail, to the said Contractor at his last given address, or delivered in person to the said Contractor or his authorized representative on the work.

55. PROVISIONS REQUIRED BY LAW DEEMED INSERTED

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

56. SUSPENSION OF WORK

Should the Owner be prevented or enjoined from proceeding with work either before or after the start of construction by reason of any litigation or other reason beyond the control of the Owner, the Contractor shall not be entitled to make or assert claim for damage by reason of said delay; but time for completion of the work will be extended to such reasonable time as the Owner may determine will compensate for time lost by such delay with such determination to be set forth in writing.

57. MAINTENANCE OPERATIONS

The Contractor shall schedule and execute his work so as to avoid interruption of existing services or operations, public or private. The Contractor will use every precaution to prevent damage of any existing facility, and in the event of damage will, at no expense to the Owner, repair and otherwise make good any damage to facilities resulting from his operations in connection with the contract. The Contractor will take whatever measures necessary to accurately determine the exact location of existing underground facilities prior to commencing construction.

58. MAINTENANCE

The Contractor will be required to maintain all work done by him in a first-class condition for sixty (60) days after the same has been completed as a whole, and the Engineers have notified the Contractor in writing that the work has been finished to their satisfaction. The retained percentage will not be due or payable to the Contractor until the 60-day maintenance period is up.

59. PROTECTION AND RESTORATION OF PROPERTY

- a. The Contractor shall not enter upon private property for any purpose without first obtaining permission, and he shall use every precaution necessary to prevent damage or injury to any public or private property, trees, fences, monuments, underground structures, etc., on and adjacent to the site of the work. He shall protect carefully, from disturbance or damage, all land monuments and property marks until an authorized agent has witnessed or

otherwise referenced their location, and shall not remove them until directed.

- b. Except as specifically provided in the contract documents, the Contractor shall not do any work that would affect any railway track, pipeline, telephone, telegraph, or electric or transmission line, or other structure nor enter upon the right-of-way or other lands appurtenant thereto, until authority therefore has been secured from the proper parties. The Contractor shall not be entitled to any extension of time or any extra compensation on account of any postponement, interference, or delay resulting from his requirement, except as specifically provided in the contract.
- c. The Contractor shall be responsible for all damage or injury to property of any character resulting from any act, omission, neglect, or misconduct in his manner or method of executing said work, or due to his non-execution of said work, or at any time due to defective work or materials, and he shall not be released from said responsibility until the work shall have been completed and accepted.
- d. When or where any direct or indirect damage or injury is done to public or private property by, or on account of any act, omission, neglect, or misconduct in the execution of the work, or in consequence of the non-execution thereof on the part of the Contractor, he shall restore at his own expense, such property to a condition similar or equal to that existing before such damage or injury was done, by repairing, rebuilding, or otherwise restoring, as may be directed, or he shall make good such damage or injury in an acceptable manner.

60. RESPONSIBILITY FOR DAMAGE CLAIMS

The Contractor shall be responsible for all injury or damage of any kind resulting from his work, to persons or property. The Contractor hereby assumes the obligation to indemnify and save harmless the Owner and Engineers including associates, agents and representatives, from every expense, liability, or payment arising out of or through injury to any person or persons including death and loss of services, or damage to property, regardless of who may be the Owner of the property, suffered through any cause whatsoever in the construction work involved in the contract and to defend on their behalf any suit brought against them arising from any such cause.

61. USE AND OCCUPANCY PRIOR TO ACCEPTANCE BY OWNER

The Contractor agrees to the use and occupancy of a portion or unit of the project before formal acceptance by the Owner, provided the Owner:

- (a) Secures written consent of the Contractor except in the event, in the opinion of the Engineer, the Contractor is chargeable with unwarranted delay in completing the contract requirements;
- (b) Secures consent of the Surety;
- (c) Secures endorsement from the insurance carrier(s) permitting

- occupancy of the building or use of the project during the remaining period of construction; or
- (d) When the project consists of more than one building, and one of the buildings is occupied, secures permanent fire and extended coverage insurance, including a permit from the insurance carrier to complete construction.

62. INTEREST OF FEDERAL, STATE OR LOCAL OFFICIALS

No Federal, State or Local official shall be admitted to any share or part of this contract or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

63. OTHER PROHIBITED INTERESTS

No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept or approve or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspection, construction or material supply contract or any subcontract in connection with the construction of the project, shall become directly or indirectly interested personally in this contract or in any part hereof. No officer, employee, architect, attorney, engineer or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall become directly or indirectly interested personally in this contract or in any part thereof, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the project.

64. USE OF CHEMICALS

All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of either E.P.A. or U.S.D.A. Use of all such chemicals and disposal of residues shall be in strict conformance with instructions.

65. MAINTENANCE OF TRAFFIC

Traffic is to be maintained on all roads and streets which must be crossed by lines. If the open-cut method is used, two separate cuts must be made leaving one lane open to traffic at all times.

The Contractor shall notify the Owner and D.O.T. prior to performing any work which disrupts normal flow of traffic, and shall utilize appropriate warning signs, flagmen and other procedures necessary to ensure safety and minimize inconvenience to the public.

66. SPECIAL HAZARDS

The Contractor's and his Subcontractor's Public Liability and Property Damage

Insurance shall provide adequate protection against the following special hazards: Excavation, shoring, underpinning, blasting, and explosion to the extent to which such risks are present.

67. ENGINEER'S DIRECTIONS REGARDING WORK PARTIALLY COMPLETED

The Engineer may direct that any section or part of the project considered to be in serviceable condition be placed in use or operation, even though not entirely completed. Such use or operation shall not be held to be an acceptance of the work, or section thereof, so placed in operation, or a waiver of any of the provisions of the Contract Documents.

68. ENGINEER'S EXAMINATION OF WORK COMPLETED

At the request of the Engineer, the Contractor shall, at any time before final acceptance of the work, remove, or uncover such portions of the finished work as may be directed. After examination the Contractor shall restore said portions of the work to the standard required by the Specifications. Should the work thus exposed or examined prove acceptable, the uncovering or removing, and the replacing or making good of the parts removed, shall be paid for as Extra Work, but should the work so exposed or examined prove unacceptable, the uncovering or removing, and the restoration shall be at the Contractor's expense.

69. ENGINEER'S LIABILITY

In carrying out any of the provisions of this Contract or in exercising any power or authority granted to him by it, there shall be no liability upon the Engineer or his authorized agents and representatives, it being understood that in such matters he acts solely as the Owner's representative.

70. EROSION AND SEDIMENT CONTROL

Care shall be exercised in grading operations to minimize erosion. Temporary sediment control structures will be erected at the Engineer's direction where necessary. Also Contractor shall comply with the State of Georgia and any applicable local Regulations for erosion control.

71. ACCEPTANCE OF FINAL PAYMENT CONSTITUTES RELEASE

The acceptance by the Contractor of final payment shall be and shall operate as a release to the Owner of all claims and all liability to the Contractor for all things done or furnished in connection with this work and for every act and neglect of the Owner and others relating to or arising out of this work. No payment, however, final or otherwise, shall operate to release the Contractor or his sureties from any obligations under this contract or the Performance and Payment Bond.

72. OWNER'S RIGHT TO SUSPEND WORK

The Owner shall have the authority to suspend the work, wholly or in part as he may

deem necessary because of conditions unsuitable for proper prosecution of the work or failure on the part of the Contractor to carry out the provisions or to meet the specified requirements. The Contractor shall not suspend operations without the Owner's permission.

73. TIME FOR COMPLETION AND LIQUIDATED DAMAGES

It is hereby understood and mutually agreed, by and between the Contractor and the Owner, that the date of beginning and the time for completion as specified in the contract of the work to be done hereunder are ESSENTIAL CONDITIONS of this contract; and it is further mutually understood and agreed that the work embraced in this contract shall be commenced on a date to be specified in the "NOTICE TO PROCEED."

The Contractor agrees that said work shall be prosecuted regularly, diligently, and uninterruptedly at such rate of progress as will insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for the completion of the work described herein is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

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 a part consideration for the awarding of this contract, to pay to the Owner the amount specified in the contract, not as a penalty but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day 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 impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be retained from time to time by the Owner from current periodical estimates.

It is further agreed that time is of the essence of each and every portion of this contract and of the specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where, under the contract, an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this contract. Provided, that the Contractor shall not be charged with liquidated damages or any excess cost when the Owner determines that the Contractor is without fault and the Contractor's reasons for the time extension are acceptable to the Owner; provided, further, that the Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due:

- (a) To any preference, priority or allocation order duly issued by the Government;

(b) To unforeseeable cause beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, or of the public enemy, acts of the Owner, acts of another contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and severe weather; and

(c) To any delays of Subcontractors or suppliers occasioned by any of the causes specified in subsections (a) and (b) of this article.

Provided, further, that the Contractor shall, within ten (10) days from the beginning of such delay, unless the Owner shall grant a further period of time prior to the date of final settlement of the contract, notify the Owner, in writing, of the causes of the delay, who shall ascertain the facts and extent of the delay, and notify the Contractor within a reasonable time of its decision in this matter.

SECTION 00820

ENGINEER'S SUPPLEMENTAL GENERAL CONDITIONS

1. NOTIFICATION OF CONSTRUCTION

Prior to the commencement of construction, the Contractor shall give written notice to each property owner and/or business owner. The notice shall include the nature of the construction, the approximate duration of the construction, and the Contractor's name and contact information.

2. PRIOR NOTIFICATION OF SERVICE INTERRUPTION

The Contractor shall organize his work in such a way that water and sewer service will remain uninterrupted except for short periods of time when connections are being made. When it is necessary for water or sewer service to be interrupted, the Contractor shall first receive approval from the Engineer and shall then notify all affected sewer customers of the proposed time of interruption and the expected duration. Notification shall be in person whenever possible. When in person notification is not possible, a flier similar to the example provided shall be distributed to each residence or business. Ideally, both in person notification and a flier shall be given.

Notification shall be sufficiently prior to the interruption of service so as to allow customers to make necessary arrangements to their personal or business schedules. 24 hours shall be considered a standard minimum.

The Contractor shall maintain a log of times, dates, duration, the addresses affected, and the reason for any interruption of water service. The log shall be kept on a form similar to the example provided and shall be submitted to the Engineer along with every pay request.

3. BASIC EQUIPMENT REQUIRED

The nature of the work is such that due to the proximity of existing facilities, there is the possibility that existing water and/or sewer services or mains may be damaged and necessitate immediate repair. Consequently it is essential that the Contractor not perform any work unless certain basic and essential tools and materials are present on the job site. Tools and materials considered basic and essential shall include but not be limited to:

- All tools and materials necessary to repair a four (4) inch or six (6) inch sanitary sewer service,
- All tools and materials necessary to correctly perform the construction currently underway,
- Any additional equipment or material that the Owners Representative may require.

- Valve wrench,
- Fire Hydrant wrench, and
- All tools and materials necessary to repair a three quarter inch (¾) or one (1) inch copper or galvanized iron water service.

4. TRAFFIC CONTROL AND DETOURS

The Contractor shall organize his work in such a way as to minimize the impact on traffic flow on streets and highways. No local street shall be cut or blocked without prior approval from the Engineer, the City of Holly Springs, and the Cherokee County Road Department. No state highway or route shall be cut, blocked, or have traffic restricted without prior approval from the Georgia Department of Transportation.

Traffic is to be maintained on all roads and streets which must be crossed by the sanitary sewer mains. If the open cut method is approved and used, one lane must be open to traffic at all times.

The Contractor shall notify the Owner and the appropriate transportation agency prior to performing any work which disrupts the normal flow of traffic, and shall utilize appropriate warning signs, flagmen, and other procedures necessary to ensure safety and minimize inconvenience to the public. The Contractor shall coordinate all necessary permitting for lane closures with the proper authority.

If it is determined by the D.O.T. that traffic flow shall not be impeded during certain hours (i.e. "rush hour"), the Contractor shall organize his work accordingly. No extra payment will be made for delays resulting from any traffic related restrictions on working hours.

5. CONTRACTOR IDENTIFICATION AND LANGUAGE REQUIREMENTS

All equipment used for the maintenance or installation of utility facilities on public right-of-way shall be identified with signs that indicate the Utility Owner's name and telephone number. The construction foreman shall carry a name badge that identifies the utility company for whom he/she is working. At least one person in each operation or location shall be fluent in English. This individual shall have knowledge of what his or her company is doing and why.

6. PROJECT MANAGEMENT

The Contractor shall schedule and coordinate the work of the Contractor and all subcontractors and others involved to maintain the accepted progress schedule. His duties shall also include the planning of the work, the scheduling or ordering and delivery of materials, and checking and control of all work under this contract. Construction schedules shall be submitted to the Engineer for review prior to the start of any work. Schedules shall be verified or updated as necessary on a monthly basis.

The Contractor shall be responsible for complete supervision and control of his subcontractors as though they were his own forces. Notice to the Contractor shall be considered notice to all affected subcontractors.

The Contractor shall appoint a qualified representative to act as the Project Coordinator, or Superintendent, who shall be responsible for coordinating all work and providing liaison with the Engineer and the Owner. The Project Coordinator or Superintendent shall, in addition, plan the work, schedule the ordering and delivery of materials, and check and control the various phases of the construction of all work under this contract. The Project Coordinator or Superintendent shall, in all matters, represent the Contractor at the sites of the work in the absence of a Corporate Officer or Principal of the firm.

The Project Coordinator or Superintendent shall not be changed unless the Project Coordinator or Superintendent proves to be unsatisfactory to the Contractor and ceases to be in his employ.

7. EQUIPMENT ADJUSTMENT AND CALIBRATION

All mechanical and electrical equipment, including related control systems, shall be subjected to preliminary operation and testing by the Contractor before the individual facilities and systems are put into operation. Tests shall be made to determine whether the equipment has been properly assembled, aligned, adjusted, wired and connected. Any changes, adjustments, or replacement of equipment which are due to errors or omissions on the part of the Contractor, or which may be otherwise necessary to comply with the requirements of this Contract, shall be done without additional cost to the Owner. Upon completion of the checking and adjustment, the Contractor shall demonstrate that each separate piece of equipment in each system of related items of mechanical equipment and the related items of mechanical equipment and the related instrumentation and control equipment operate in accordance with the requirements of the Contract Specifications. Where no specific performance requirements are stated in the Specifications, the test shall show that the equipment operates in accordance with normal application practice of the equipment. The demonstration tests shall show that the equipment operates smoothly and without excessive noise or vibration, that the equipment is responsive to manual and automatic controls, that control and protective devices are properly set, that the equipment will run continuously when continuous operation is intended, and that the equipment will run on a controlled or intermittent basis when this operation is intended. The demonstration test for each piece of equipment shall include check out from each remote control point. All alarm systems and safety lockout systems shall also be demonstrated for proper function along with all process instrumentation and controls.

The demonstration tests shall be arranged by the Contractor who shall notify the Engineer not less than 3 days in advance of the date of the test. The Contractor shall provide personnel from the various trades involved to operate and demonstrate the equipment.

8. SYSTEM START-UP

The Contractor shall place the various items of equipment into operation, along with the related piping and metering systems, and shall notify the Engineer at least 3 days in advance of the date of start-up.

Schedule for such start-up of the majority of the equipment and pumping systems will occur during the duration of the Contract period and prior to final completion and acceptance of the overall project. After satisfactory start-up of these individual systems, including all of the related equipment, they will remain in continuous or intermittent operation as required.

All equipment and accessories shall be adjusted and calibrated prior to any start-up as specified under these Special Conditions. Any equipment placed into temporary operation prior to final completion of the total project shall be re-adjusted and/or calibrated.

The Contractor shall supervise, control, and be responsible for the operation and maintenance of the new equipment and/or system during a period of at least 10 days after each individual item is placed into operation. The Contractor shall furnish an adequate number of competent start-up personnel to provide supervision during these phases. The Contractor shall remain responsible for making any required changes, repairs or replacements to the new installation during this period.

9. INSTRUCTION OF OWNER'S EMPLOYEES

The Contractor shall provide competent personnel who fully understand the operation of the equipment to instruct the Owner's employees in the operation and maintenance of each item and system. Such instruction shall take place prior to acceptance of the installation by the Owner at such a time or times that are acceptable to the Owner. The Contractor shall include the cost of this training in the bid price for this Contract. Training shall be of the on-the-job type, and shall cover all areas of operation and equipment maintenance. The training program shall be for a minimum of 2 days of 8 hours each. Training shall be done by a factory or maintenance representative of the various items of equipment.

Scheduling of instruction of the Owner's employees will be mutually agreed upon between the Owner, Contractor and the Engineer.

10. OPERATING INSTRUCTION MANUALS

The Contractor shall prepare and submit 6 copies of a complete set of operating instructions for the overall project and covering all equipment and systems furnished. Operating instructions shall be prepared specifically for each system installed under this Contract and shall consider the specific equipment and controls included. Operating instructions shall be complete for each separate system, and shall detail start and stop procedures and shall explain all safety

devices and detail procedures and precautions for restarting after failure or safety lockout situations.

Two copies of operating instruction shall be submitted to the Engineer for review with shop drawings for the equipment and shall be resubmitted with corrections and additional requested information prior to the period of personnel training.

11. MAINTENANCE INSTRUCTION MANUALS

The Contractor shall prepare and submit 6 copies of a complete set of maintenance instruction manuals for the overall project and covering all equipment furnished. Manuals shall include complete parts lists of all equipment and recommended spare parts. Manuals shall be prepared specifically for the particular equipment furnished and shall consider the specific operation of this equipment in the particular process system involved. Complete lubrication requirements shall be listed, including recommended lubricant and lubricating intervals or schedule.

Two copies of the above shall be submitted on a preliminary basis for review by the Engineer with the shop drawings for the equipment. Final submittal of Maintenance Manuals shall be received prior to any equipment start-up.

12. DIVISION OF WORK

Division of work as made by the Contract Plans and Specifications is for the purpose of specifying all work which is required. There is no attempt to make complete classification according to trade or any agreements which may exist between Contractors or groups of Contractors and trade union. Such division and classification of the work shall be the Contractor's responsibility.

13. RESTORATION

The Contractor shall conduct his operations so that restoration of roadways, driveways, curb and gutter, ditches and easements progresses along with the pipe laying. If the Engineer determines that inadequate progress is being made with the restoration, he may shut down the Contractor's pipe laying operation until the restoration is caught up with the pipe installation.

Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed to those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.



SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

The work described by these specifications is located in Cherokee County, Georgia. The work occurs in the City of Holly Springs southeast of the intersection of Hickory Road and Old Highway 5. The project consists of the construction of a fiberglass wet well and sewage lift station, including the installation of pumping equipment, electrical equipment, standby generator, 6" force main and gravity sanitary sewer mains.

PART 2 - PRODUCT

2.01 The work to be done consists of furnishing all labor, equipment and materials required to construct the lift station, force main and gravity sanitary sewer mains as shown on the plans and described in the contract specifications.

2.02 Major Components of the work are:

Lift Station
Submersible pumps and discharge piping
Install approximately 5000 L.F of 6" DIP Force Main
4455 LF 8" Sanitary Sewer
200 L.F. 6" Service Line
33 Manholes
Check, plug and surge relief valves in the valve pit.
Pump guide rail system
Electrical control system
Grading and site work
Erosion Control Measures

****END OF SECTION****

SECTION 01020

ALLOWANCES

PART 1 - GENERAL

The Contractor shall include in his lump sum bid of the lift station the allowances stated herein. These allowances shall cover manufactured equipment or services that will be provided to the contractor by others. The contractor shall cause the work covered by these allowances to be provided by such suppliers as the Owner may select. The Contractor's cost for handling, coordinating and any other costs that are necessary to complete these items, but not specifically covered in the allowance, shall be included in the Contractor's lump sum bid. The final amount of any allowance item listed herein shall be adjusted accordingly by change order to reflect actual cost.

PART 2 - SCHEDULE OF ALLOWANCES

2.01 SPARE PARTS AND TOOLS

The Contractor shall allow the sum of \$3,000 for the purchase of spare parts and tools to be selected by the Owner and furnished by the Contractor.

2.02 GENERATOR FUEL

The Contractor shall allow the sum of \$1,000 to provide necessary fuel for proposed generator start-up, testing and re-filling tank upon successful start-up.

2.03 SOILS TESTING

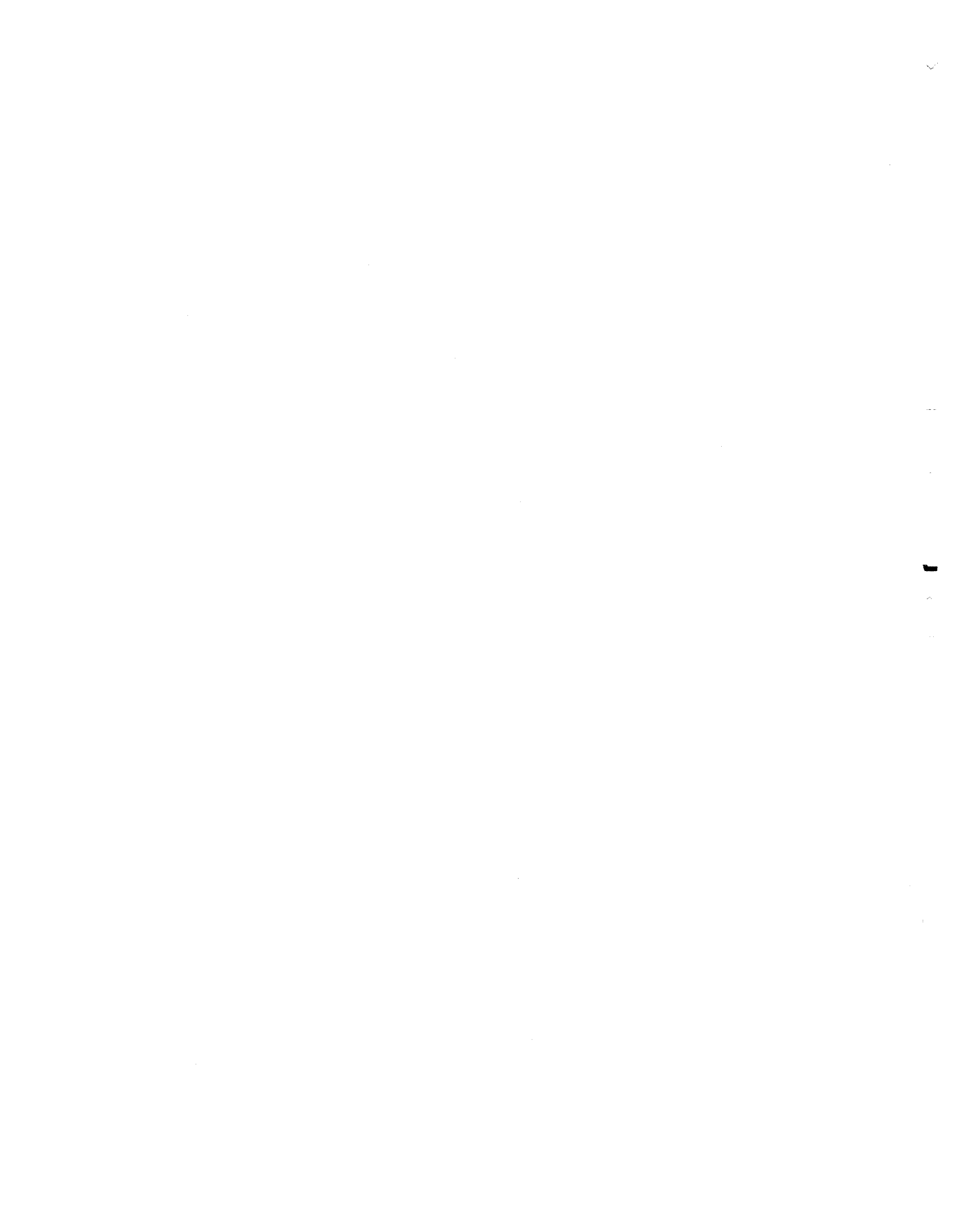
The Contractor shall allow the sum of \$2,000 for independent soils testing on as needed basis.

PART 3 – EXECUTION

3.01 INSTRUCTIONS TO BIDDERS

The Contractor shall include in his lump sum bid cost of the sanitary sewer lift station the total of items 2.01, 2.02, 2.03. (\$6,000).

****END OF SECTION****



SECTION 01050

FIELD ENGINEERING BY CONTRACTOR

PART 1 - GENERAL

1.1 GENERAL

- 1.1.1 The Contractor shall: Provide, at no additional cost to the owner, field engineering services required for the Project.
 - 1.1.1.1 Survey work required in execution of the Project.
 - 1.1.1.2 Civil, structural or other professional engineering services specified, or required to execute Contractor's construction methods.
- 1.1.2 Prior to construction or sitework, the Engineer will identify existing control points indicated on the drawings, as needed.

PART 2 - PRODUCT

2.1 SURVEY REFERENCE POINTS

- 2.1.1 Existing basic horizontal and vertical control points for the project are those designated on drawings.
- 2.1.2 The Contractor shall locate and protect control points prior to starting any clearing, grubbing or construction, and preserve all permanent reference points during construction. The Contractor shall provide, at his expense, any temporary staking, including necessary off-set staking to preserve the control points.
 - 2.1.2.1 The Contractor shall make no changes or relocation without prior written notice to Engineer.
 - 2.1.2.2 The Contractor shall report to Engineer when any reference point is lost or destroyed, or requires relocation due to changes in the scope of the project.
 - 2.1.2.3 The Contractor shall require a surveyor to replace project control points which may be lost or destroyed. Establish replacements based on original survey control.

2.2 PROJECT SURVEY REQUIREMENTS

2.2.1 Establish lines and levels, locate and lay out, by instrumentation and similar appropriate means:

2.2.2 Construction Staking

2.2.2.1 Stakes for grading, fill and topsoil placement

2.2.2.2 Stakes for pipeline alignment and manhole locations

2.2.2.3 Pipeline elevations and invert elevations.

2.2.2.4 From time to time, verify layouts by the same methods.

2.2.3 Topographic Layout

Prior to any construction adjacent to a wetland area, existing ground shall be surveyed and existing ground elevations and gradients shall be recorded. Such information shall be submitted to the Engineer prior to construction near the wetland area. Such information shall be submitted to the Engineer.

2.2.4 Roadway and Driveway Restoration

Prior to the installation of the sanitary sewer across any roadway or driveway by open cut, boring or tunneling, the profile of the roadway or driveway and the cross-sections to be disturbed by construction shall be surveyed. This information shall be submitted to the Engineer prior to any construction. Upon the completion of the sanitary sewer installation, the profile of any restored roadway or driveway and cross-sections disturbed by construction shall be surveyed. Such information shall be submitted to the Engineer.

2.2.5 Record Drawing Surveying

2.2.5.1 Establish necessary control points and provide necessary equipment to accurately record the location of the sanitary sewer system as constructed.

2.2.5.2 Record the location of force main at every fitting and bend.

2.2.5.3 Vertical locations shall be shown referenced to Mean Sea Level.
Reference all horizontal locations to the NAD83 datum (latest adjustment) and reference all vertical locations to the NAVD88 datum.

PART 3 - EXECUTION

3.1 RECORDS

Maintain a complete, accurate log of all control and as-built survey work as it progresses.

3.2 SUBMITTALS

3.2.1 On request of the Engineer, submit documentation to verify accuracy of field engineering work.

3.2.2 Upon the submittal of the final pay request and prior to final payment, provide an ASCII text file with the record locations of the new sanitary sewer system in accordance with the CCWSA Sanitary Sewer Standards, including at a minimum the following information:

3.2.2.1 Station

3.2.2.2 Northing

3.2.2.3 Easting

3.2.2.4 Elevation (top of fitting on force main, ground elevation, top of pipe elevation, top of manhole, invert elevation (in and out),

3.2.2.5 Description of point (Point ID (See CCWSA Staff), fitting description, manhole number,

3.2.2.6 For the gravity sewer line, this data (northing, easting, elevation, station) shall be collected and submitted to the Engineer for every manhole, including the Manhole ID, the Manhole Lid Elevation, the Invert elevations, and the description of the each pipe entering and leaving the manhole (Diameter, Material, Invert, Type (i.e., force main, service, sewer main, etc.)

3.2.2.7 For the force main, this data (northing, easting, elevation, station), shall be collected and submitted to the Engineer for the entire length of the force main. The force main shall be located at 50 foot intervals (finished ground and top of pipe). All sudden changes in elevation shall also be located and recorded. All fittings and air release valves shall also be located and recorded. The size and material of the force main shall also be recorded.

3.2.2.8 For the lift station, this data (northing, easting, and elevations) shall be collected and submitted to the Engineer for the location of the wet well, the invert elevations of the well and all pipes entering the wet well, the

invert elevation of the pumps and the top of pipe elevations of the force main as it leaves the wet well. Also recorded shall be the corners of the fence surrounding the site, the valve pit for the force main, and all other points at the lift station site requested by the CCWSA GIS staff.

Along with submittal of electronic text file, Contractor shall submit a red-line copy of a set of construction plans detailing all aspects of the construction that differ from the original construction plans. These plans shall also detail all unknown underground pipes in the path of construction or adjacent to the new CCWSA facilities.

****END OF SECTION****

SECTION 01060

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL

The Contractor shall, without additional expense to the Owner, be responsible for obtaining any necessary licenses, permits and complying with any and all applicable Federal, State and Municipal laws, codes and regulations in connection with the prosecution of the work included in this contract.

1.2 SAFETY AND HEALTH

The Contractor shall take proper safety and health precautions to protect the Work, the workers, the public, and the property of others.

1.3 NPDES Permit

If the disturbed area exceeds 1.0 acre or if the disturbed area is within 200 feet of a state water, the Contractor shall be required to comply with the EPD's General Permit GAR100002 as the primary permittee. **THIS PROJECT IS EXPECTED TO DISTURB MORE THAN 1.0 ACRE AND IS ALSO WITHIN 200 FEET OF A STATE WATER.** Therefore the Contractor will be required to comply with the EPD's General Permit GAR100002 as the primary permittee. Please note the requirements set forth in the plan set and in the permit documents. The latest permit is available on the Georgia EPD Website.

1.4 DEFINITIONS:

Design Professional: The term Design Professional shall mean a professional licensed by the State of Georgia in the field of: engineering, architecture, landscape architecture, forestry, geology, or land surveying and is a Certified Professional in Erosion and Sediment Control.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

The Contractor as a minimum shall perform the following duties:

- A. Maintain the erosion and sediment control on the project site in accordance with the approved plans.
- B. Install and maintain the erosion and sedimentation control devices and practice best management practices to comply with the requirements and intent of the Erosion, Sedimentation and Pollution Control Plan.
- C. Comply with all federal, state and local regulations regarding erosion and sediment control.
- D. Comply with all requirements of the EPD's NPDES Permit No. GAR 100002.
- E. Comply with all requirements of Cherokee County and the City of Holly Springs regarding work inside and adjacent to the right of way of any roadways on this project.
- F. Comply with all easement stipulations.

****END OF SECTION****

SECTION 01150

MEASUREMENT AND PAYMENT

1. GENERAL

No quantities shall be measured for payment except items listed in the proposal, unless the Owner has approved "extra" work, in writing, in accordance with the contract documents and has so advised the Contractor before the work was actually performed.

Any and all other materials, labor, etc., furnished and required shall be considered as incidental to the items to be measured for payment.

The unit or lump sum prices bid for the various items shall be full compensation for furnishing all materials, tools, equipment, labor and incidentals necessary and/or required to complete the work as shown on the plans and called for in the specifications.

The quantities to be paid for shall be determined by actual measurement or count of the amount placed. The Engineer shall make all measurements and the Contractor shall make certain all work has been measured before concealing; otherwise, he may be required to uncover or make accessible any work so concealed in order to receive payment for such items.

2. FORCE MAIN

All force main shall be measured horizontally and payment shall be made at the unit price bid per linear foot. Unit price bid for force main shall include any and all clearing and grubbing of right-of-way required for the construction, property restoration and other work that is not designated as a pay item.

3. FORCE MAIN TESTING

No separate payment will be made for required pressure testing of the force main. Contractor's cost for testing shall be included in the bid price of the force main pipe.

4. STEEL CASINGS

Payment for this item shall be made at the unit price bid per linear foot and shall include furnishing all incidentals and extra labor required to complete installation of the force main and/or sewer in the steel pipe. Unit price bid shall also include payment for furnishing and installing grout in the annular space between the force main and the steel pipe. Unit price bid shall also include full compensation for all tools, labor, and materials necessary to seal up the steel pipe after installation of force main pipe. Where solid rock is encountered in the bore and verified by the Owner's representative, the additional fee

per linear foot in item 3 of the bid form shall be paid to the Contractor for the length of casing installed through the solid rock.

5. POLYETHYLENE CASING

All ductile iron force main pipe shall be encased in polyethylene tubing. Payment for this tubing shall be included in the unit price bid per linear foot for the force main.

6. LIFT STATION

Lift station construction shall be paid for at the lump sum in the Bid Proposal. Price shall include, but not be limited to, clearing and grubbing of site, precast concrete structures, fiberglass wet well, all excavation, dewatering, backfilling, reinforced concrete construction, furnishing and installing pumps, motors, piping (gravity and pressure), valves, manholes, complete electrical distribution and control system, meter and meter vault and related appurtenances, fencing, 3/4" copper water main with backflow prevention, and all associated work as necessary for complete construction as shown on the plans and/or as specified herein. Lump sum limits shall be the property line for the lift station.

The lump sum price bid for the pump station shall be full compensation for furnishing all materials, tools, equipment, labor and incidentals necessary and/or required to complete work as shown on the plans and called for in the specifications. Included in the lump sum price shall be the allowances defined in Section 01020.

All items shown on the plans or called for in the specifications and not specifically shown in the proposal as unit price items will be paid for at the lump sum price shown in the proposal. Lump sum items will be paid for based on approved construction schedules and percentage of lump sum item actually completed at time of pay request.

Stored materials price will be reimbursable at the price paid for the product by the Contractor. Only those materials, which are stored on the job site to the approval of the Engineer, will be paid for a stored material and a bill-of-sale for each item must be submitted with each monthly pay request for stored material. A ten percent retainage shall be held on stored materials the same as other pay items.

7. STANDARD MANHOLES

Manholes will be counted in place. Each manhole will be measured from the invert of the lowest pipe at the centerline to the top of the brickwork. Price of the manhole shall include cast iron ring, cover and steps.

Payment will be made at the unit price bid per each for manholes having a depth of six feet or less, measured from the invert of the lowest pipe to the top of the brickwork, and the unit price bid shall include the manhole ring, cover, boots, steps and water proof manhole casting and cover if required. It shall also include the cost of vents where

shown. When the depth of manholes exceeds six feet, the difference between the actual depth and six feet will be paid for at the unit price bid per vertical foot for extra depth for manholes.

8. WATER PROOF MANHOLE VENTS

Waterproof manhole vents shall be counted in place. Payment will be made as a part of the unit price bid for manholes.

9. WATERTIGHT FRAME & COVERS

Watertight frame & covers payment will be made as a part of the unit price bid for manholes.

10. SEWER PIPE

All sewer lines will be measured horizontally from center to center of manholes, and cut determined by the difference in elevation from the ground surface of the center line of the ditch to the invert grade of sewer.

Payment will be made at the unit price bid per foot for each size, cut classification and type of pipe as included in the proposal and as shown on the plans and in the specifications.

Unit price bid for sewer pipe shall include any and all clearing and grubbing of right-of-way required for the construction of sewer lines, property restoration and other work that is not designated as a pay item.

The unit price per linear foot of pipe shall also include stabilizer stone used for Class "C" bedding. The unit price shall also include Class "B" bedding, where shown, and installation of stone to 2/3 of the pipe diameter where P.V.C. pipe is used. If poor soil conditions require using stabilizer stone in excess of these minimum requirements, then the stone will be paid for extra at the bid price for stabilizer stone.

11. WATER SERVICE TO LIFT STATION

The lump sum price bid for providing the water service to the lift station shall include and be full compensation for all labor, materials, tools, equipment and incidentals necessary to complete the connection as shown on the plans; including accessories and miscellaneous materials for same. The lump sum price bid shall include the 6" x 3/4" tap on the existing water main, the 3/4" corp stop, the 3/4" copper service main from the existing water main to the lift station, the curb stop, meter boxes, and backflow prevention devices, and all other appurtenances required to provide the water service to the lift station.

12. CONNECTING TO EXISTING SEWER OR MANHOLE

The price bid for connection to existing manholes shall include and shall be full compensation for all labor, materials, tools, equipment, and incidentals necessary to complete the connection as shown on the contract drawings, including drop manholes and extra depths of the same. Payment shall be made on a per each basis at the unit price bid for that type and size connection. All tools, materials, equipment, labor and other incidentals necessary to core and connect to the existing manhole, rework the manhole invert and plug any existing sewer mains to be abandoned shall be included in the unit price bid. No payment shall be made under any other item for work necessary to make connections to existing manholes, except under the category of subgrade stabilizer which shall be paid for separately at the unit price bid. Connection shall be completed in accordance with CCWSA Sanitary Sewer Standards.

13. SOLID ROCK EXCAVATION

The quantity of rock excavation to be paid for shall be the average actual length times the average actual depth, times a width equal to the nominal diameter of the pipe plus 24 inches. Solid rock excavation will be paid for at the unit price bid per cubic yard.

14. ADDITIONAL SUBGRADE STABILIZER

Subgrade stabilizer stone will be paid for at the unit price bid per ton. Stone that is used for Class "C" bedding will not be paid for as subgrade stabilizer, nor will it be paid for where Class "B" is shown on the plans. It will be paid for where job conditions require stabilizer stone beyond the minimum bedding requirements shown on the plans only where extra stone is approved in writing by the Engineer. Where stabilizer stone is eligible for payment the quantity (tonnage) will be taken from delivery tickets, if these are identified separately from non-legible stone; otherwise, the quantity will be computed by measuring the volume placed and applying a weight of 120 pounds per cubic foot. If a discrepancy exists the computed quantities shall govern.

15. MISCELLANEOUS CONCRETE

Miscellaneous concrete for thrust blocking of the force main and other uses shall be measured in place. Payment under this item at the unit price bid per cubic yard shall cover all costs of furnishing and placing miscellaneous concrete.

16. PIPE FOR SERVICE LINE

The actual length of service lines for sanitary sewer that is installed and accepted will be measured in place and paid for at the unit price bid per linear foot.

17. SERVICE CLEANOUTS

Cleanouts shall be paid for at the unit price bid for each constructed and accepted. The

unit price bid for each shall include all materials, labor, equipment, tools and other incidentals required to complete installation as shown on the detailed drawings.

18. TEMPORARY SILT FENCE “Sd1” – DOUBLE ROW OF TYPE C

Double Row of Type C Silt fence shall be measured in place and paid for at the unit price bid per linear foot for 2 side by side silt fences. Payment shall be full compensation for all materials and labor necessary to install, maintain and eventually remove and properly dispose of silt fencing as indicated on the plans or called for in the specifications. Silt fence must be installed in accordance with the Manual for Erosion Control in Georgia in order to be eligible for payment. Silt fence that is not properly trenched in will not be paid for. Silt fence materials that are not in accord with the Manual for Erosion Control in Georgia will not be paid for.

19. TEMPORARY SILT FENCE “Sd1” – SINGLE ROW OF TYPE C

Single Row of Type C Silt fence shall be measured in place and paid for at the unit price bid per linear foot for one row of silt fence. Payment shall be full compensation for all materials and labor necessary to install, maintain and eventually remove and properly dispose of silt fencing as indicated on the plans or called for in the specifications. Silt fence must be installed in accordance with the Manual for Erosion Control in Georgia in order to be eligible for payment. Silt fence that is not properly trenched in will not be paid for. Silt fence materials that are not in accord with the Manual for Erosion Control in Georgia will not be paid for.

20. CONSTRUCTION EXIT “Co”

Temporary construction exits that are installed and accepted in accordance with the Manual for Erosion Control in Georgia will be counted in place and paid for at the unit price bid per each. Payment shall be full compensation for all labor, materials, geotextile underlayment, stone and miscellaneous items necessary for construction of the construction exit as indicated on the plans. No additional payment will be made for maintenance or removal of the exit.

21. EROSION CONTROL MATTING “Mb”

Erosion control matting shall be paid for on a square yard basis for matting actually placed and maintained. The unit price shall be full compensation for all labor, tools, equipment, and materials necessary to put matting in place.

22. CHECK DAMS “Cd”

Check dams shall be paid for on a per unit basis for each. The unit price shall be full compensation for all labor, tools, equipment, and materials necessary to put the check dams in place in accordance with the Manual for Erosion Control in Georgia.

23. STORM DRAIN OUTLET PROTECTION "ST"

Storm drain outlet protection shall be paid for on a per unit basis for each. The unit price shall be full compensation for all labor, tools, equipment, and materials necessary to put the storm drain outlet protection in place.

24. INLET SEDIMENT TRAP "Sd2"

Inlet sediment traps shall be paid for on a per unit basis for each. The unit price shall be full compensation for all labor, tools, equipment, and materials necessary to put the inlet sediment trap in place.

25. FILL DIRT

No payment shall be made for any fill dirt shown on the plans.

26. AIR/VACUUM VALVE ASSEMBLY

Air and vacuum relief valves will be paid for at the unit price bid per each for each assembly and shall include furnishing and installing the air and vacuum relief valve, gate valve, related piping and fittings, flanged outlet, manhole, flat slab top, manhole ring and cover and all incidentals required to complete the assembly as shown on the construction drawings.

27. MISCELLANEOUS IRON FITTINGS AND SPECIALS

Miscellaneous ductile iron fittings and specials will be counted in place. A list of the fittings installed including their weights shall accompany each pay request.

Payment for mechanical joint fittings will be made at the unit price bid per pound for iron specials and fittings and will be made on an individual basis for each iron fitting installed. Weight of iron fittings will be calculated at the AWWA C110 weight for 350 PSI mechanical joint fittings not including weight of joint accessories, and this payment will cover the cost of joint accessories.

28. RESTRAINED JOINTS

No extra payment shall be made for restrained joints. The price should be included in the pipe bid price.

29. LOCATOR TAPE

No separate payment will be made for locator tape. The cost of installing this item shall be included in the contractor's bid price for the installation of PVC service line.

30. WYES AND BENDS

Wyes and bends that are installed and accepted will be counted in place by size and type. Payment for wyes and bends will be made at the unit price bid per each of the various sizes and types of wyes and bends.

31. ASPHALT TOPPING TYPE "F" (For Asphalt Resurfacing of Streets)

If directed by the Owner, the Contractor will pave the designated portion of street with 1-1/2" type "F" topping. Asphalt topping type "F" will be paid for at the unit price bid per square yard of the material actually placed and accepted.

32. CONCRETE BASE FOR TRENCHES (For Asphalt Resurfacing of Streets)

Before asphalt topping is placed a layer of concrete shall be placed in compacted trench as shown in the details. The base shall be finished flush with existing pavement. Payment will be on a linear foot basis as measured along the pipe centerline.

33. EXFILTRATION AND INFILTRATION TESTING

Payment for this item should be included in the bid price of the pipe.

34. GRASSING (All Types)

The area to be seeded will be measured when a satisfactory solid stand of grass has been obtained, and the area will be obtained by multiplying the length times the width. Grassing will be paid for at the unit price bid per square yard. Grassing shall conform to the requirements of the Manual for Erosion Control in Georgia.

Special grassing (sod) will be replaced as sod and will be paid for under the unit price bid per square yard for sod. Sod placed without the direction of the Engineer or Owner shall be paid for as seeded grassing.

Before seeding or sodding is placed, the Contractor shall consult with the Engineer to determine which form of grassing shall be utilized.

35. TEMPORARY STRAW MULCH STABILIZATION (Ds1)

Straw mulch stabilization placed for temporary purposes in areas where the Contractor needs to return after a short absence (such as a weekend) shall be paid for at the unit price bid per square yard. The Engineer's field representative must approve the use of this item prior to its installation to be eligible for payment. Mulch placed such that the soil is still visible shall not be measured or eligible for payment.

36. LANDSCAPING

The lump sum price bid for landscaping is for landscaping removed and replaced that is not covered by other proposal items. The price shall include, but not limited to all labor, materials, laying and staking, fertilizing, mulching and guaranteeing involved in the installation.

37. REMOVE AND REPLACE FENCE

Fencing payment will be made at the unit price bid per linear foot for the actual number of linear feet of fence removed and replaced.

38. REMOVE AND REPLACE CONCRETE CURB AND GUTTER

Concrete curb and gutter removed and replaced shall be paid for at the unit price bid per linear foot.

39. REMOVE AND REPLACE ASPHALT DRIVEWAY

Asphalt pavement shall be removed, disposed of, and replaced as detailed on the plans. Payment shall be made on a square yard basis. The width used in payment calculations shall be the actual replacement width up to a maximum of nominal pipe diameter plus 48". The unit price bid per square yard for removal and replacement of asphalt pavement shall be full compensation for all labor, materials, tools, and equipment necessary to remove, dispose of, and replace asphalt pavement.

40. REMOVE AND REPLACE CONCRETE DRIVEWAY

Concrete pavement shall be removed, disposed of, and replaced as detailed on the plans. Payment shall be made on a square yard basis. The width used in payment calculations shall be the actual replacement width up to a maximum of nominal pipe diameter plus 48". The unit price bid per square yard for removal and replacement of concrete pavement shall be full compensation for all labor, materials, tools, and equipment necessary to remove, dispose of, and replace concrete or pavement.

41. REMOVE AND REPLACE GRAVEL DRIVEWAY

Gravel driveways shall be removed and restored to a condition equal to or better than that before construction.

Removal and replacement of gravel driveway shall be measured in place and paid for at the unit price bid per square yard. The unit price bid shall be full compensation for removal proper disposal of debris and replacement of gravel driveway to a condition equal to or better than existed before construction.

42. REMOVE AND REPLACE MAIL BOX

No payment shall be made for mail boxes removed and replaced. Mail boxes shall be replaced the same day as removal, as to not prevent mail delivery.

43. REMOVE AND REPLACE SIDEWALK

Sidewalk removed and replaced will be measured in place and paid for at the unit price bid per linear foot for type of sidewalk removed and replaced.

44. REPLACING RIGHT-OF-WAY MARKERS OR IRON PINS

When existing concrete markers or iron pins are moved during the construction of the sanitary sewer, the Contractor shall replace the iron pin or concrete markers. The iron pin or marker shall be offset and replaced in the same existing location. All concrete markers or iron pins replaced shall be paid at the bid price for each.

45. REMOVE AND REPLACE ROCK WALL

Rock wall removed and replaced shall be paid at the unit price bid per linear foot for the actual number of linear feet of wall removed and replaced.

46. DUST CONTROL

Dust control efforts completed in accordance with the Manual for Erosion and Sediment Control in Georgia shall be paid for at the lump sum price bid and shall include all materials, equipment, tools and labor necessary to complete the work. Payment for this item shall be included in the final pay request only.

47. REMOVE AND REPLACE HEADWALL

Removing and replacing storm drain headwalls shall be paid for at the unit price bid per each to remove and replace the headwall to the satisfaction of the Engineer and Owner and in accordance with Cherokee County DOT standards.

48. TREE PROTECTION FENCING

Payment for tree protection fencing shall be made at the unit price bid per linear foot for the actual number of linear foot of tree save fence installed in accordance with the Georgia Manual for Erosion and Sediment Control. Payment will only be made for the tree protection fence placed at the direction of the field engineer.

49. REMOVE AND REPLACE CONCRETE DITCH

Concrete ditch or flumes removed and replaced shall be paid at the unit price bid per linear foot for the actual number of linear feet of concrete ditch removed and replaced.

50. INSTALLATION OF VERTICAL 2" PVC PIPING FOR GPS DATA COLLECTION

The Contractor shall be paid the unit price bid per each location of 2" PVC piping installed for the purpose of as-built data collection. The Contractor shall be responsible for all materials, labor, equipment and other incidentals necessary to install, label and protect the PVC vertical sections from the time that the force main is installed until the Contractor's Surveyor can make the necessary measurements and cut the pipe off below the ground. If debris clogs the pipe or if the pipe is broken off or lost, the Contractor will be required to excavate the area down to the main to reinstall the PVC pipe at the Contractor's expense.

51. REMOVE AND REPLACE STORAGE BUILDING

Storage buildings removed and replaced shall be paid for at the unit price bid for each.

52. REMOVE AND REPLACE CULVERT

Storm drains and culverts removed and replaced shall be paid at the unit price bid per linear foot for the actual number of linear feet of storm drains removed and replaced.

53. REMOVE AND REPLACE POWER POLE

Power poles removed and replaced shall be paid for at the unit price bid for each.

54. STORM WATER MONITORING - COMPLIANCE WITH EPD NPDES GAR 100002 PERMIT

In accordance with these specifications, the Contractor shall comply with the EPD's NPDES GAR 100002 Permit. The bid proposal has been set up to include all costs of the monitoring, inspecting, required fees, filing of notices, reporting and other requirements of the Permit as required by the contract documents and the NPDES GAR 100002 within the unit prices bid per month for compliance.

55. TURBIDITY BARRIER

Turbidity barriers installed and later removed in accordance with the erosion control plans shall be paid at the unit price bid per linear foot.

56. STREAM BANK STABILIZATION

Stream bank stabilization completed in accordance with the Manual for Erosion and Sediment Control in Georgia shall be paid for at the unit price bid for each.

****END OF SECTION****

SECTION 01152

APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

- A. Submit applications for Payment to the Engineer in accord with the schedule established by Conditions of the Contracts and Agreements between Owner and Contractor.
- B. Related Requirements in other parts of the Project Manual:
 - 1. Lump Sum: Agreement between Owner and Contractor.
 - 2. Progress payments, retainages and final payment: Conditions of the Contract.
- C. Related Requirements specified in other Sections:
 - 1. Contract Closeout: Section 01700

1.02 FORMAT AND DATA REQUIRED

- A. Submit applications on a form approved by Engineer, with itemized data typed in proper format. All pages of the payment application shall be 8.5" x 11".

1.03 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

- A. When the Owner or the Engineer requires substantiating data, Contractor shall submit suitable information, with a cover letter identifying:
 - 1. Project.
 - 2. Application number and date.
 - 3. Detailed list of enclosures.
 - 4. For stored products:
 - a. Item number and identification as shown on application.
 - b. Description of specific material.
- B. Submit one copy of data and cover letter for each copy of application.

1.04 SUBMITTAL PROCEDURE

- A. Submit application for payment to the Engineer at the times stipulated in the Agreement.
- B. Number: Five copies of each application.
- C. When the Engineer finds the application properly completed and correct, he will transmit a certificate for payment to Owner, with a copy to Contractor.

****END OF SECTION****

SECTION 01311

CONSTRUCTION SCHEDULES AND MEETINGS

PART 1 - GENERAL

- A. Promptly after award of the contract, the Contractor shall prepare and submit to the Engineer estimated construction progress schedules for the Work, with subschedules of related activities which are essential to its progress.
- B. Submit revised progress schedules periodically.

1.02 FORM OF SCHEDULES

- A. Prepare schedules in the form of a horizontal bar chart,
 - 1. Provide separate horizontal bar for each trade or operation.
 - 2. Horizontal time scale: Identify the first work day of each week.
 - 3. Scale and spacing: To allow space for notations and future revisions.
 - 4. Minimum sheet size: 11" by 17".
- B. Format of listings: The chronological order of the start of each item of work.
- C. Identification of listings: By major specification section numbers.

1.03 CONTENT OF SCHEDULES

- A. Construction Progress Schedule:
 - 1. Show the complete sequence of construction by activity.
 - 2. Show the dates for the beginning, and completion of, each major element of construction.
 - 3. Show projected percentage of completion for each item, as of the first day of each month.
- B. Submittals Schedule for Shop Drawings, Product data and samples. Show:
 - 1. The dates for Contractor's submittals.
 - 2. The dates approved submittals will be required from the Engineer.
- C. Products Delivery Schedule Dates.
- D. Provide subschedules to define critical portions of prime schedules.

1.04 PROGRESS REVISIONS

- A. Indicate progress of each activity to date of submission.
- B. Show changes occurring since previous submission of schedules:
 - 1. Major changes in scope.
 - 2. Activities modified since previous submission.
 - 3. Revised projections of progress and completion.
 - 4. Other identifiable changes.
- C. Provide a narrative report as needed to define:
 - 1. Problem areas, anticipated delays, and the impact on the schedule.
 - 2. Corrective action recommended, and its effect.

1.05 SUBMISSIONS

- A. Submit initial schedules within 15 days after award of Contract.
 - 1. The Engineer will review schedules and return review copy within 15 days after receipt.
 - 2. If required, resubmit within 7 days after return of review copy.
- B. Submit revised progress schedules at construction meetings or with each application for payment.
- C. Submit one reproducible transparency and one opaque reproduction.

1.06 DISTRIBUTION

- A. Distribute copies of the reviewed schedules to:
 - 1. Job site file.
 - 2. Subcontractors.
 - 3. Other concerned parties.
- B. Instruct recipients to report promptly to the Contractor, in writing, any problems anticipated by the projections shown in the schedules.

1.07 CONSTRUCTION MEETINGS

- A. A construction meeting shall be scheduled once each month. The meeting shall be held on site at a time and date mutually agreed upon by the Contractor and Engineer and Owner.

1.08 PRECONSTRUCTION CONFERENCE

After award of the bid and prior to beginning construction, a conference will be held with the representatives of the Contractor, Owner, Engineer and the affected utility companies to discuss schedules and utility conflicts in the Project. This conference is intended to establish lines of communication between the parties involved. Time and place of preconstruction conference will be determined at time of bid award.

****END OF SECTION****

SECTION 01340

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.01.1 SCOPE

Submit shop drawings, product data and samples required by the Contract Documents. Designate in the construction schedule, or in a separate coordinated schedule, the dates for submission and the dates that reviewed shop drawings, product data and samples will be needed.

1.02 SHOP DRAWINGS

A. Shop drawings shall be submitted in a clear and thorough manner to the Engineer. Copies returned to the Contractor will be marked as follows:

1. "No Exceptions Noted" - Indicates the drawings have been reviewed for conformance with the contract documents and no exceptions have been taken. Proceed with the work.
2. "Make Corrections Noted" - Indicates the drawings have been reviewed for conformance with the contract documents and work may proceed in accordance with all comments. Resubmittal will not be required.
3. "Revise and Resubmit" - Indicates the drawings have been reviewed for conformance with the contract documents, and work may not proceed. After items to which exceptions have been taken are corrected, Contractor shall again submit copies for review.
4. "Rejected" - Indicates the drawings have been reviewed for conformance with the contract documents and are too incomplete or in an unacceptable condition for review. A notation will be made on the shop drawings as to the exceptions taken. Drawings shall be revised and resubmitted for review before proceeding with the work.
5. "Submit Specified Item" - Indicates that one or more items in the submittal were missing or incomplete. Work may commence on any items to which no exceptions were taken; missing or incomplete items must be submitted as noted.

B. Details shall be identified by reference to sheet and detail, schedule or room numbers shown on Contract Drawings.

1.03 PRODUCT DATA

A. Preparation

1. Clearly mark each copy to identify pertinent products or models.
2. Show performance characteristics and capacities.
3. Show dimensions and clearances required.
4. Show wiring or piping diagrams and controls.

B. Manufacturer's standard schematic drawings and diagrams:

1. Modify drawings and diagrams to delete information which is not applicable to the work.
2. Supplement standard information to provide information specifically applicable to the work.

1.04 SAMPLES

A. Office samples shall be of sufficient size and quantity to clearly illustrate:

1. Functional characteristics of the product, with integrally related parts and attachment devices.
2. Full range of color, texture and pattern.

1.05 CONTRACTOR RESPONSIBILITIES

A. Review shop drawings, product data and samples prior to submission.

B. Determine and verify:

1. Field measurements.
2. Field construction criteria.
3. Catalog numbers and similar data.
4. Conformance with specifications.

C. Coordinate each submittal with requirements of the work and of the contract documents.

1. Notify the Engineer in writing, at time of submission, of any deviations in the submittals from requirements of the contract documents.
2. Begin no fabrication or work which requires submittals until return of submittals with Engineer approval.

1.06 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the work or in the work of any other contractor.

B. Telecopier sheets, Faxes, and copies of faxes are not allowed as shop drawing submittals.

C. Number of submittals required:

1. Shop drawings: Submit the number of opaque reproductions which the Contractor requires plus three copies which will be retained by the Engineer.
2. Product data: Submit the number of copies which the Contractor requires, plus three which will be retained by the Engineer.

3. Samples: Submit the number stated in each specification section.

D. Submittals shall contain:

1. The date of submission and the dates of any previous submissions.
2. The project title and number.
3. Contract identification.
4. The names of:
 - a. Contractor.
 - b. Supplier.
 - c. Manufacturer.
5. Identification of the product, with the specification section number.
6. Field dimensions, clearly identified as such.
7. Relation to adjacent or critical features of the work or materials.
8. Applicable standards, such as ASTM or Federal Specifications numbers.
9. Identification of deviations from contract documents.
10. Identification of revisions on resubmittals.
11. An 8 in. x 3 in. blank space for contractor and Engineer stamps.
12. Contractor's stamp, initialed or signed, certifying his review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Work and of Contract Documents.

1.07 RESUBMISSION REQUIREMENTS

- A. Make any corrections or changes in the submittals required by the Engineer and resubmit until approved.
- B. Shop Drawings and Product Data:
 1. Revise initial drawings or data, and resubmit as specified for the initial submittal.
 2. Indicate any changes which have been made other than those requested by the Engineer.
- C. Samples: Submit new samples as required for initial submittal.

****END OF SECTION****

SECTION 01410

TEST REQUIREMENTS

GENERAL

Materials furnished for all construction shall be subject to test at all times by the Engineer and any samples or specimens selected for test shall be furnished at no cost. The cost of all such test shall be borne by the contractor. All tests shall be made by a recognized testing laboratory, acceptable to the Engineer. The following minimum test reports or certificates shall be furnished to the Engineer prior to incorporation of the material in the work.

Cement: Certified mill tests that all cement meets the applicable specifications and that it is not more than 90 days form date of manufacture to incorporation into the work.

Concrete: See Section 03000.

Fine Aggregate: Approval of source of supply by the Engineer and certificate by supplier that the specifications have been met.

Coarse Aggregate: Same as above for fine aggregate.

Brick: No laboratory tests will be required of brick, unless so directed by the Engineer.

P.V.C. Sewer Pipe: P.V.C. sewer pipe shall be tested to certify that the pipe meets the material specifications.

Ductile Iron Pipe: Certified tests of the manufacturer that the pipe furnished meets the material specifications in Section 02606 and 02710.

Precast Manholes: Shop drawings of manholes shall be submitted showing the complete design of the manhole proposed. Engineer's approval of design, materials and manufacturing procedure shall be obtained before any manholes are delivered to the job site.

Bitumastic Materials: Manufacturers furnishing bitumastic materials shall supply certified test reports in duplicate that their materials meet the specifications. The quarry furnishing stone for the base shall furnish certified test reports that their material meets the specifications.

Asphaltic Plant Mix: A certificate shall be furnished by the supplier of an asphaltic plant mix that the material furnished meets the requirements of the specifications of the Georgia Highway Department.

Soil Testing: General. The Contractor will select a qualified independent testing laboratory for the purpose of identifying soils, checking densities, and classifying soils materials during construction. Payment for the testing will be by the Contractor.

The Contractor shall include the cost of retaining a soils testing agency during backfill operation to adequately test each 6 inch lift of backfill. Proper compaction shall be obtained for each lift before continuing backfill operation on top of that lift. Compaction reports shall be submitted to the engineer showing passing compaction tests for each lift.

Moisture-Density Tests. Testing shall be in accordance with ASTM Methods D698 and D1557. A test shall be performed on each type of material used in the work regardless of source. Tests will be accompanied by particle-size analyses of the soils tested (ASTM Methods D421 and D422). Changes in color, gradation, plasticity or source of fill material will require the performance of additional tests. Copies of all test results shall be furnished the Engineer.

Field Density Tests. Tests shall be made in accordance with ASTM Method D1556. If any compaction test reveals that fill or backfill is not compacted as specified, the Contractor shall scarify and re-compact as required to achieve the specified density. Additional compaction tests shall be made to verify proper compaction.

Submittals. The soils technician will submit formal reports of all compaction tests and retests to the Contractor, Owner and Engineer as soon as possible upon completion of the required tests.

This report information is to include but not be limited to the following:

1. Date of the test and date submitted.
2. Location of test.
3. Wet weight, moisture content and dry weight of field sample.
4. Description of soil.
5. Maximum dry density and moisture content of the lab sample which best matches the field sample in color, texture, grain size and maximum dry density.
6. Ratio of field dry density to maximum lab dry density expressed as a percentage.
7. Comments concerning the field density passing or failing the specified compaction.
8. Comments about re-compaction if required.

Compaction Results. The soils technician is to advise the Engineer and Contractor immediately of any compaction tests failing to meet the specified minimum requirements. No additional lift is to be placed on a lift with any portion failing.

Grading: Upon completion of other construction operations, the entire site, within the limits shown on the Drawings, shall be brought to the finished grades indicated and which will provide proper drainage. All surfaces shall be raked smooth and shall be free of all vegetable matter, debris and stones larger than 2-1/2 inches. Allow for thickness of required stone.

Mill Tests: Mill tests, if any, shall be conducted and reports submitted as specified for such material. Mill or shop tests shall be accomplished by the manufacturer or supplier of the materials, and may be conducted by an independent testing laboratory. These tests shall be performed in accordance with the ASTM Standard, if specified, or with other applicable standards.

The cost of mill tests shall be included in the lump sum price bid, and no additional payment will be made.

Laboratory Tests: Laboratory tests shall be conducted and test reports submitted where this type of test is specified. All laboratory tests shall be made by a reputable independent laboratory. These tests shall be performed in accordance with ASTM Standards, if specified, or other applicable standards if no reference is included.

The contractor shall arrange for all tests of preliminary samples of materials and mixtures, in order to determine suitability of source and for initial design mixes of concrete. The cost of these preliminary tests shall be included in the lump sum price of the contract and no additional payment will be made.

Routine tests of materials incorporated into the project will be performed by an independent testing laboratory. Samples shall be provided by the Contractor. The Contractor will pay for all concrete cylinder tests and preliminary tests to determine initial design mixes.

Soils tests for gradation, moisture content and density will be paid for by the Contractor.

Field Tests: Field tests of mechanical and electrical equipment, piping systems, electrical systems, control systems, ventilation systems, heating systems, water mains, pressure mains, sewers, drains, and similar facilities shall be conducted where this type of test is specified.

Field tests include determination of performance, capacity, efficiency, function, tightness, leakage or other special requirements. These tests shall be performed in accordance with applicable standards and test codes.

Field tests shall be set up and accomplished by the Contractor who shall provide all tools, equipment, instruments, personnel and other facilities required for the satisfactory completion of each test.

Factory Tests: Factory tests of mechanical and electrical equipment relative to performance, capacity, rating, efficiency, function or special requirements shall be conducted in the factory or shop for each item when this type of test is specified. These tests shall be performed in accordance with applicable standards and test codes.

Factory tests shall be set up and accomplished by the equipment manufacturer who shall provide all shop space, tools, equipment, instruments, personnel and other facilities required for the satisfactory completion of each test.

The cost of factory tests shall be included in the lump sum price of the Contract and no additional payment will be made for factory testing.

Reference Standards: Reference to the standards of any technical society, organization, or association, or to codes of local or state authorities, shall mean the latest standard, code, specification, or tentative standards adopted and published at the date of taking bids, unless specifically state otherwise.

Qualifications of Laboratory:

- A. Meet "Recommended Requirements for Independent Laboratory Qualification", published by American Council of Independent Laboratories.
- B. Meet basic requirements of ASTM E 329, "Standards of Recommended Practice for Inspection and Testing Agencies for concrete and steel as used in construction."
- C. Authorized to operate in the State in which the Project is located.

Laboratory Duties:

- A. Promptly submit written report of each test and inspection: One copy each to the Engineer, Owner, Contractor, and one copy to Record Documents file. Each report shall include:
1. Date issued.
 2. Project title and number.
 3. Testing laboratory name, address and telephone number.
 4. Name and signature of laboratory inspector.
 5. Date and time of sampling or inspection.
 6. Record of temperature and weather conditions.
 7. Date of test.
 8. Identification of product and specification section.
 9. Location of sample or test in the project.
 10. Type of inspection or test.
 11. Results of tests and compliance with contract documents.
 12. Interpretation of test as required by the Engineer or the Owner.
- B. Perform additional tests as required by the Engineer or the Owner.

Limitations of Authority of Testing Laboratory:

- A. Laboratory is not authorized to:
1. Release, revoke, alter or enlarge on requirements of Contract Documents.
 2. Approve or accept any portion of the work.
 3. Perform any duties of the contractor.

Contractor's Responsibilities:

- A. Cooperate with laboratory personnel provide access to work, to Manufacturer's operations.
- B. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.
- C. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other materials mixes which require control by the testing laboratory.
- D. Furnish copies of products test reports as required.

- E. Furnish incidental labor and facilities:
1. To provide access to work to be tested.
 2. To obtain and handle samples at the project site or at the source of the product to be tested .
 3. To facilitate inspections and tests.
 4. For storage and curing of test samples.
- F. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.
1. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred due to Contractor's negligence.
- G. Employ and pay for the services of a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required:
1. For the Contractor's convenience.
 2. When initial tests indicate work does not comply with Contract Documents.

****END OF SECTION****

SECTION 01510

TEMPORARY UTILITIES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Furnish, install and maintain temporary utilities required for construction, remove on completion of work.
- B. Related Requirements specified in other sections:
 - 1. Summary of work: Section 01010
 - 2. Field Offices and Sheds: Section 01590

1.02 REQUIREMENTS OF REGULATORY AGENCIES

- A. Comply with National Electric Code.
- B. Comply with Federal, State and local codes and regulations and with utility company requirements.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. Materials may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

2.02 TEMPORARY ELECTRICITY AND LIGHTING

- A. Contractor shall arrange with utility company, provide service required for power and lighting, and pay all costs for service and for power used.
- B. Contractor shall provide adequate artificial lighting for all areas of work when natural light is not adequate for work, and for areas accessible to the public.

2.03 TEMPORARY HEAT AND VENTILATION

- A. Provide temporary heat and ventilation as required to maintain adequate environmental conditions to facilitate progress of the work, to meet specified minimum conditions for the installation of materials, and to protect materials and finishes from damage due to temperature or humidity.
- B. Provide adequate forced ventilation for enclosed areas for curing of installed materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors, or gases.
- C. Portable heaters shall be standard approved units complete with controls.

- D. Pay all costs of installation, maintenance, operation and removal, and for fuel consumed.

2.04 TEMPORARY TELEPHONE SERVICE

- A. Arrange with local telephone service company, provide direct line telephone service at the construction site for the use of personnel and employees. Service required:
 - 1. One direct line instrument in Field Office.
 - 2. One direct line instrument in Owner's representative's office.
 - 3. Other instruments at the option of the Contractor, or as required by regulations.
 - 4. One fax machine for sending and receiving necessary information about the project.
- B. Pay all costs for installation, maintenance and removal, and service charges for local calls. Toll charges shall be paid by the party who places the call.

2.05 TEMPORARY WATER

- A. Arrange with the Owner to provide metered water for construction purposes, pay all cost associated for installation, maintenance and removal of the temporary water.

2.06 TEMPORARY SANITARY FACILITIES

- A. Provide sanitary facilities in compliance with laws and regulations.
- B. Service, clean and maintain facilities and enclosures.

PART 3 - EXECUTION

3.01 GENERAL

- A. Comply with applicable requirements specified in Division 15 - Mechanical, and in Division 16 - Electrical.
- B. Maintain and operate systems to assure continuous service.
- C. Modify and extend system as work progress requires.

3.02 REMOVAL

- A. Completely remove temporary materials and equipment when their use is no longer required.
- B. Clean and repair damage caused by temporary installations or use of temporary facilities.

****END OF SECTION****

SECTION 01590
FIELD OFFICES AND SHEDS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Furnish, install and maintain temporary field offices during the entire construction period.
- B. Furnish, install and maintain storage and work sheds needed for construction.
- C. At completion of work, remove field offices, sheds and contents.
- D. Related requirements specified in other sections:
 - 1. Temporary utilities: Section 01510.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

- A. Comply with requirements of Federal, State and local codes and regulations.

1.03 OTHER REQUIREMENTS

- A. Prior to installation of offices and sheds, consult with Engineer on location, access and related facilities.

1.04 REQUIREMENTS FOR FACILITIES

- A. Construction:
 - 1. Structurally sound, weathertight, with floors raised above ground.
 - 2. Temperature transmission resistance: compatible with occupancy and storage requirements.
 - 3. At Contractor's option, portable or mobile buildings may be used.
- B. Storage Sheds:
 - 1. To requirements of the various trades.
 - 2. Dimensions: Adequate for storage and handling of products.
 - 3. Ventilation: Comply with specified and code requirements for the products stored.
 - 4. Heating: Adequate to maintain required temperatures for the products stored.

PART 2 - PRODUCTS

2.01 MATERIALS, EQUIPMENT, FURNISHINGS

- A. May be new or used, but must be serviceable, adequate for the required purpose, and must not violate applicable codes or regulations.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Fill and grade sites for temporary structures to provide surface drainage.

3.02 INSTALLATION

- A. Construct temporary field offices and storage sheds on proper foundations, provide connections for utility services.
 - 1. Secure portable or mobile buildings when used.
 - 2. Provide steps and landings at entrance doors.
- B. Mount thermometer at convenient outside location, not in direct sunlight.
- C. Mount a rain gauge at convenient location for accurate rainfall data.

3.03 MAINTENANCE AND CLEANING

- A. Provide periodic maintenance and cleaning for temporary structures, furnishings, equipment and services.

3.04 REMOVAL

- A. Remove temporary field offices, contents and services at a time they are no longer needed.
- B. Remove storage sheds when they are no longer needed.
- C. Remove foundations and debris; grade the site to required elevations and clean the area.

****END OF SECTION****

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 – GENERAL

1.01 SCOPE

- A. Material and equipment incorporated into the work:
 - 1. Conform to applicable specifications and standards.
 - 2. Comply with size, make, type and quality specified, or as specifically approved in writing by the Engineer.
 - 3. Manufactured and fabricated products:
 - a. Design, fabricate and assemble in accord with the best engineering and shop practices.
 - b. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.
 - c. Two or more items of the same kind shall be identical, by the same manufacturer.
 - d. Products shall be suitable for service conditions.
 - e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
 - 4. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

1.02 MANUFACTURER'S INSTRUCTIONS

- A. When Contract documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to Engineer.
 - 1. Maintain one set of complete instructions at the job site during installation and until completion.
- B. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements.
 - 1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for further instructions.
 - 2. Do not proceed with work without clear instructions.
- C. Perform work in accord with manufacturer's instructions. Do not omit any preparatory step or

installation procedures unless specifically modified or exempted by Contract Documents.

1.03 TRANSPORTATION AND HANDLING

- A. Arrange deliveries of products in accord with construction schedules, coordinate to avoid conflict with work and conditions at the site.
 - 1. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
 - 2. Immediately on delivery, inspect shipments to assure compliance with requirements of contract documents and approved submittals, and that products are properly protected and undamaged.
- B. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

1.04 STORAGE AND PROTECTION

- A. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.
 - 1. Store products subject to damage by the elements in weathertight enclosures.
 - 2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.
- B. Exterior Storage
 - 1. Store fabricated products above the ground, on blocking or skids, prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation.
 - 2. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
- C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions and free from damage or deterioration.
- D. Protection after installation:
 - 1. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed.

1.05 SUBSTITUTIONS AND PRODUCT OPTIONS

A. Products List.

1. Within 30 days after contract date, submit to Engineer a complete list of major products proposed to be used, with the name of the manufacturer and the installing subcontractor.

B. Contractor's Options.

1. For products specified only by reference standard, select any product meeting that standard.
2. For products specified by naming several products or manufacturers, select any one of the products or manufacturers named, which complies with the specifications.
3. For products specified by naming one or more products or manufacturers and "or approved equal", Contractor must submit a request as for substitutions for any product or manufacturer not specifically named.

C. Substitutions

1. For a period of 30 days after contract date, the Engineer will consider written requests from Contractor for substitution of products.
2. Submit a separate request for each product, supported with complete data, with drawings and samples as appropriate, including:
 - a. Comparison of the qualities of the proposed substitution with that specified.
 - b. Changes required in other elements of the work because of the substitution.
 - c. Effect on the construction schedule.
 - d. Cost data comparing the proposed substitution with the product specified.
 - e. Any required license fees or royalties.
 - f. Availability of maintenance service, and source of replacement materials.
3. The Engineer shall be the judge of the acceptability of the proposed substitution.

D. Contractor's Representation:

1. A request for a substitution constitutes a representation that contractor:
 - a. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.
 - b. Will provide the same warranties or bonds for the substitution as for the product specified.

- c. Will coordinate the installation of an accepted substitution into the work, and make such other changes as may be required to make the work complete in all respects.
 - d. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.
- E. The Engineer will review requests for substitutions with reasonable promptness, and notify contractor, in writing, of the decision to accept or reject the requested substitution.

****END OF SECTION****

SECTION 01640

GENERAL EQUIPMENT STIPULATIONS

PART 1 – GENERAL

1.01 SCOPE

These General Equipments Stipulations apply, in general, to all equipment and piping. They supplement the detailed equipment specifications, but in case of conflict, the detailed equipment specifications shall govern.

1.02 COORDINATION

The Contractor shall resume full responsibility for the coordination of the installation of all equipment, materials and products furnished under these Contract Documents. The Contractor shall be completely responsible for verification that all structures, piping and equipment components furnished by him and/or his Subcontractors and Suppliers are compatible. The Contractor shall start up each equipment system and shall make all necessary adjustments to place each system in proper operating condition.

1.03 ADAPTATION AND LOCATION OF EQUIPMENT

- A. Equipment shall be readily adaptable for installation and operation in the structures to be constructed under these Contracts. No responsibility for alteration of a planned structure to accommodate other types of equipment will be assumed by the Owner. Equipment, which requires alteration of the structures, will be considered only if the Contractor assumes all responsibility for making and coordinating all necessary alterations. All such alterations shall be made at the Contractor's expense.
- B. The Contractor shall install the work in such manner that the equipment, piping, vents, conduit, panels, ductwork, etc., be as neatly installed and out-of-the-way as physically possible. All equipment, piping, ductwork, conduit, etc., shall be installed to provide needed maintenance and passage space.

1.04 PATENT ROYLTIES

All royalties and fees for patents covering materials, articles, apparatus, devices, or equipment shall be included in prices bid by the Contractor.

1.05 EQUIPMENT GUARANTEE

The Contractor and equipment manufacturer shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective materials, breakage or other failure. The guarantee period shall be defined in the section entitled "Warranties and Bonds" of these Specifications.

1.06 WORKMANSHIP AND MATERIALS

- A. All equipment shall be designed, fabricated, and assembled in accordance with the best modern engineering and shop practice. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall be new and shall not have been in service at any time prior to delivery, except as required by tests. All bolts, nuts, fastening, pipe and fittings shall be manufactured in conformance with the United States system of measurement.
- B. Materials shall be suitable for service conditions. Iron castings shall be tough, close grained, gray iron free from blowholes, flaws, or excessive shrinkage and shall conform to ASTM A 48, Class 30 minimum. Plugging of defective castings shall not be permitted. Castings shall be annealed to remove internal stresses prior to machining and shall have the mark number and heat number cast on them.
- C. Except where otherwise specified, structural and miscellaneous fabricated steel used in items of equipment shall conform to the Standards of the American Institute of Steel Construction. All structural members shall be considered as subject to shock or vibratory loads.
- D. All replaceable or expendable elements such as filters, screens, drive belts, fuses, indicator lamps, etc., shall be easily accessible and replaceable without need of dismantling equipment or piping. All such items shall be of a standard type that is readily available from multiple suppliers.
- E. Threaded openings for drains or vents in pump volutes, compressor or fan scrolls, air receivers, and heat exchangers which are plugged during normal operation shall be provided with stainless steel plugs.

1.07 LUBRICATION AND LUBRICATION FITTINGS

- A. Equipment shall be adequately lubricated by systems, which require attention no more frequently than weekly during continuous operation. Lubrication systems shall not require attention during start-up or shutdown and shall not waste.
- B. Lubricants of the type recommended by the equipment manufacturer shall be provided in sufficient quality by the Contractor to fill all lubricant reservoirs and to replace all lubricants consumed during testing, start-up, and initial operation. The Contractor shall provide sufficient quantities of lubricants to lubricate all equipment for one year of normal service before final acceptance of the equipment will be made by the Owner.
- C. Where special run-in oil or storage lubricants are used, they shall be flushed out and replaced with the required service lubricant by the Contractor.
- D. Tag each piece of equipment with cloth tag showing proper type lubricant, period between lubrication, date of lubrication, and worker's initials. Have space for ten

lubrication notations.

- E. Except for rotating shaft couplings, all lubrication fittings shall be brought to the outside of all equipment so that they are readily accessible from the outside without the necessity of removing covers, plates, housings, or guards. Fittings shall be accessible from safe, permanent platforms or portable high-pressure grease gun. Connection from a remote fitting to the point of use shall be with minimum 3/16-inch stainless steel tubing, securely mounted parallel to equipment and protected where exposed.

1.08 ELECTRIC MOTORS

- A. Unless otherwise required by the detailed equipment specifications, motors furnished with equipment shall comply with the following:
 - 1. Motors shall be designed and applied in compliance with NEMA, ANSI, IEEE and AFBMA standards and the NEC for the specific duty imposed by the driven equipment.
 - 2. Where frequent starting occurs, motors shall be designed for frequent starting duty equivalent to the duty service required by the driven equipment.
 - 3. All motors shall be rated for continuous duty at 40°C ambient. Motor temperature rise above 40°C ambient on continuous operation at nameplate horsepower shall not exceed the NEMA limit for 1.0 service factor and Class B insulation, or Class A insulation if used.
 - 4. Motors shall be designed for full voltage starting. Motors operate under a ± 10 percent voltage variation and ± 5 percent frequency variation.
 - 5. Motor-bearing life shall be based upon the actual operating load conditions imposed by the driven equipment.
 - 6. Motors shall be sized for the altitude at the location where the equipment is to be installed.
 - 7. Motors shall be sized so that, under maximum continuous load imposed by the driven equipment, the motor nameplate horsepower for operation in 40°C ambient is at least 15 percent more than driven load. Continuous equipment load shall not exceed 87 percent of motor nameplate horsepower, whether motor service factor is 1.0 or higher.
 - 8. Where the detailed specifications call for encapsulated motor windings, the motor shall have a sealed insulation system designed for a more severe environment than usual varnish treatments can withstand. The insulation system shall be General Electric "Polyseal", Allis-Chalmers "Poxeal", U.S. Motors "Everseal", or equal. Motors in this case may be single voltage rated.

9. Motors shall have a clamp-type grounding terminal inside the motor conduit box.
 10. Motors with external conduit boxes shall have oversized conduit boxes.
 11. Motors in occupied areas shall be quiet rated and marked so.
- B. It is the intent of this general specification to allow the manufacturer's standard motor on integrally-constructed, motor-driven equipment such as appliances, hand tools, etc., that is specified by model number in which a redesign of the complete unit would be required for a motor with other features as may be specified herein.
- C. Unless otherwise required by the detailed equipment specifications, motors within the horsepower ranges indicated below shall be rated and constructed as follows:
1. Below $\frac{1}{2}$ horsepower:
 - a. 115-volt, 60 hertz, single phase
 - b. Totally enclosed, fan cooled
 - c. Permanently lubricated, sealed bearings
 - d. Built-in manual-reset thermal protector: or furnished with integrally mounted stainless steel enclosed manual motor-overload switch
 2. $\frac{1}{2}$ to 1 horsepower:
 - a. 230/460-volt, 60 Hertz, 3-phase
 - b. Totally enclosed, fan cooled
 - c. Specially insulated for use in damp locations below 20°C
 - d. Grease-lubricated, antifriction bearings
 3. 1 $\frac{1}{2}$ horsepower and above:
 - a. 230/460-volt, 60 Hertz, 3-phase
 - b. Totally enclosed, fan enclosed
 - c. Specially insulated for use in damp location below 20°C
 - d. Grease-lubricated antifriction bearings or oil-lubricated sleeve bearings
 - e. Vertical motors shall have 15-year average-life thrust bearings

1.09 DRIVE UNITS

- A. Except when specified otherwise in the detailed equipment specifications, 87 percent of the nameplate horsepower rating of each drive motor shall be at least equal to the theoretical brake horsepower required to drive the equipment under full load, including all losses in speed reducers and power transmission.
- B. The nominal input horsepower rating of each gear or speed reducer shall be at least equal to the nameplate horsepower of the drive motor.
- C. Drive units shall be designed for 24-hour continuous service and shall be constructed so that oil leakage around shafts is precluded.
- D. GEAR MOTORS
 - 1. Gear Motors shall be rated AGMA Class II and shall bear an AGMA nameplate.
- E. GEAR REDUCERS
 - 1. Each gear reducer shall be totally enclosed, oil-lubricated, with antifriction bearings throughout. Worm gear reducers shall have a service factor of at least 1.25. Shaft-mounted gear reducers shall be rated AGMA Class II. Other helical, spiral bevel, and combination bevel-helical gear reducers shall have a service factor of at least 1.40. Each gear reducer shall bear an AGMA nameplate or the manufacturer shall certify that the gear reducer is designated and rated in accordance with AGMA standards.
- F. CHAIN DRIVES
 - 1. Chain drives shall utilize roller chain having an ultimate strength of not less than 10 times the maximum working loads.
- G. V-BELT DRIVES
 - 1. Each V-belt drive shall include a sliding base or other suitable tension adjustment. Fixed ratio V-belt drives shall have a service factor of at least 1.5 based on motor nameplate horsepower.
- H. COUPLINGS
 - 1. Couplings between motors drives or between drives and the driven equipment shall have a service factor of not less than 1.25 based on motor nameplate horsepower. Couplings between drives and the driven equipment shall have a service factor not less than that of the drive based on motor nameplate horsepower. All couplings rotating at speeds less than 900 rpm shall be of all steel construction. In general, couplings shall be of the tapered grid steel spring type or the crowned gear type.

I. OVERTORQUE PROTECTION

1. All low speed, high torque drives for equipment such as mechanical screens, conveyors, and clarifier and thickener mechanisms shall be protected against excessive torque by means of a suitable over torque protection device. Acceptable devices shall include torque switches, shear pins, shear keys and full-release torque couplings. Torque limiting couplings using sliding surfaces or friction to limit torque shall not be used.

1.10 SAFETY GUARDS

- A. All belt or chain drives, fan blades, couplings, and other moving or rotating parts shall be covered on all sides by a safety guard. Safety guards shall be fabricated from 16 USS gauge or heavier galvanized or aluminum-clad sheet steel or ½-inch mesh galvanized expanded metal. Each guard shall be designed for easy installation and removal. All necessary supports accessories shall be provided for each guard. Supports and accessories, including bolts, shall be galvanized. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water. All safety guards shall comply with OSHA General Industry Standards, Part 1910, Subpart O, Machinery and Machine Guarding. Provide tachometer access on shaft ends. The safety guards shall be painted yellow in accordance with Section 09900, Painting.

1.11 ANCHOR BOLTS

- A. Equipment suppliers shall furnish suitable anchor bolts for each item of equipment. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed. Two nuts and two washers shall be provided with sufficient threads to permit a nut and washer to be installed on the concrete side of the concrete form or supporting template, but in no case shall bolts be threaded less than 2 (two) inches. Anchor bolts used in anchoring rotating or vibrating equipment shall be provided with suitable lock washers.
- B. Unless otherwise shown or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit a minimum of one (1) inch of grout beneath the baseplate and to provide adequate anchorage into structural concrete. Individual, embedded anchor bolts for heavy equipment shall be centered in a steel pipe sleeve having an inside diameter approximately two (2) times the bolt diameter and an embedded length approximately eight (8) times the bolt diameter.
- C. Bolts specified to be bent shall be bent cold. Bend radius shall not be less than twice the bolt diameter. Unless otherwise shown or specified, anchor bolts shall be embedded in concrete a minimum distance of fifteen (15) times the bolt diameter. Unless otherwise shown or specified, all anchor bolts shall be at least ½ inch diameter.
- D. All embedded anchor bolts or anchor bolt materials shall be ASTM A 193, Grade

B8, ASTM A 276, Type 304, or IFI-104, Grade 304 stainless steel threaded per ANSI B1.1. Nuts shall be heavy hex nuts, ANSI B18.2, semi finished pattern, and shall be ASTM A 194, Grade 8 or IFI-104, Grade 304 stainless steel. Flat washers shall be 18-8 stainless steel and shall conform to ANSI B27.2

- E. Expansion anchors shall be used to anchor equipment to existing concrete. Expansion anchors shall be stainless steel, Type 304 and shall be of the wedge type for use in bottomless holes. Expansion anchors shall conform to the applicable requirements of Federal Specification FF-S-325. Installation methods shall be in conformance with the manufacturer's recommendations for maximum pullout and shear strength, but in no case shall the depth of the hole be less than eight (8) bolt diameters or three (3) inches, whichever is greater. The minimum distance between the center of any expansion anchor and an edge or exterior corner of concrete shall not be less than five (5) times the diameter of the hole in which it is installed. The minimum distance between adjacent anchors shall not be less than ten (10) times the diameter of the hole in which it is installed.

1.12 EQUIPMENT BASES

- A. Where shown on the Drawings, equipment shall be installed on a raised reinforced concrete base. The base shall be a minimum of four (4) inches in height and shall extend beyond the equipment baseplate approximately two (2) inches on all sides.
- B. The electrical contractor shall be instructed concerning electrical conduit locations prior to pouring the concrete base.
- C. Unless otherwise specified, a cast iron or welded steel baseplate shall be provided for each pump, compressor, and any other item of equipment which is to be installed on a concrete base. Each unit and its drive assembly shall be supported on a single baseplate of neat design. Baseplates shall have pads for anchoring all components and adequate grout holes. Baseplates for pumps shall have a raised lip all around and a threaded drain connection. Baseplates shall be anchored to the concrete base with suitable anchor bolts and the space beneath filled with epoxy or non-shrink grout as specified in the grouting section.
- D. On direct-coupled equipment, motor and driven equipment shall be doweled to a common base with a minimum of two (2) dowels each.

1.13 ALIGNMENT OF MOTORS AND EQUIPMENT

- A. In every case where a drive motor is connected to a driven piece of equipment by a flexible coupling, the coupling halves shall be disconnected and the alignment between the motor and the equipment checked and corrected. Machinery shall first be properly aligned and leveled by means of steel wedges and shims or jacking screws near anchor bolts. Anchor bolts shall be tightened against the shims on wedges or jacking screws and the equipment shall again be checked for level and alignment before placing grout. Wedges shall not be placed between machined surfaces.

- B. In general, checking and correcting the alignment shall follow the procedures set up in the Standards of the Hydraulic Institute, Instructions for Installation, Operation, and Maintenance of Centrifugal Pumps. Equipment shall be properly leveled and brought into angular and parallel alignment.
- C. Equipment shall be installed in such a way that no strain is transmitted to the equipment by piping systems or adjacent equipment.

1.14 GROUTING

- A. A special epoxy, non-shrink grout shall be used in the placement of all pump, motor, and equipment baseplates or bedplates, column baseplates, other miscellaneous baseplates, and other gouting applications as shown on the Drawings. Grouting materials and installation shall be specified in the section entitled "Nonmetallic Grouting" of these specifications and Contract Drawings.

1.15 WELDING AND BRAZING

- A. All welds shall be sound and free from embedded scale and slag. All butt welds shall be continuous and where exposed to view shall be ground smooth. All continuous welds shall be gas and liquid tight. Welds in piping shall have full penetration and shall be smooth on the inside of the pipe. Intermittent welds shall have an effective length of at least two (2) inches and shall be spaced not more than six (6) inches apart.
- B. All welding of steel and aluminum, including materials, welding techniques, general safety practices, appearance and quality of welds, and methods of correcting defective work, shall conform to the latest requirements of AWS Specifications. Structural steel welding shall conform to the requirements of the AWS Structural Welding Code. The general recommendations and requirements of the AWS Structural Code shall also apply to welded aluminum structures. The welding process and welding operators must meet qualification tests and welding performance tests in accordance with the latest provisions of ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications. Welding process and qualification procedures for welding of pipe shall conform to the latest requirements of ANSI B31.1, Section 327, Welding, and Section 328, Brazing and Soldering. All welding qualification tests shall be witnessed by the Engineer, except as provided herein. All costs associated with the qualification or testing of welder and welding operators shall be borne by the Contractor.
- C. Actual welding procedures to be used in field assembly and installation of equipment furnished under this Contract shall be submitted to the Engineer for approval prior to beginning the work. Reports certifying that the welding procedures, welders and welding operators that the Contractor intends to use are qualified as specified above shall also be submitted to the Engineer prior to beginning the work. In case of welder qualifications for shop welding and for carbon steel field welding, welders presenting certified qualification papers validated within the preceding six (6) month period and acceptable to the Engineer will not be required to take the qualification tests. In case of field welding of stainless steel or aluminum, all welders shall be required to take the

qualification tests regardless of past experience or availability of certified qualification papers.

- D. Field welding practices shall conform to OSHA construction standards, Part 1926, Subpart J, Welding and Cutting. Shop welding practices shall conform to OSHA General Industry Standards, Part 1910, Subpart Q, Welding, Cutting, and Brazing.
- E. Welding electrodes for structural steel shall conform to the standard recommendations of the AISC. Welding electrodes for stainless steel shall conform to applicable AWS Specifications and shall be as recommended by "Welded Austenitic Chromium-Nickel Stainless Steel, Techniques and Properties". Published by the International Nickel Company, New York, New York. Welding electrodes for aluminum shall conform to applicable AWS Specifications.
- F. Each welder and welding operator must identify his/her welds with his/her assigned symbol.
- G. Welders performing unsatisfactory work shall be removed from the welding process.
- H. The Owner may inspect any weld by radiographic or other means. Welds not in accordance with the requirements specified herein shall be repaired or replaced at the Contractor's expense. Excessive porosity, nonmetallic inclusions, lack of fusion, incomplete penetration, and cracking shall constitute grounds for rejection of welds.

1.16 ERECTION AND SETTING

- A. In erection and setting of all fabricated equipment, the Contractor shall exercise care to ensure that each item of equipment is adequately supported so as not to bend or distort under its own weight until adequate foundation support and anchorage are provided. Where lifting lugs, angles or clips are provided on equipment, they shall be used in erecting and setting equipment. Erection and setting of equipment and structural steel shall conform to the requirements of OSHA Construction Standards, Part 1926, Subpart R, Steel Erection, Subpart H, Material Handling, Storage Use, and Disposal, and Subpart N, Cranes, Derricks, Hoists, and Conveyors. Erection of structural steel shall conform to the latest requirements of the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings.
- B. During placement and prior to any grouting or connection of adjacent piping the equipment shall be leveled and aligned true to level, plumb, alignment, and grade with all parts bearing or fitting the structure or equipment accurately and securely. It shall not be permitted to cock out of alignment, redrill, reshape or force fit any fabricated items.
- C. The Contractor shall take all measurements necessary to properly fit his work in the field, and he shall be governed by and responsible for these measurements

and the proper working out of all details. The Contractor shall be responsible for the correct fitting of all work in the field and the accurate placement of all anchor bolts installed by him.

- D. The Contractor shall bring all parts to be erected or assembled into close contact. Before assembly, all surfaces to be in contact with other shall be thoroughly cleaned. Drift pins may be used only for bringing members into position, never to enlarge or distort holes. Torching or burning of holes or cutting of fabricated items to correct misalignment or shop errors shall not be permitted. Enlargement of holes necessary to make field connections shall be done only with the Engineer's approval by reaming with twist drills and in a manner acceptable to him.
- E. All equipment shall be furnished with suitable eyebolt lifting lugs or lifting angles to facilitate handling.

1.17 SPECIAL TOOLS

- A. Equipment requiring periodic repair and adjustment shall be furnished complete with special tools, instruments, and accessories required for proper maintenance. Special tools and accessories shall include those tools and accessories not normally available in an industrial hardware or mill supply house. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

1.18 SHOP PRIMING AND PAINTING

- A. All equipment shop priming and painting, including surface preparation, workmanship and materials, shall be as specified in the section entitled "Painting", of these Specifications.

1.19 FIELD PRIMING

- A. All iron and carbon steel surfaces not specified to be galvanized or shop primed and all ferrous or nonferrous surfaces specified to be field primed and painted shall be coated in the field with one or more coats of primer in accordance with the requirements of the section entitled "Painting", of these Specifications.

1.20 FIELD PAINTING

- A. Except for interior surfaces of vessels and enclosed equipment not specified to be field painted, all ferrous and nonferrous surfaces of equipment which have received one or more coats of shop or field applied primer shall be field painted after installation in accordance with the requirements of the section entitled "Painting", of these Specifications.

1.21 GALVANIZING

- A. All galvanizing shall be done by the hot dip process after fabrication in conformity with the requirements of ASTM A 123, A 153, A 384 and A 385.

articles to be galvanized shall be pickled before galvanizing.

- B. Where galvanizing bolts are specified or required by the Drawings, cadmium or zinc plated bolts will be acceptable provided cadmium plating conforms to ASTM A 165, Type NS, and zinc plating conforms to ASTM A 164, Type GS.
- C. Areas of galvanizing damaged by welding or burning or otherwise damaged shall be thoroughly stripped and cleaned and recoated with zinc to the required thickness by the hot dip process.
- D. Galvanizing articles shall be free from uncoated spots, blisters, flux, black spots, dross, projections and other defects not consistent with acceptable galvanizing practice.
- E. Zinc and cadmium plating shall be subject to visual examination to determine uniformity of coating. The Engineer may require that the coating uniformity be tested in accordance with ASTM A 239.

1.22 PROTECTION AND STORAGE

- A. All equipment shall be boxed, crated or otherwise completely enclosed and protected during shipment, handling and storage. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry at all times. Pumps, motors, valves, control panels, instrumentation, electrical equipment, HVAC equipment and other equipment having antifriction or sleeve bearings shall be stored at a temperature of at least 60°F. Other equipment may stored outside under cover. All equipment shall be stored above ground level and adequately supported on wood blocking or other approved support material. Printed storage instructions of the manufacturers shall be strictly adhered to.
- B. Painted, anodized or otherwise coated surfaces shall be protected against impact, abrasion, discoloration and other damage. All coated surfaces, which are damaged prior to acceptance of equipment, shall be cleaned and coated to the satisfaction of the Engineer with the same or equivalent coating used in the original application.
- C. Electrical equipment, motors, controls and instrumentation shall be protected against moisture or water damage. All space heaters provided in the equipment shall be kept connected and operating at all times until equipment is placed in service. Electrical equipment stored without space heaters shall be provided with desiccants to protect against moisture damage. Desiccant shall be silica gel porous bags at not less than one ounce per cubic foot of volume. Desiccant shall be replaced periodically.
- D. Electrical equipment and instrumentation shall be stored in a location that is free from excessive or injurious amounts of vibration.
- E. Rotating equipment such as pumps, motors, fans etc., shall be rotated periodically. In the absence of specific exercising instructions by the equipment manufacturer, each item of rotating equipment shall be rotated a minimum of ten

(10) revolutions at intervals not to exceed twenty (20) days. When shafts are too difficult to rotate by hand, nonmetallic grips shall be used to turn the shafts.

- F. Vehicles such as trucks, forklifts, tractors, lawn mowers and other engine-powered equipment shall be started up and operated at intervals not to exceed fifteen (15) days. Equipment shall be run until engine temperatures and pressures are in normal operating ranges. All lifting, lowering, tilting, loading and unloading accessories shall be operated at least once during the exercise period. Equipment shall be removed under power from the parked position and run a sufficient distance so as to ensure proper lubrication of the drive train and suspension components. All operators employed to exercise the vehicles shall be qualified and thoroughly familiar with the proper operation of the equipment. Forklifts, tractors, lawn mowers and other small engine-powered equipment shall be stored indoors in garages or other suitable structures. Trucks stored outdoors shall be washed using approved materials at intervals not to exceed fifteen (15) days. All exercising and storage of vehicular equipment shall be conducted in a manner acceptable to the Engineer.
- G. Interiors of gear and bearing cases housing oil-lubricated gears and bearings shall be filled with a rust inhibiting oil prior to storage or, if extended storage is anticipated, coated periodically with a rust inhibiting oil mist at intervals of time acceptable to the Engineer. Interiors of large pumps shall be protected using vapor phase inhibitor paper or porous bags of rust inhibiting, vapor emitting crystals. Exposed shafts shall be coated with rust preventative compound then wrapped with oil-impregnated paper and polyethylene film and sealed with waterproof tape prior to shipment.
- H. Individually packaged, unpainted steel parts shall be protected by a wrapping of vapor phase inhibiting or oil-impregnated paper and polyethylene film prior to shipment.
- I. Parts and equipment not requiring periodic inspection or maintenance shall be stored unopened in their original packaging until used.
- J. Parts, instruments, controls and small items of equipment shall be stored above ground or floor level on suitable shelves or racks in a heated, watertight warehouse.
- K. Flanged openings on equipment shall be covered with suitable solid wooden or metal blanks securely bolted to the flange using a minimum of four bolts and a suitable rubber gasket. Ends of threaded pipe and fittings shall be seated watertight with metal or plastic caps. Threaded openings shall be sealed watertight with metal or plastic plugs. Other openings shall be sealed with two layers of 6-mil polyethylene securely taped in place with waterproof tape.
- L. A maintenance log on each item of mechanical and electrical equipment requiring periodic attention in storage shall be maintained by the Contractor. Oil and grease changes, exercising, desiccant replacement, nitrogen purge checks, heater checks, insulation checks and other periodic maintenance shall be entered in the log. The maintenance log shall be made available to the Engineer on

request.

- M. A resistance test shall be performed on all motor windings and heater elements following storage and prior to installation as a check for insulation deterioration or moisture damage during storage. Insulation tests shall be performed in accordance with the requirements of these Specifications.
- N. Immediately prior to installation, equipment shall be cleaned of any protective coatings used during storage and any rust, dirt, grit or other foreign material shall be removed.
- O. After installation and prior to start-up, all grease-lubricated joints, shaft couplings and bearings shall be flushed out and re-greased. All oil reservoirs and sumps shall be completely drained and flushed and re-filled with proper lubricant. Screens and filters shall be checked for contamination and replaced if necessary. The equipment shall then be tagged, signed and dated, indicating that the equipment has been properly lubricated for start-up.
- P. After storage, rubber parts such as valve seats, diaphragms, expansion joints, gaskets, hoses and shaft couplings shall be checked for hardening or cracking. Deteriorated parts shall be replaced prior to start-up by the Contractor at his own expense.

1.23 VIBRATION TESTS

- A. Unless specified otherwise in the detailed equipment specifications, each pump, motor or similar item of stationary rotating equipment having a rated power in excess of 50 Hp or an operating speed in excess on 1,800 rpm shall be tested in the field for acceptable vibration levels. Vibration testing shall be performed by an experienced, factory-trained and authorized vibration analysis expert (not a sales representative) retained by the Contractor for this work. Each unit or pump system shall be tested separately without duplicate equipment running. All field-testing shall be done in the presence of the Engineer. The engineer shall be furnished with four (4) certified copies of vibration test data for each test performed.

1.24 PRESSURE AND TEMPERATURE GAUGES

- A. The Contractor shall furnish a compound pressure/vacuum gauge on the suction and a pressure gauge on the discharge of each pump, unless otherwise specified. Gauges shall be 4 to 5 inches in diameter with phenolic cases and clear shatterproof lenses. Gauges shall have a white background and black pointers and characters. Maximum scale reading shall be twice the maximum operating pressure of the fluid being measured. Accuracy shall be ± 2 percent. The operating mechanism shall be of the Bourbon type with positive protection against any solids contamination of the operating mechanism provided. Pressure gauges shall provide NPT connection and shall be isolated from piping by gauge cocks. Pressure gauges on rotary or reciprocating equipment shall be provided with pressure snubber.

1.25 LIMIT SWITCHES

- A. Unless otherwise specified, limit switches on equipment shall be of the heavy-duty, precision type with NEMA 4 steel enclosure and standard pretravel lever or plunger operator as required. Limit switches shall SPDT or DPDT contacts rated not less than five (5) amps inductive, ten (10) amps resistance at 120 volts AC. Limit switches in hazardous locations shall be enclosed in a cast aluminum, explosion-proof enclosure.
- B. Unless otherwise specified, pressure switches shall be of the snap-acting type with interval adjustment and shock-resistance, cast, waterproof enclosure. Contacts shall be SPDT or DPDT rated minimum fifteen (15) amps at 125 volts AC. Switch operation shall be by means of a Teflon diaphragm or Type 316 stainless steel bellows, depending on pressure range. All wetted parts shall be of brass or stainless steel. Switch shall have a repeatability of ± 1 percent of range or better. Switch shall be UL listed.
- C. Unless otherwise specified, temperature switches shall of the non-indicating, snap-acting type with internal adjustment, oil-filtered stainless steel sensing bulb, and shock resistant, cast watertight enclosure. Contacts shall be SPDT or DPDT rated minimum fifteen (15) amps at 125 volts AC. Switches shall be furnished with a separate stainless steel well. Switch shall be UL listed.

1.26 INSTALLATION CHECK

- A. An experienced, competent, and authorized service representative of the manufacturer of each item of equipment or other person acceptable to the Engineer shall visit the site of the work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the equipment manufacturer's representative or other person authorized by the Engineer to perform the installation check shall be present when the equipment is placed in place in operation and shall revisit the jobsite as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of the Engineer.
- B. Each equipment manufacturer's representative or other person authorized by the Engineer to perform the installation check shall furnish to the Owner, through the Engineer, a written report certifying that the equipment (1) has been properly installed and lubricated; (2) is in accurate alignment; (3) is free from any undue stress imposed by connecting piping or anchor bolts; and (4) has been operated under full load conditions and that it operated satisfactorily. The work described under these Contract Documents will not accepted as complete until satisfactory installation certifications have been submitted in accordance with the requirements of this section.
- C. The Contractor shall properly coordinate the visits by the manufacturer's representatives, particularly where the operation of an item of equipment is dependent on the operation of the other equipment. Prior to calling the manufacturer's representative, the Contractor shall ensure that all necessary related equipment, structures, piping and electrical work is complete. The

contractor shall pay for any revisits to the site by the manufacturer's representative made necessary due to the Contractor's failure to properly coordinate the visits.

- D. The Contractor shall inform the Engineer of any impending visits of manufacturer's representatives at least seventy-two (72) hours before the visits so that the Engineer can make arrangements to have his representative at the site to witness the installation check of the manufacturer's representative.
- E. The Contractor shall secure the services of the manufacturer's representative at the site of the work for as long as is necessary to check the installation and place the equipment in satisfactory operation.
- F. Electrical connections to equipment shall be made only upon approval of the manufacturer's representative.
- G. All costs for this work shall be included in the Contract Price(s) and no separate payment will be made.

1.27 FIELD TESTING

- A. After installation and checkout, all equipment shall be field-tested. During the field tests, the equipment shall be subjected to various full load and partial load conditions and emergency operating and shutdown conditions. The ability of the equipment to operate in the prescribed manner without overheating, jamming, excessive noise or vibration or evidence of excessive wear shall be demonstrated to the satisfaction of the Engineer.
- B. All equipment shall be tested before it is covered or insulated. All accessory equipment, which may be damaged by conditions during the test shall be isolated or otherwise protected.
- C. Should results of the tests indicate that the equipment has failed to perform in accordance with requirements of the applicable detailed equipment specification, in the opinion of the Engineer, the Contractor shall make at his own expense such modifications or adjustments as required for satisfactory operation, including replacement of any or all components, if necessary. Following the modifications or adjustments, the Contractor shall repeat the field tests as specified herein. This procedure shall be repeated until results of the field tests indicate that the equipment has satisfied the requirements of the applicable section.
- D. The cost of all field-testing shall be included in the Contract Price(s) and no separate payment will be made.

1.28 IDENTIFICATION OF PIPING AND EQUIPMENT

All piping and equipment shall be identified as follows:

- A. All equipment and piping specified to be painted shall be color-coded. The colors shall be as specified in the section entitled "Painting" of these

Specifications. Insulated piping shall be identified using plastic bands, arrows and letters, colored and sized in accordance with said "Painting" section.

B. All major items of equipment shall have an identification nameplate. The Contractor shall submit a suitable list of all items of major equipment to the Engineer, who will furnish the Contractor with an identification numbering system. The nameplates shall be of Type 304 stainless steel, No. 6 finish, and not less than No. 16 gauge with indented stamped lettering. Nameplates shall be attached to equipment bases easily visible and accessible locations. Nameplates shall be fastened in a permanent manner, arranged not to damage the equipment, with not less than four (4) stainless steel fasteners. All nameplates shall contain as a minimum the following information, where applicable:

1. Name of equipment (from equipment specifications)
2. Manufacturer
3. Model designation
4. Rated horsepower
5. Service factor
6. Electrical and insulation specifications
7. Speed (rpm)
8. Capacity and head (discharge pressure)
9. Net weight

Lettering shall be upper case, block style in size and spacing to suit the nameplate. A sample nameplate including fastenings shall be submitted to the Engineer for approval prior to manufacture of any of the nameplates. The identification nameplates shall not be painted.

C. All valves shall be identified with a round brass disc, approximately 1½ inch in diameter and not less than No. 14 gauge, coated with a clear lacquer. Discs shall be fastened in a permanent manner, however, attachment by chain to handwheels or other operators shall not be acceptable. Discs shall be stamped using indented numerals and/or letters with a valve number corresponding to its identification number in the valve schedule to be included in the Operation and Maintenance Manual.

D. All pushbutton stations, switches, motor controllers, transmitters and other control equipment shall have identification nameplates of the engraved, laminated plastic type affixed to or adjacent to the switch, pushbutton station, etc.

E. All manufacturer's nameplates, identification nameplates, and ASME code plates located on areas of equipment to be insulated shall be removed and reattached on

uninsulated areas in a manner acceptable to the Engineer and in his presence.

1.29 WARNINGS SIGNS

- A. Permanent warning signs shall be furnished and installed on all mechanical and electrical equipment where a hazard exists as specified herein. Signs shall be made in accordance with OSHA requirements and shall be suitable for exterior use. Mounting details shall be in accordance with manufacturer's recommendations; location as approved by the Engineer. Fasteners shall be stainless steel.
- B. Warning signs shall be approximately ten (10) inches high by fourteen (14) inches wide, colored yellow and black, on minimum 0.080-inch aluminum stock.
- C. Warning signs shall be furnished as follows:
 - 1. The following sign shall be affixed to all equipment which may be started automatically from a remote location:

CAUTION

THIS EQUIPMENT MAY START

AUTOMATICALLY

BY REMOTE CONTROL

- 2. The following sign shall be affixed to all electrical equipment or instrument panels, as applicable.

CAUTION – SHOCK HAZARD

THIS EQUIPMENT IS POWERED BY MULTIPLE SOURCES.

CONTACTS MAY BE ENERGIZED AFTER LOCAL POWER

IS DISCONNECTED

- 3. The following sign shall be provided at all where oxygen or flammable materials are stored or used (colored red, white, and black):

DANGER

NO SMOKING, MATCHES,

OR OPEN FLAMES

4. The following sign shall be affixed to all entrance hatches or access manways on covered tanks and vessels:

CAUTION

OXYGEN DEFICIENT OR TOXIC CONDITIONS MAY EXIST.

FOLLOW PRESCRIBED PROCEDURES BEFORE ENTRY.

5. The following sign shall be provided at all equipment blow-offs:

CAUTION

LOUD BLOWDOWN MAY OCCUR

WITHOUT WARNING

****END OF SECTION****

SECTION 01700

CONTRACT CLOSEOUT

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Comply with requirements stated in conditions of the contract and in specifications for administrative procedures in closing out the work.
- B. Related requirements in other parts of the contract documents.
 - 1. Fiscal provisions, legal submittals and additional administrative requirements: Conditions of the Contract.
- C. Related requirements specified in other sections:
 - 1. Operating and Maintenance Data: Section 01730
 - 2. Field Engineering: Section 01050

1.02 SUBSTANTIAL COMPLETION

- A. When contractor considers the work is substantially complete, he shall submit to Engineer:
 - 1. A written notice that the work, or designated portion thereof, is substantially complete.
 - 2. A list of items to be completed or corrected.
- B. Within a reasonable time after receipt of such notice, the Engineer will make a construction review to determine the status of completion.
- C. Should Engineer determine that the work is not substantially complete:
 - 1. Engineer will promptly notify the contractor in writing giving the reasons therefor.
 - 2. Contractor shall remedy the deficiencies in the work, and send a second written notice of substantial completion to the Engineer.
 - 3. Engineer will again review the work for completion status.
- D. When the Engineer finds that the work is substantially complete, he will:
 - 1. Prepare and deliver to Owner a tentative certificate of Substantial Completion with a tentative list of items to be completed or corrected before final payment.
 - 2. After consideration of any objections made by the Owner as provided in conditions of the contract, and when Engineer considers the work substantially complete, he will execute and deliver to the Owner and the Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be completed or corrected.

1.03 FINAL CONSTRUCTION REVIEW

- A. When Contractor considers the work is complete, he shall submit written certification that:
 - 1. Contract documents have been reviewed.
 - 2. Work has been reviewed for substantial compliance with contract documents.
 - 3. Work has been completed generally in accordance with contract documents.
 - 4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
 - 5. Work is completed and ready for final construction review.
- B. Engineer will perform a review to verify the status of completion with reasonable promptness after receipt of such certification.
- C. Should Engineer consider that the work is incomplete or defective:
 - 1. Engineer will promptly notify the Contractor in writing, listing the incomplete or defective work.
 - 2. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to Engineer that the work is complete.
 - 3. Engineer will again review the work.
- D. When the Engineer finds that the work is acceptable under the contract documents, he shall request the contractor to make closeout submittals.

1.04 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ENGINEER

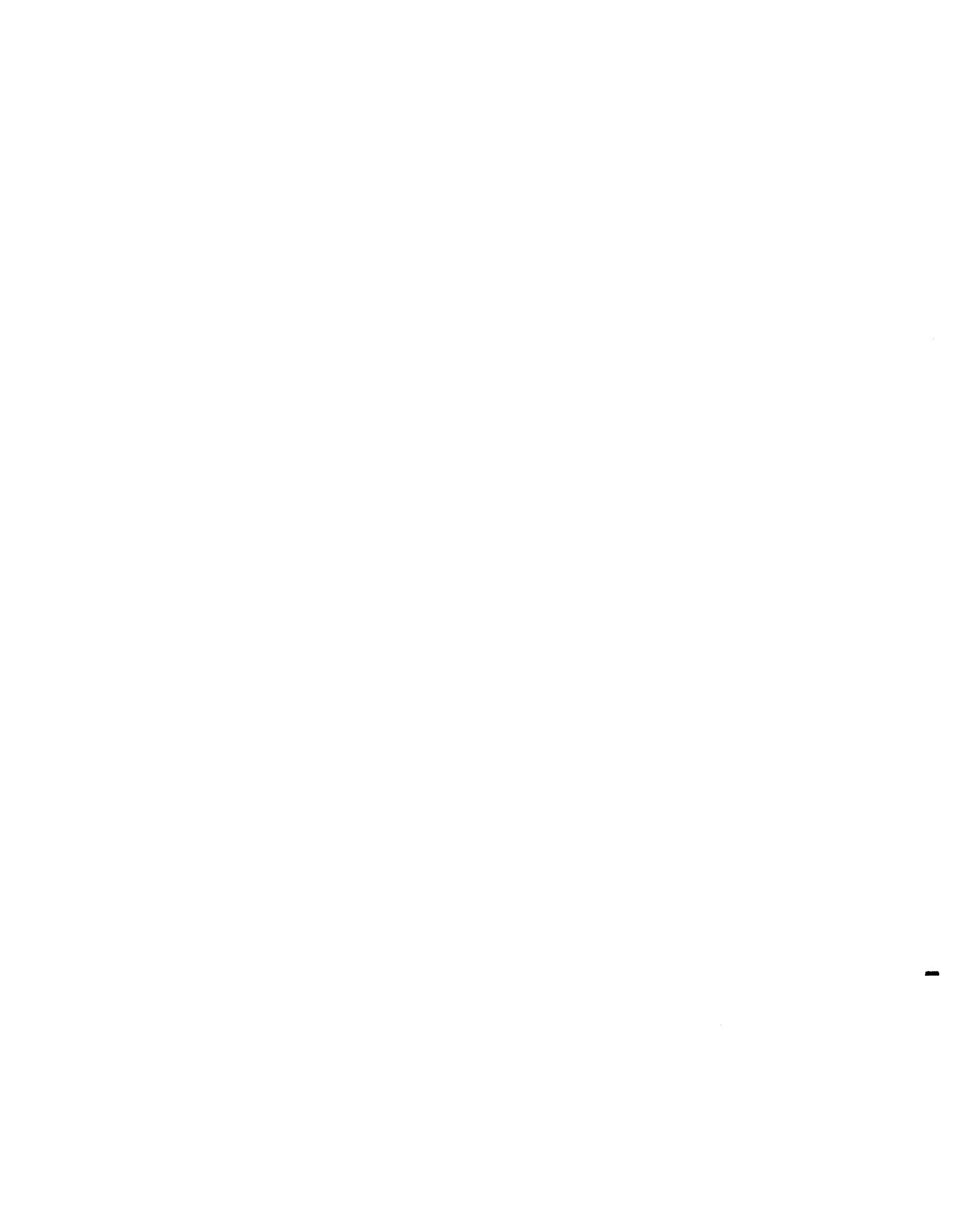
- A. Operating and maintenance data, instructions to Owner's personnel: To requirements of Section 1730.
- B. Spare Parts and Maintenance Materials: To requirements of Section 01730.
- C. Evidence of Payment and Release of Liens: To requirements of General and Supplementary Conditions.
- D. Certificate of Insurance for Products and Completed Operation.
- E. Evidence of Payment and Release of Liens: Refer to requirements of General and Supplementary Conditions.
- F. At Contract close-out, legible record construction drawings will be submitted to the Engineer for the Owner containing the following:
 - 1. Depths of various elements of foundation in relation to finish grade.

2. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
4. Field changes made by Field Order or by Change Order.
5. Details not on original contract drawings.
6. Record Drawing Data in accord with Section 01050 requirements.

1.05 FINAL ADJUSTMENT OF ACCOUNTS

- A. Submit a final pay request to the Engineer, including final affidavit.
- B. Final Pay Request shall reflect all adjustments to the Contract Sum:
 1. The original Contract Sum.
 2. Additions and deductions resulting from:
 - a. Previous change orders.
 - b. Allowances.

****END OF SECTION****



SECTION 01730

OPERATING AND MAINTENANCE MANUAL

PART 1- GENERAL

Prior to final acceptance the furnish five (5) copies of an Engineer approved "OPERATING AND MAINTENANCE MANUAL" for each piece of equipment or system as called for in the individual specifications.

1.01 FORMAT

A. BINDER

1. Commercial quality three-ring binders with plastic covers.
2. 8 1/2" X 11"
3. Identify each binder with title "OPERATING AND MAINTENANCE DATA"
4. Include a table of contents with each binder.

B. CONTENT OF MANUAL

1. Copy of each warranty, bond and service contract issued.
2. Manufacturer's data giving full information on products.
 - a. catalog number, size, composition
 - b. color and texture
 - c. information for ordering
3. INSTRUCTION FOR CARE AND MAINTENANCE
 - a. Manufacturer's recommendation for types of cleaning agents and methods.
 - b. Cautions against cleaning agents and methods which are detrimental to the product.
 - c. Recommended schedule for cleaning and maintenance.
4. SUPPLIER
 - a. With each product or system include the name, address and telephone number of the supplier, and the nearest source of supply for parts, and replacement.

5. OPERATING PROCUDRES:
 - a. Start-up, break-in, routine and normal operating instructions.
 - b. Regulation, control, stopping, shut-down and emergency instructions.

****END OF SECTION****

SECTION 01740
WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 PROJECT MAINTENANCE AND WARRANTY

- A. Maintain and keep in good repair improvements covered by these drawings and specifications during the life of the contract.
- B. Indemnify the Owner against any repairs which may become necessary to any part of the work performed and to items of equipment and systems procured for or furnished under this Contract, arising from defective workmanship or materials used therein, for a period of one year after date of Substantial Completion.
- C. The Contractor shall not be obligated to make replacements which become necessary of ordinary wear and tear, or as a result of improper operation or maintenance, or as a result of improper work or damage by another Contractor or the Owner, or to perform any work which is normally performed by a maintenance crew during operation.
- D. In the event of multiple failures of major consequences prior to the expiration of the (1) one-year warranty described above, the affected unit shall be disassembled, inspected, and modified or replaced as necessary to prevent further occurrences. All related components, which may have been damaged or rendered non-serviceable as a consequence of the failure, shall be replaced. A new (12) twelve-month warranty against defective or deficient design, workmanship, and materials shall commence on the day that the item is reassembled and placed back into operation. As used herein, multiple failures shall be interpreted to mean (2) two or more successive failures of the same kind in the same item or failures of the same kind in (2) two or more items. Major failures may include, but are not limited to, cracked or broken housings, piping, or vessels, excessive deflections, bent or broken shafts, broken or chipped gear teeth, premature bearing failure, excessive wear, or excessive leakage around seals. Failures, which are directly and clearly traceable to operator abuse, such as operations in conflict with published operating procedures, or improper maintenance, such as substitution of unauthorized replacement parts, use of incorrect lubricants or chemicals, flagrant over-or-under lubrication, and using maintenance procedures not conforming with published maintenance instructions, shall be exempted from the scope of the (1) one-year warranty. Should multiple failures occur in a given time, all products of the same size and type shall be disassembled, inspected, modified or replaced, as necessary and rewarranted for (1) one-year.
- E. The Contractor shall, at his own expense, furnish all labor, tools and equipment required and shall make such repairs and removals or shall perform such work or reconstruction as may be made necessary by any structural or functional defect or failure resulting from neglect, faulty workmanship or faulty materials, in any part of the Work performed by him. Such repair shall also include refilling of trenches, excavations or embankments which show settlement or

erosion after backfilling or placement.

- F. Except as noted on the Drawings or as specified, all structures such as embankments and fences shall be returned to their original condition prior to the completion of the Contract. Any and all damage to any facility not designated for removal, resulting from the Contractor's operations, shall be promptly repaired by the Contractor at no cost to the Owner.
- G. In the event the Contractor fails to proceed to remedy the defects of which he has been notified within (15) fifteen days of the date of such notice, the Owner reserves the right to cause the required materials to be procured and the work to be done, as described in the drawings and specifications, and to hold the Contractor and the sureties on his bond liable for the cost and expense therefore.
- H. Notice to Contractor for repairs and reconstruction will be made in the form of a registered letter addressed to the Contractor at his home office.
- I. Neither the foregoing paragraphs nor any provision in the Contract Documents, nor any special guarantee time limit implies any limitation of the Contractor's liability with the law of the place of construction.

****END OF SECTION****

SECTION 02100

SITE PREPARATION

PART 1 - GENERAL

1.01 Definitions: The terms "Clearing" and "Grubbing" used in these specifications will be as defined in the Georgia Department of Transportation Specifications, 2001 Edition, Section 201.

1.02 Work Included: Furnish all labor, equipment and materials as required to prepare the construction site for the required work as shown on the drawings or as specified herein. Site preparation required for this project includes, but is not necessarily limited to:

- A. Observation of the following clearing limits. Clearing at construction sites shall be limited to the disturbed area as shown on the Drawings.
- B. Stripping and storage of topsoil.

1.03 RELATED WORK

- A. Earthwork Section 02200

1.04 QUALITY ASSURANCE

- A. The Contractor, in conducting the work required on this project, is to cause little or no damage to the soils and vegetation outside the limits of construction defined in this and other sections of these Specifications, as shown on the Drawings, or required by the Engineer. Any damage to soil or vegetation outside the limits of construction shall be repaired immediately, by the Contractor, as defined herein at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 TOP SOIL

The top soil to be stockpiled is the top loamy soil and organic matter that overlays the subsoil.

PART 3 - EXECUTION

3.01 WORKMANSHIP

- A. Clear all ground vegetation from the site within indicated limits of work, as required. These cleared materials shall be chipped and spread uniformly over cleared area after construction or burned in accordance with Georgia D.O.T. Specifications and local laws. Pits for burner must be approved by the Engineer.
- B. Those areas which are cleared beyond specified limits shall be restored to their original state at the expense of the Contractor. Trees damaged during construction shall be replaced by the Contractor; at the Engineers discretion, trees that are damaged during construction may have their wounds dressed and coated with an approved pruning paint.

- C. Prior to any grading at any point on the Project, the area to be graded shall be cleared and/or grubbed, then the topsoil shall be stripped and stockpiled. Topsoil shall be stockpiled in an area chosen by the Contractor and approved by the Engineer. Stockpiled topsoil shall have temporary grassing (Section 02486) applied and erosion control (Section 02200) placed around the base of the stockpile.
- D. Topsoil stockpile areas shall be cleared as defined herein prior to being used as a stockpile area.

3.02 ENVIRONMENTAL PROTECTION

- A. Defined in Section 02200.
- B. During construction the Contractor shall provide and maintain all necessary erosion control devices required by governing laws or ordinances to prevent siltation and soil erosion.
- C. All such work shall be done without additional cost to the Owner.

****END OF SECTION****

SECTION 02200

EARTHWORK

1. WORK INCLUDED: Earthwork for this project includes, but is not necessarily limited to:
 - A. Excavation for structures;
 - B. Furnishing and installing graded aggregate base under all concrete slabs on grade;
 - C. Filling and backfilling to attain indicated grades;
 - D. Trenching and trench backfilling;
 - E. Rough and finish grading around structures;

2. RELATED WORK

- A. Testing laboratory services Section 01410
- B. Subsurface conditions Section 02010
- C. Grassing and Mulching Section 02480

3. SITE CONDITIONS

The accuracy of information contained in the plans and specifications as to topography, underground structures, foundation conditions, character of soil, position and quantity of ground and subsoil water, are not guaranteed by the Owner. Bidders must satisfy themselves by personal examination and by such other means as they desire with respect to actual site conditions. Unforeseen conditions shall not constitute a claim for increased compensation under the terms of the contract, nor constitute a basis for the cancellation thereof.

4. JOB CONDITIONS

- A. Erect sheeting, shoring and bracing as necessary for protection of persons, structures and excavations.
- B. Provide dewatering and drainage as required to accomplish work.

5. QUALITY ASSURANCE

- A. Testing Agency
 1. In place soil compaction tests to be performed by a testing laboratory employed by the Contractor.
 2. If the compaction does not meet the Specification, the Contractor shall remove the part of embankment not meeting the specifications and replace with properly compacted material and shall pay for all compaction tests made for such defective areas.

B. Reference Standards

1. ASTM D698-78, Moisture-Density Relations of Soils
2. ASTM D1556-64, Density of Soil in Place by the Sand-Cone Method.

6. FILL MATERIAL, GENERAL

- A. Fill material shall consist of soil or soil-rock mixture which is free from topsoil, organic matter, and other deleterious substances. Large boulders, thick rock or quartz layers which are not broken down by compaction equipment will not be suitable for use in the fill.
- B. Fill material shall be subject to the approval of the Engineer.

7. TRENCH AND STRUCTURAL BACKFILL

- A. On-site fill material used for trench and structural backfill shall meet the requirements of Article 6 above. Material shall be free of rock or stone larger than two inches.
- B. Granular material when required for trench and structural backfill shall be free from organic substance and other deleterious matter, shall be subject to the approval of the Engineer, and shall be in particle size grading within the following limits:
- (1) Passing the number four sieve: 100%
 - (2) Passing the number 200 sieve: 3% Maximum

8. AGGREGATE BASE UNDER CONCRETE SLAB

Aggregate base under concrete slabs on grade, where shown on the plans, shall be clean mineral aggregate with particle size grading within the following limits:

- (1) Passing the one inch mesh: 100%
- (2) Passing the number four sieve: Not more than 5%
- (3) Passing the number 200 sieve: Not more than 1%

9. RIP RAP

The stone used for rip-rap shall meet the requirements of Section 805 of Ga. D.O.T. Specifications, 2001 edition, "Stone for Plain Rip-Rap," and shall have the weight shown on the plans or proposal.

10. NON-SPECIFIED MATERIALS

All other materials, not specifically described but required for a complete and proper installation, shall be as selected by the Contractor subject to the approval of the Engineer.

11. GENERAL

- A. Prior to all work of this Section, become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section.
- B. Do not allow or cause any of the work performed or installed to be covered up or enclosed by work of this Section prior to all required inspections, tests, and approvals. Should any of the work be so enclosed or covered up before it has been approved, uncover all such work at no additional cost to the Owner.
- C. The Contractor will provide erosion and sediment control as shown on the plans. All erosion control measures taken shall comply with the Manual for Erosion and Sediment Control in Georgia ("the Manual"). The contractor shall periodically inspect and maintain all erosion control devices. Note that ANY statement or requirement of these specifications that conflicts or differs with the latest edition of the Manual for Erosion and Sediment Control in Georgia, the requirements of the Manual shall take precedence and govern the erosion control measures. Also, the requirements of the EPD's GAR 100002 NPDES permit shall govern and control erosion control efforts of the Contractor.

12. EXCAVATION

- A. Excavate to grades shown on the Drawings. Where excavation grades are not shown on the Drawings, excavate as required to accommodate the installation. Extend excavation as required for proper formwork construction.
- B. Backfill and compact all overexcavated areas as specified for fill below, and at no additional cost to the Owner unless so directed by the Engineer in which case the contractor shall be paid the price bid per cubic yard.
- C. Control grading in vicinity of structures to prevent surface water from running into excavated areas.
- D. Where depressions result from, or have resulted from the removal of surface or subsurface obstructions, open the depression to equipment working width and remove all debris and soft material as directed by the Engineer.
- E. Solid rock excavation.
 - 1. Notify the Engineer when rock is encountered and before its removal.
 - 2. Rock excavation shall be defined as solid rock in the original bed, or well defined ledges, or boulders and detached pieces or rock containing more than 1/2 cubic yard of rock each, which require drilling, blasting or the use of jack hammers to remove.
 - 3. Blasting operations shall be conducted in strict accordance with all existing ordinances and regulations, and shall be done by personnel licensed to use explosives. All structures shall be carefully protected and the blast covered by suitable material.

4. Any damage caused by blasting shall be promptly repaired by the Contractor at his own expense. Explosives and other blasting supplies shall be stored in accordance with all state and local laws. Where rock is encountered in pipe trenches, foundation footings, pump pits and other parts of structures, the rock shall be removed to at least 6 inches below the bottom of the pipe, footings, pump pits, and other parts of structures. Then the surface shall be brought back to grade of the bottom of the structure by backfilling in 6" layers with selected material and tamping to the same average density of the undisturbed earth adjacent thereto.

13. TRENCHING

- A. Trench excavation shall be by open cut from the ground surface, unless otherwise called for on the plans or allowed by the Engineer. Not more than 100 feet of trench shall be opened on any line in advance of pipe laying.
- B. Pipe trenches shall be straight and true to grade and in the location shown on the plans. The bottom of the trenches shall be hand dressed so that the pipe has an even bearing on solid undisturbed earth throughout its entire length between bell, or coupling holes.
- C. Bell holes shall be excavated at all pipe joints for bell and spigot and mechanical joint pipe. Bell holes shall be large enough to facilitate the proper installation of all joints. No part of the pipe bell or coupling shall be in contact with sides or bottom of the trench.
- D. All trenches shall be of sufficient width to provide ample working space on each side of the pipe for maintaining a straight line of pipe.
- E. Water lines shall be laid at the elevations indicated. At points of interference with storm sewers and cross drains, pipe will be run under the conflicting utility.

14. FILL UNDER STRUCTURES

- A. Prior to placing any fill material, the subgrade shall be proof-rolled in the presence of the Engineer. Any unstable areas shall be repaired and the placing of fill materials shall proceed only after inspection and approval by the Engineer.
- B. Approval of the fill material by the Engineer shall be required prior to initiating filling operations.
- C. No fill shall be placed or compacted in a frozen condition or on top of frozen material. No fill material shall be placed when free water is standing on the surface of the area where the fill is to be placed and no compaction of fill will be permitted with free water on any point of the surface of the fill to be compacted.
- D. Scarify existing surfaces to provide bond with new material.
- E. Place fill and backfill in layers not exceeding six inches before compaction and thoroughly tamp with a sheepsfoot roller unless other wise indicated or specified. Compact to a density of not less than 95% of the maximum laboratory dry density, as determined by ASTM D698. The final two 6" lifts that brings the backfill to sub-grade shall be compacted to 98% of the maximum laboratory dry density, as determined by

ASTM 0698. If necessary, in order to obtain the required compaction, the Contractor shall add moisture or shall air dry the material. Each lift must be tested and passed the required compaction before backfill operations are continued.

- F. Stones in earth fill must be well distributed and no stones over four inches in diameter may be left within 36 inches of finished grade.

15. BACKFILLING AROUND STRUCTURES

- A. Backfilling around structures shall not proceed until authorized by the Engineer.
- B. All formwork, debris and other undesirable material shall be removed prior to backfilling. Area shall be dewatered.
- C. Backfill material shall be as specified in this section. Backfill shall be placed in layers of 6 inches maximum and shall be of a moisture content which will permit proper compaction. Each layer shall be compacted by mechanical tampers and special care shall be taken to prevent uneven loading or damage to the structure.
- D. Compact backfill material to a minimum relative density of 95% as determined by ASTM D698 (Standard Proctor).

16. BACKFILLING TRENCHES

- A. The backfilling of pipe trenches shall be started immediately after the pipe installation has been approved by the engineer.
- B. Backfill material shall be as specified in this section. The material shall contain no rock greater than two inches in maximum dimension.
- C. Backfill shall be tamped in layers not over 6 inches thick. Tamping shall be done with mechanical tamps in such a manner as to thoroughly compact the backfill without moving or injuring the pipe. The remainder of the backfill may be placed in the trench by a machine, but the backfill shall be compacted to the top of the trench, either by pneumatic hand tamps, hydro-tamps, or other approved methods. After compaction, the dry weight per cubic foot shall be at least 95 percent of the maximum laboratory dry weight per cubic foot as determined by ASTM D698. The trench shall be backfilled and the surface brought to its original grade and profile contour.
- D. In rock excavation, the backfill from the bottom of the trench to one foot above the top of the pipe shall be finely pulverized soil, free from rocks and stones. The rest of the backfill shall not contain over 75% broken stone, and the maximum sized stone placed in the trench shall not have a weight exceeding 50 pounds. Excess rock and fragments of rock weighing more than 50 pounds shall be loaded and hauled to disposal as directed by the Engineer.

17. FINISH GRADING

- A. The contractor shall employ a competent person to interpret elevations and grading details shown on plans.

- B. Areas to be grassed shall be spread with selected topsoil that has been obtained from site clearing. The topsoil shall be mixed into the surface and compacted suitably for planting.
- C. Areas around buildings and structures shall be graded so as to prevent accumulation of water within the area.

18. TEMPORARY EROSION CONTROL

- A. The Contractor will provide erosion and sediment control as shown on the plans. All erosion control measures taken shall comply with the Manual for Erosion and Sediment Control in Georgia ("the Manual"). The contractor shall periodically inspect and maintain all erosion control devices. Note that ANY statement or requirement of these specifications that conflicts or differs with the latest edition of the Manual for Erosion and Sediment Control in Georgia, the requirements of the Manual shall take precedence and govern the erosion control measures. Also, the requirements of the EPD's GAR 100002 NPDES permit shall govern and control erosion control efforts of the Contractor.

19. DISPOSAL OF EXCESS MATERIAL

- A. Excess material may be disposed of on site in areas selected by the Contractor and approved by the Engineer.
- B. Disposal sites shall be cleared and grubbed and topsoil stockpiled as required in Section 02100.
- C. Disposal sites shall be graded to be free draining, with side slopes no greater than 3:1, and to fit the existing topography.
- D. Upon completion of work at the disposal sites, the areas shall be finish graded as required in this section and grassed and mulching as required in section 02600.

20. GROUND WATER

Control of ground water shall be accomplished in a manner that will preserve the strength of the foundation soils, will not cause instability of the excavation slopes, and will not result in damage to existing structures. Where necessary to these purposes, the water level shall be lowered in advance of excavation, utilizing wells, well points or similar methods. The water level, as measured in piezometers, shall be maintained a minimum of three feet below the prevailing excavation level. Open pumping with sumps and ditches, if it results in boils, loss of fines, softening of the ground or instability of slopes, will not be permitted. Wells and well points shall be installed with suitable screens and filters so that continuous pumping of fines does not occur. The discharge shall be arranged to facilitate collection of samples by the Engineer. Silt collection bags shall be installed and utilized to prevent the loss of silt into state waters.

****END OF SECTION****

SECTION 02210

SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The contractor is responsible for implementing best management practices to prevent and minimize erosion and resultant sedimentation in all cleared and grubbed areas during and after construction. This Section covers the work necessary for the installation of structures and measures for the prevention and control of soil erosion. The CONTRACTOR shall furnish all material, labor and equipment necessary for the proper installation, maintenance, inspection, monitoring, reporting and removal (where applicable) of erosion prevention and control measures.

The Contractor will provide erosion and sediment control as shown on the plans. All erosion control measures taken shall comply with the Manual for Erosion and Sediment Control in Georgia ("the Manual"). The contractor shall periodically inspect and maintain all erosion control devices. Note that ANY statement or requirement of these specifications that conflicts or differs with the latest edition of the Manual for Erosion and Sediment Control in Georgia, the requirements of the Manual shall take precedence and govern the erosion control measures. Also, the requirements of the EPD's GAR 100002 NPDES permit shall govern and control erosion control efforts of the Contractor.

1.02 RELATED SECTIONS

- A. Excavation, Grading and Stone Rip Rap are included in Section 02200.

1.03 REFERENCES

- A. CONTRACTOR shall be familiar with the following reference documents and keep those at the construction site at all times. These documents need to be complied with as applicable.
1. Manual for Erosion and Sediment Control In Georgia (the "Green Book"), latest edition.
 2. State of Georgia Department of Transportation Standard Specifications, Construction of Roads and Bridges, (the GDOT Specifications).
 3. National Stone Association, Aggregate Classification (the NSA Classification).
 4. Cherokee County Soil Erosion and Sediment Control Ordinance.
 5. Erosion, Sedimentation and Pollution Control Plan (the Plan) as required by the NPDES Permit.
 6. EPD General Permit No. GAR 100002.

1.04 DEFINITIONS

- A. ENGINEER: For the purposes of this Section 02210, the term ENGINEER is synonymous with consulting engineer, licensed professional, designer, and consultant as used in permits, laws, rules, regulations, ordinances and other soil erosion and sediment control references. For the purposes of this Section 02210, the Cherokee County Water and Sewerage Authority representative may at any time during the project provide direction. This direction shall be considered equivalent to direction from the ENGINEER.
- B. CONTRACTOR: For purposes of this Section 02210, the term CONTRACTOR is synonymous with general contractor, discharger, operator, primary permittee and permittee (permit holder) as used in permits, laws, rules, regulations, ordinances and other soil erosion and sediment control references.
- C. Qualified Personnel: For purposes of this Section 02210, the term Qualified Personnel means a person who has successfully completed an erosion and sediment control short course eligible for continuing education units, or an equivalent course approved by Environmental Protection Division of the Georgia Department of Natural Resources and the State Soil and Water Conservation Commission.

1.05 REGULATORY COMPLIANCE

- A. Land disturbance activities are not authorized to begin until after all required erosion and sediment control permits are obtained from the United States, the State of Georgia, Cherokee County, and/or Cherokee County Water and Sewerage Authority. CONTRACTOR shall comply with requirements specified in the Contract Documents or by the ENGINEER. CONTRACTOR shall also comply with all other laws, rules, regulations, ordinances and requirements concerning soil erosion and sediment control established by the United States, the State of Georgia, and/or Cherokee County. The following documents and the documents referenced therein define the regulatory requirements for this Section 02210.
 - 1. Manual for Erosion and Sediment Control: CONTRACTOR shall follow practices and standards of the Georgia Soil and Water Conservation Commission Manual for Erosion and Sediment Control in Georgia, latest edition.
 - 2. Comprehensive Monitoring Plan: When a Comprehensive Monitoring Plan (CMP) is provided in the Contract Documents, CONTRACTOR shall follow the practices described in the CMP.
 - 3. National Pollutant Discharge Elimination System (NPDES) Permit for Storm Water Discharges From Construction Activities, Permit No. GAR100002

1.06 SUBMITTALS

- A. CONTRACTOR shall submit to the ENGINEER the proposed schedule for installation, maintenance and removal of all temporary and permanent erosion and sediment control measures. The schedule shall reflect the requirements of Paragraph 1.07 below

(Sequence of Construction of Temporary Sediment Control Structures) and must show the anticipated starting and completion date for all land development activities including:

1. Installation of temporary and permanent sediment control structures
2. Stormwater management facilities,
3. Timber salvage operations,
4. Clearing operations,
5. Grubbing operations,
6. Rough and finished grading,
7. Building construction,
8. Landscaping, including all seeding and sodding, and
9. Removal of temporary sediment control structures.

1.07 SEQUENCE OF CONSTRUCTION OF TEMPORARY SEDIMENT CONTROL MEASURES

- A. Install all erosion and sediment control structures specified herein and shown in the Contract Documents, or as directed by the ENGINEER, as the first item of work within a given drainage area. Construction and installation of all sediment control structures shall begin downgradient of the area to be disturbed and proceed upgradient. CONTRACTOR shall at all times maintain all soil erosion and sediment control structures and practices throughout construction and until permanent grass cover is established.

1.08 PAYMENT PROCEDURES

- A. The price bid for work covered under this Section 02210 shall include the furnishing, placement, maintenance, and removal of the silt fence, hay bales, temporary dikes and ditches, sediment traps, sediment basins, construction exits and all temporary vegetative and non-vegetative ground cover and all earthwork, labor, materials, and equipment necessary to complete the work as specified or directed by ENGINEER.

PART 2 - SPECIFIC REQUIREMENTS

The requirements specified herein and shown in the Contract Documents are minimum requirements for preventing or minimizing soil erosion and sediment transport. CONTRACTOR shall install and maintain soil erosion and sediment control measures in accordance with the following criteria. Requirements set forth in the Manual for Erosion and Sediment Control in Georgia shall govern in case of a conflicting information, unless clearly identified as a deviation from this Manual.

2.01 EROSION CONTROL MEASURES (BMPs)

All erosion control measures shall meet the material, installation and maintenance requirements set forth in the Manual for Erosion and Sediment Control in Georgia, latest edition.

PART 3 - EXECUTION

3.01 INSPECTIONS AND MAINTENANCE

- A. CONTRACTOR shall designate a Qualified Person to perform inspections. The BMPs are to be inspected in accordance with the notes on the erosion control plan, the Manual for Erosion and Sediment Control in Georgia, and the NPDES GAR 100002 Permit requirements.

3.02 REMOVAL OF TEMPORARY SEDIMENT CONTROL STRUCTURES

At such time that temporary erosion and control structures are no longer required under this Section 02210, the CONTRACTOR shall notify the ENGINEER of its intent and schedule for the removal of the temporary structures, and obtain the ENGINEER's approval in writing prior to removal. Once CONTRACTOR has received such written approval from ENGINEER, CONTRACTOR shall remove as approved the temporary structures and all sediments accumulated at the removed structure shall be returned upgradient. In areas where temporary control structures are removed, the site shall be left in a condition that will restore original drainage.

3.03 SILT AND EROSION CONTROL PERMITTING

This project is under the jurisdiction of the Environmental Protection Division (*EPD*) General National Pollutant Discharge Elimination System (*NPDES*) Permit, No. GAR100002, for Storm Water Discharges From Construction Activities. An erosion control plan for this project is included in the plans. It will be the responsibility of the Contractor to obtain and meet the requirements and conditions set forth by this permit. The permit requirements and conditions are available through the EPD. All required documents necessary to the permit shall be prepared by the Contractor and provided by the Contractor to the EPD including but not limited to the Notice of Intent (*NOI*) and Notice of Termination (*NOT*) as well as all required inspection forms and documents. Copies of all documents and reports prepared by the Contractor and provided by the Contractor to the EPD shall be provided to the Owner and the Engineer at the time they are provided to the EPD. The Contractor is hereby defined as the Primary Permittee.

This project is also under the jurisdiction of storm water discharge monitoring as required by this permit. A Comprehensive Monitoring Plan (*CMP*) is included in the plans. It will be the responsibility of the Contractor to meet the requirements and conditions set forth by the NPDES Permit for storm water discharge monitoring including but not limited to monitoring and sampling reports. Copies of all documents and reports prepared by the Contractor and provided by the Contractor to the EPD shall be provided to the Owner and the Engineer at the time they are provided to the EPD.

****END OF SECTION****

SECTION 02400

CONSTRUCTION DEWATERING

PART 1 - GENERAL

- 1.01 The Contractor shall be responsible for controlling groundwater in a manner that will preserve the strength of the foundation soils, will not cause instability of the excavation slopes, and will not result in damage to existing structures.
- 1.02 Where permeable soils are encountered at subgrade elevations the Contractor shall maintain the groundwater level a minimum of 3' below the prevailing excavation level.
- 1.03 The Contractor shall submit for the Engineer's approval a construction dewatering plan. The plan shall indicate the method of dewatering to be used, the location of any wells or pumps, and where pumped groundwater is to be discharged. No excavation will be allowed without an approved dewatering plan.

PART 2 - PRODUCT

- 2.01 Equipment used for dewatering is optional to the Contractor.
- 2.02 Mechanical equipment used shall be in good working order and suitable for use under the anticipated conditions.
- 2.03 Wells and well points if used shall be installed with suitable screens and filters so that continuous pumping of fines does not occur.

PART 3 - EXECUTION

- 3.01 The Contractor shall maintain and operate his dewatering equipment until the permanent structure is in place.
- 3.02 Should the Contractor choose to use any part of the permanent underdrain system for construction dewatering, he shall take appropriate precautions to prevent contamination of the underdrain material by soil fines or any other type of material which would decrease the effectiveness of the drainage material.
- 3.03 No compensation for removal of unstable material below the subgrade shall be allowed if in the opinion of the Engineer, modified dewatering techniques would solve the problem and result in a suitable subgrade.
- 3.04 Dewatering discharge shall be accessible for collection of samples by the Engineer.

****END OF SECTION****



SECTION 02433

STORM DRAINAGE PIPE

PART 1 - GENERAL

1.01 WORK INCLUDED: The work consists of furnishing and installing storm drain pipe to provide cross drainage of storm water underneath roadways.

PART 2 - PRODUCTS

2.01 CORRUGATED ALUMINUM PIPE: Section 840.01 GA D.O.T. Standard Specifications, (latest edition).

2.02 CORRUGATED STEEL PIPE: Section 844.01 GA D.O.T. Standard Specifications, (latest edition) and Standard 1030D.

2.03 REINFORCED CONCRETE PIPE: Section 843.01 GA D.O.T. Standard Specifications, (latest edition).

2.04 FLARED END SECTION: To be of same material as pipe.

PART 3 - EXECUTION

3.01 EXCAVATING, TRENCHING, AND BEDDING FOR PIPE

- A. General: Provide excavating, trenching, and bedding for storm drains in accordance with the provisions of Section 02200, and as follows:
- B. Movement of construction machinery: Use all means necessary to avoid displacement of, and injury to, the pipe and structures while compacting by rolling or operating equipment parallel with the pipe. Movement of equipment over a culvert or storm drain at any stage of construction is solely at the risk of the Contractor.
- C. Bedding: Provide a bedding surface for the pipe with a firm foundation of uniform density throughout the entire length of the pipe. Bed pipes carefully in a soil foundation accurately shaped and rounded to conform to the lower 1/4 of the outside perimeter of the circular pipe, or set the pipe in a bed of sand. Tamp bedding when necessary. Provide bell holes and depressions for pipe joints of only the length, depth, and width required for properly making the particular joint.

3.02 PLACING PIPE

A. General:

1. Carefully examine each pipe to placing. Promptly set aside all defective pipe and all damaged pipe. Clearly identify all defects. Do not install defective pipe or damaged pipe.
2. Place all pipe to the grades and alignment shown.
3. Do not place pipe in water, nor place pipe when trench or weather is unsuitable for such work.

4. Install flared end section as shown on the drawings.

3.03 PIPE JOINTS

- A. Pipe joints shall be made close and even, butting all around.
- B. Coupling for corrugated metal pipe shall be either dimpled band or hugger type. Bolts and nuts shall be galvanized steel.

3.04 BACKFILLING

- A. Backfill in accordance with the provisions of Section 02200 and as specified herein.
- B. Fill material shall be deposited evenly on both sides of the pipe in tamped layers not exceeding 6" in depth until at least three-fourths the depth of the pipe has been reached. For wide trenches tamping shall be done for a distance on each side of the pipe to at least the diameter of the pipe.

****END OF SECTION****

SECTION 02444

CHAIN LINK FENCE AND GATES

PART 1 - GENERAL

1.01 WORK INCLUDED: Provide and install non-climbable chain link fence and gates of the types and sizes and at the locations shown on the drawings.

PART 2 - PRODUCTS

2.01 GENERAL

All components galvanically compatible.

2.02 CHAIN LINK FABRIC

The fabric shall be green vinyl coated, conforming to FS RR-F-00191/1 Type A, Class I, two inch mesh, one piece fabric, full height. Wire diameter shall be 0.148 inch.

2.03 GATES

The gates shall be black vinyl coated, conforming to FS RR-F-00191/2 Type A single swing or double swing as shown. Frames shall be round zinc-coated steel assembled with corner fittings and 3/8 inch steel truss rods. Fabric shall be same as for fence. Hinges shall allow for swinging the gate open through a 180 degree arc. Latches for double gates shall be of the plunge bar type operable from either side of the gate with integral padlock clasp. Keepers shall be provided for double gates.

2.04 POSTS

The posts shall be green vinyl coated, conforming to FS RR-F-00191/3, Type 1, Class 1, diameters as follows:

Line post 2 inches diameter

Corner post 3 inches diameter

Gate post 4 inches diameter.

2.05 TOP RAILS AND BRACES

Top rails and braces shall be green vinyl coated, conforming to FS RR-F-00191/3 Type II Class 1, with top rail and braces 1-5/8 inches in diameter.

2.06 BARRED WIRE SUPPORT ARMS

Conform to FS RR-F-00191/4 Type X.

2.07 BARBED WIRE

Shall be four point pattern, two strand No. 12-1/2 gauge Aluminumized steel after weaving with large barbs placed 3 inches apart. When vinyl coating is specified for fence fabric, barbed wire shall also be vinyl coated with the exception of the barbs.

2.08 CONCRETE

Class B, as described in section 03300.

2.09 BOTTOM TENSION WIRE

The bottom tension wire shall be not less than no. 7 gage wire. Tie or clips shall be provided for attaching the wire to the fabric at intervals not exceeding 2 feet.

PART 3 - EXECUTION

3.01 INSPECTION:

1. Stake out location of fence and gate prior to installation. Obtain approval of fencing and gate location from Owner prior to any installation.
2. Verify that final grading in fence location is completed without irregularities which would interfere with fence installation. Assure that maximum gap between fence fabric and ground will be no greater than 3 inches.

3.02 PREPARATION

1. Measure and lay out complete fence line.
2. Measure parallel to surface of ground.
3. Locate and Mark position of posts.
4. Locate line posts at equal distance spacing, not exceeding 10 foot centers.
5. Locate corner posts at positions where fence changes direction more than 10 degrees.

3.03 INSTALLATION

1. Posts
 - A. Minimum post hole diameter three times outside post diameter.
 - B. Minimum post hole depth 3 in. below post bottom.
 - C. Place concrete in hole to depth of post bottom.
 - D. Set post plumb to 1/4 in. in 10 ft.

- E. Fill hole with concrete to 2 in. above grade.
 - F. Crown surface of concrete to slope away from post.
2. Fence Fabrics
- A. Stretch fabric tight between terminal post.
 - B. Position bottom of fabric approximately 1 in. to 2 in. above ground level at each post.
 - C. Join ends of fabric by weaving with single strand of fabric wire to form continuous mesh pattern with selvage twisted to match balance of fabric.
 - D. Attach fabric to line posts using wire ties or clips, spacing not to exceed 15 in. o.c.
 - E. Attach top edge of fabric to top rail using wire ties or clips, spacing not to exceed 24 in. o.c.
 - F. Attach bottom edge of fabric to bottom tension wire using wire ties or clips not to exceed 24 in. o.c.
3. Gates
- A. Install gates plumb and level 1/4 in. in 10 ft.
 - B. Install ground-set items in concrete.
 - C. Adjust hardware to provide smooth operation.

3.04 ADJUST AND CLEAN

- 1. Adjust brace rails and tension rods for rigid installation.
- 2. Tighten hardware, fasteners, and accessories.
- 3. Remove excess and waste materials from project site.

****END OF SECTION****

SECTION 02486

GRASSING AND MULCHING

PART 1 - GENERAL

1.01 WORK INCLUDED:

- A. This work shall consist of ground preparation, furnishing and planting, seeding, fertilizing, sodding and mulching of all disturbed areas. Note that all grassing and mulching shall meet the requirements of the latest edition of the Manual for Erosion and Sediment Control in Georgia, with regard to Products and Execution.
- B. Areas to be grassed:
 - 1. All graded or disturbed areas within the construction limits where natural vegetation has been removed except for areas to be paved.
 - 2. All existing grassed areas within the final fenced area of the site shall be regrassed to meet the requirements of this specification.

1.02 RELATED WORK

- A. Earthwork Section 02200

1.03 JOB CONDITIONS: Schedule work to comply with requirements for erosion control.

****END OF SECTION****

SECTION 02513

ASPHALT CONCRETE PAVING

PART 1 - GENERAL

- 1.01 WORK INCLUDED: All labor equipment and materials required to furnish and install Type F asphalt concrete paving as shown on the Drawings.
- 1.02 RELATED WORK:
- A. Earthwork: Section 02200
 - B. Testing Laboratory Services: Section 01410
- 1.03 SHOP DRAWINGS
- Shop drawings shall be submitted in accordance with Section 01340 of the specifications.

PART 2 - PRODUCTS

- 2.01 GRADED AGGREGATE BASE COURSE: Section 815, Ga. DOT Standard Specifications, latest edition.
- 2.02 BITUMINOUS PRIME COAT: Section 821, Ga. DOT Standard Specifications, latest edition. Viscosity grade MC-70.
- 2.03 ASPHALTIC CONCRETE BINDER COURSE: Section 828, Ga. DOT Specifications, latest edition. Type "B" Modified
- 2.04 BITUMINOUS TACK COAT: Section 822, Ga. DOT Standard Specifications, latest edition. Grade SS-1 or SS-1h.
- 2.05 ASPHALTIC CONCRETE SURFACE COURSE: Section 828, Ga. DOT Standard Specifications, latest edition.

PART 3 - EXECUTION

- 3.01 Construct graded aggregate base course in accordance with Section 310, Ga. DOT Standard Specifications, latest edition.
- 3.02 Apply bituminous prime coat in accordance with Section 412, Ga., DOT Standard Specifications, latest edition.
- 3.03 Construct asphaltic concrete binder course in accordance with Section 400, Ga. DOT Standard Specifications, latest edition.

- 3.04 Apply bituminous tack coat in accordance with Section 413, Ga. DOT Standard Specifications, latest edition.
- 3.05 Construct asphaltic concrete surface course in accordance with Section 400, Ga. DOT Standard Specifications, latest edition.
- 3.06 Omit all references to measurement and payment in the Ga. DOT Specifications.
- 3.07 Existing Paving

Where existing paving is removed for pipeline installation, the pavement shall be restored as shown in the details included in the plans.

****END OF SECTION****

SECTION 02515

PROTECTION OF EXISTING SITE

PART 1 - GENERAL

1.00 ROADS

The contractor shall be aware of the existing paved entrance roadway. All equipment shall be unloaded off the paved sections. No track equipment shall be allowed on paved roads, without the use of pads. Any portion of the existing paving damaged due to equipment will be repaired and maintained by the contractor at no additional cost to the owner. Final repairs and repaving will require restoration of the base, and the asphalt shall be replaced per the typical trench repair shown in the plans.

1.01 GRASSING

The contractor shall re-grass any places where he has destroyed the existing grassed areas. This shall include any areas where equipment has traveled, storage sheds have been constructed, trailers have been installed, or any areas disturbed. Grading and grassing of any disturbed areas shall be described elsewhere in these specifications.

1.02 PIPING

The contractor shall repair any piping damaged during construction. All damaged piping shall be reported to the engineer before repairs are made. The owner will assist in the location of underground piping, but the contractor shall be responsible for digging down and verifying the exact locations.

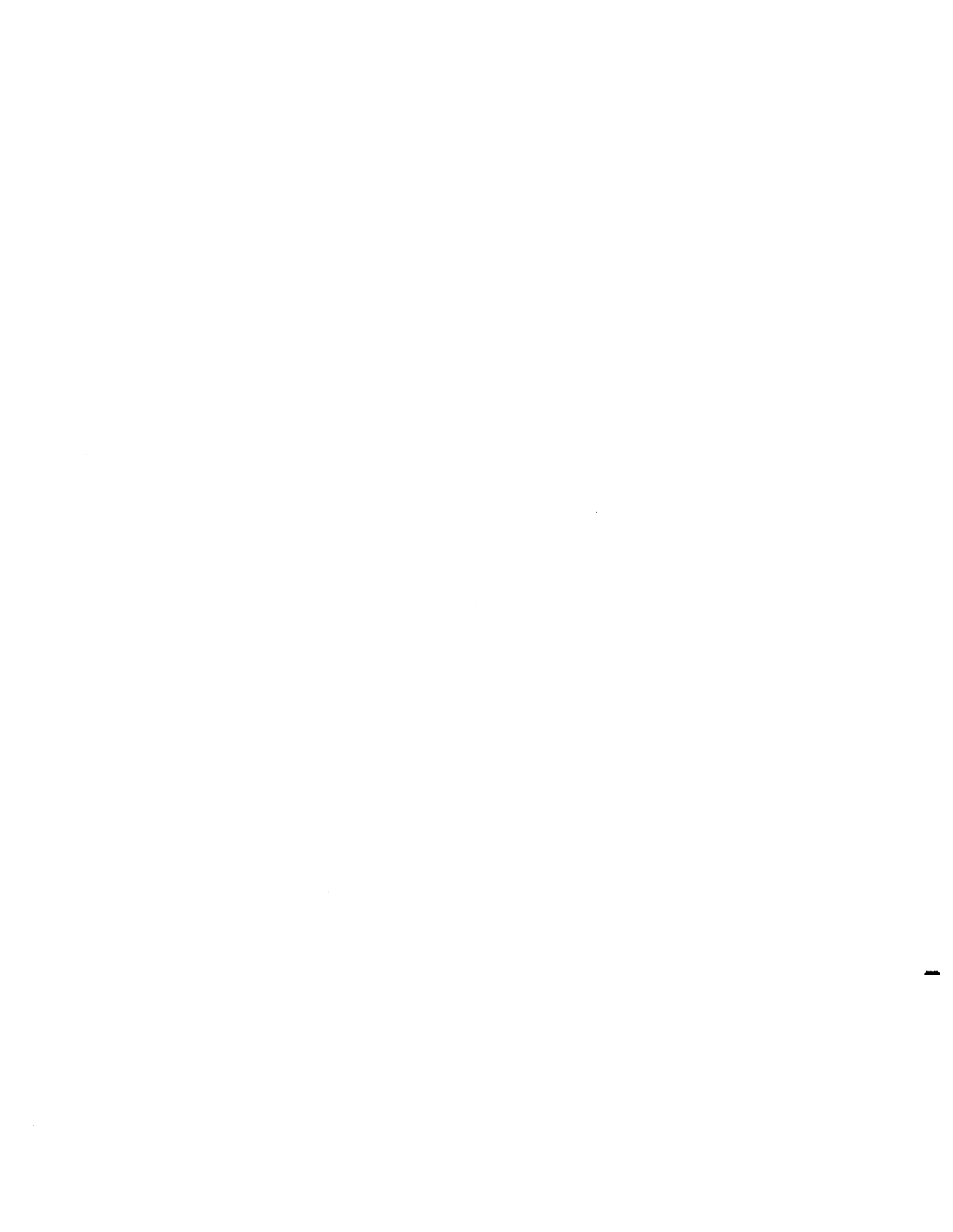
1.03 PARKING

The contractor shall prepare a place for the parking of construction equipment and vehicles. The existing parking lot and paved roads will not be used by the contractor during inclement weather for the purpose of parking vehicles.

1.04 UTILITIES

The contractor shall locate and flag all power, control, phone, water, chemical, air, water and wastewater lines prior to beginning of construction. The existing drawings are for general location and layout. The contractor shall make itself familiar and locate all utilities prior to construction of any phase. The contractor will be solely responsible for repairs to any utilities damaged.

****END OF SECTION****



SECTION 02605

PRECAST CONCRETE MANHOLES AND STRUCTURES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide and install pre-cast concrete manholes and vaults of the size and types at the locations shown on the drawings.

1.02 RELATED WORK

- A. Earthwork is included in Section 02200
- B. Cast-in-Place Concrete is included in Section 03300

1.03 SUBMITTALS

- A. Submit to the Engineer, in accordance with Section 01300, copies of all materials required to establish compliance with this Section. Submittals shall include at least the following:
 - 1. Product data, materials data, and installation data for base sections, riser sections, eccentric and concentric conical top sections, and flat slab tops, with notarized certificate indicating compliance with ASTM C478.
 - 2. Details of pipe connections to manholes and vaults.
 - 3. Product data for manhole rungs, including method of installation.
 - 4. Product data for manhole frame and cover with notarized certificate indicating compliance with ASTM C48, Class 30.
 - 5. Product data for sewer brick with notarized certificate indicating compliance with ASTM C32, Grade 55
 - 6. Design data for precast concrete structures:
 - a. Sectional plans and elevations showing dimensions and reinforcing steel placement.
 - b. Structural calculations including assumptions.

1.04 REFERENCE STANDARDS

- A. Design, manufacturing, and assembly of elements of the equipment herein specified shall be in accordance with, but not limited to, published standards of the following, as applicable:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM A48 – Standard Specification for Gray Iron Castings.

- b. ASTM A615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - c. ASTM C32 – Standard Specification for Sewer and Manhole Brick Made from Clay or Shale.
 - d. ASTM C33 – Standard Specification for Concrete Aggregates.
 - e. ASTM C62 – Standard Specifications for Building Brick (Solid Masonry Units Made from Clay or Shale).
 - f. ASTM C150 – Standard Specification for Portland Cement.
 - g. ASTM C207 – Standard Specification for Hydrated Lime for Masonry Purposes.
 - h. ASTM C443 – Standard Specifications for Joints for Circular Concrete Sewer and Culvert pipe, using Rubber Gaskets.
 - i. ASTM C478 – Standard Specification for Precast Reinforced Concrete Manhole Sections.
 - j. ASTM D4101 – Standard Specification for Propylene Plastic Injection and Extrusion Materials.
- 2. American Concrete Institute (ACI)
 - a. ACI 318 – Building Code Requirements for Reinforced Concrete
 - b. ACI 350R – Environmental Engineering Concrete Structures
 - 3. American Association of State Highway and Transportation Officials (AASHTO)
 - a. Standard Specifications for Highway Bridges
 - 4. Occupational Safety and Health Administration (OSHA)
- B. Where reference is made to standards of one of the above or other organizations, the version of the standard in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. All materials shall be new and unused. The design, materials, manufacturing process, and transportation or sections shall be subject to inspection and approval at any time by the Engineer. Inspection may be made at place of manufacture, at work site following delivery, or both.
- B. Materials will be examined for compliance with ASTM standards, this Section, and approved manufacturer's drawings. Additional inspection criteria shall include: appearance, dimensions(s), blisters, cracks, and soundness.
- C. Materials shall be rejected for failure to meet any requirements specified herein. Rejection

may occur at place of manufacture, at work site, or following installation. Material on the job site that is found to be defective shall be moved immediately after being notified as unacceptable. Rejected materials shall be replaced at no cost to the Owner.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Reference to a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
- B. Like items of materials/equipment shall be the end products of one manufacturer in order to provide standardization for appearance, operation, maintenance, spare parts and manufacturer's service.
- C. Provide lifting lugs or holes in each precast section for proper handling.

2.02 PRECAST CONCRETE MANHOLES

- A. Precast manholes, including base sections, risers, top sections, and flat slab top sections shall conform to ASTM C478 and meet the following requirements:
 - 1. Bottom slab thickness shall equal the riser wall thickness or flat slab top thickness, whichever is greater.
 - 2. Top section shall be eccentric cone where cover over pipe exceeds 4 ft. Top section shall be a flat slab where cover over top of pipe is 4 ft or less.
 - 3. Base, riser, and transition top sections shall have tongue and groove joints with preformed mastic sealer.
 - 4. Precast concrete sections shall be constructed of Portland Cement with a 28-day compressive strength of not less than 4,000 pounds per square inch.
 - 5. Design precast concrete base, riser, transition top, flat slab top, and grade ring for a minimum 300 psf loading plus earth load. Calculate earth load with a unit weight of 130 pcf.
 - 6. Mark date of manufacture, name and trademark of manufacturer on the inside of each precast section.
 - 7. Construct and install precast concrete base as shown on the Drawings.
 - 8. Provide integrally cast knockout panels in precast concrete manhole sections at locations and with sizes shown on Drawings. Knockout panels shall have no steel reinforcing.

2.03 PRECAST CONCRETE STRUCTURES

- A. Precast reinforced concrete structures shall be manufactured by Tindall, Stay-Rite, or an approved equal. Refer to Drawings for inside dimensions, headroom requirements, and minimum thickness of concrete.

- B. Manufacturer shall notify Engineer at least 5 working days prior to placing concrete during manufacturing process. Engineer may inspect reinforcing steel placement prior to placing concrete.
- C. Structural design calculations and shop drawings shall be prepared and stamped by a professional engineer registered in Georgia.
- D. Design criteria:
 - 1. Precast concrete
 - a. The 28-day minimum compressive strength shall be 5,000 psi.
 - b. The maximum water content shall be six gallons per 94 pound sack of cement.
 - c. Minimum cement content shall be six 94 pound sacks of cement per cubic yard of concrete.
 - 2. Manufactured products
 - a. Conform to ACI 318 and ACI 350R.
 - b. Analyze walls and slabs using accepted engineering principals.
 - c. When “fy” exceeds 40,000 psi, “z” (ACI 318) shall not exceed 95,000 psi. “fs” shall not exceed 50 percent of “fy”.
 - d. Design products to support their own weight, weight of the soil at 120 pcf, and a live load equal to 300 psf applied to top of slab.
 - e. Cast base slab and walls together to form a monolithic base section.
 - f. Design structure walls for a water pressure of 90 psf. Originate pressure diagram at finished ground surface.
 - g. Consider discontinuities in structure produced by openings and joints. Provide additional reinforcing around openings. Frame openings to carry full design loads to support walls.
 - h. Prevent flotation, with ground water level at finished ground surface, by dead weight of structure and soil load above structure. Do not consider skin friction, soil friction, or weight of equipment in structure.
 - i. Locate horizontal wall joints 18-in minimum from horizontal centerline of wall openings. Design structure with a minimum number of joints.
 - j. Provide lifting hooks for top slab.
 - k. Locate access openings, wall sleeves, and pipe penetrations as shown on Drawings. Wall sleeves shall be provided by precast concrete manufacturer.

2.04 BRICK MASONARY

- A. Bricks shall be sound, hard, uniformly burned, regular and uniform in shape and size. Underburned or salmon brick shall not be acceptable. Only whole bricks shall be used.
 - 1. Bricks for channels and shelves shall conform to ASTM C32, Grade SS except that the mean of five tests for absorption shall not exceed 8 percent and no individual brick shall exceed 11 percent.
 - 2. Bricks for raising manhole frames to finished grade shall conform to ASTM C62.
- B. Mortar shall be composed of 1 part Portland cement, 2 parts sand, and hydrated lime not to exceed 10-lbs to each bag of cement. Portland cement shall be ASTM C150, Type II; hydrated lime shall conform to ASTM C207.
- C. Sand shall be washed, cleaned, screened, well graded with all particles passing a No. 4 sieve and conform to ASTM C33.

2.05 FRAMES AND COVERS

- A. Manhole frames shall be cast iron with a coat of asphaltic paint applied at the foundry. The weight of the frame shall be approximately 160 lbs and the cover approximately 70 pounds. The frame and cover shall be USF 580 Ring with Type K Cover or approved equal. Covers shall have "Valve" cast in them.

2.06 VAULT HATCHES

- A. Vault hatches shall be as shown on the detailed plan drawings.

2.07 JOINTING PRECAST MANHOLE SECTIONS AND STRUCTURES

- A. Seal tongue and groove joints of precast manhole and structure sections with either rubber O-ring gasket or preformed flexible joint sealant. O-ring gasket shall conform to ASTM C443. Preformed flexible joint sealant shall be Kent Seal No. 2 as manufactured by Hamilton-Kent; Ram-Nek as manufactured by K.T. Snyder Company or approved equal.
- B. Completed joint shall withstand 15 psi internal water pressure without leakage or displacement of gasket or sealant.

2.08 RUNGS

- A. Rungs shall be steel reinforced, copolymer polypropylene, 14-in wide, M.A. Industries Inc., PF Series or approved equal. Copolymer polypropylene shall conform to ASTM D4101 Classification PP200 B33450 Z02. Steel reinforcing shall be ½-in diameter, conforming to ASTM A615, Grade 60 and shall be continuous throughout rung.

2.09 PIPE CONNECTIONS TO MANHOLES AND STRUCTURES

- A. Connect pipe to manholes and structures in the following ways:
 - 1. Flexible sleeve – Integrally cast sleeve in precast section or install sleeve in a formed or

cored opening. Fasten pipe in sleeve with stainless steel clamps. Coat stainless steel clamps with bituminous material to protect from corrosion. Flexible sleeve shall be Lock Joint Flexible Manhole Sleeve; Kor-N-Seal connector type as manufactured by National Pollution Control Systems, Inc ; PSX Press-Seal Gasket or approved equal.

2. Compression gasket – Integrally cast compression gasket in precast section. Insert pipe into compression gasket. Compression gasket shall be A-Lok, or approved equal.

2.10 MANHOLE AND VAULT STEPS

- A. Manhole and vault steps shall consist of #3 steel reinforcing bars covered with polypropylene plastic or rubber and shall be supplied with depth rings and other necessary appurtenances. The manhole steps shall be “HILT” as manufactured by M.A. Industries, Inc or approved equal.

2.11 DAMPPROOFING

- A. Dampproofing shall be Hydrocide 648 by Sonneborn Building Products; Dehydratine 4 by A.C. Horn Inc.; RIW Marine Liquid by Tock Brothers, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Manhole and Structure Installation.

1. Manholes and structures shall be constructed to the dimensions shown on the Drawings and as specified herein. Protect all work against flooding and flotation. Construct cast-in-place bases in accordance with the requirements of Division 3 and the details shown on the Drawings.
2. Place base on a bed of 12-in screened gravel as shown on the Drawings. Set base grade so that a maximum grade adjustment of 8-in is required to bring the frame and cover to final grade.
 - a. Use precast concrete grade rings or brick and non-shrink mortar to adjust frame and cover to final grade.
3. Set precast concrete barrel sections and structures plumb with a ¼-in maximum out of plumb tolerance allowed. Seal joints of precast barrel sections with either a rubber “O” ring set in a recess or preformed flexible joint sealant in sufficient quantity to fill 75 percent of the joint cavity. Fill the outside and inside joint with non-shrink mortar and finished flush with the adjoining surfaces. Leaking barrel section joints shall be caulked on the inside with lead wool or non-shrink grout.
4. Allow joints to set for at least 14 hours before backfilling.
5. Plug holes in the concrete barrel sections required for handling with a non-shrinking grout or non-shrinking in combination with concrete plugs. Finish flush on the inside.
6. Cut holes in precast sections to accommodate pipes prior to setting sections in place to

prevent jarring which may loosen the mortar joints.

7. Backfill carefully and evenly around sections.

B. Pipe Connections

1. Construct pipe connections, including pipe stubs, as specified above. Close or seal pipe stubs for future connections with a gasketed watertight plug.

C. Rung Installation

1. Steel Reinforced Polypropylene Plastic Rungs

- a. Preform holes for rungs during casting of the sections, using tapered form pins specifically made for performing manhole rung holes.
- b. Drive rungs into preformed holes after concrete has developed a compressive strength of 3,000 psi.
- c. Alternatively, cast rungs into precast sections when concrete is placed.
- d. Drilling holes for rungs may be used to accommodate field conditions when approved by the Engineer. Drill holes of diameter, spacing, and depth required by rung manufacturer.

D. Brickwork

1. Mix mortar only in such quantity as may be required for immediate use. Use mortar before initial set has taken place. Mortar shall be used within 1-1/2 hours and shall be constantly worked with hoe or shovel until used. Anti-freeze mixtures shall not be included in the mortar. Install masonry when the outside temperature is above 40°F unless provisions are made to protect the mortar, bricks, and finished work from frost by heating and enclosing the work with tarpaulins or other suitable material.
2. Construct channels and shelves of brick and concrete as shown on the Drawings. Brick lined channels shall correspond in shape with the lower half of the pipe. Set shelf elevation at crown of highest pipe and slope 1-in/ft to drain toward the flow through the channel. Construct brick surfaces exposed to sewage flow with nominal 2-in by 8-in face exposed or bricks on edge.

E. Setting Frames and Covers

1. Set frames and covers in a full mortar bed. Utilize bricks or precast concrete grade rings, a maximum of 9-in thick, to assure frame and cover are set to the finished grade.
2. Set frame and cover to final grade prior to placement of permanent paving, when applicable.

F. Dampproofing

1. Paint outer surfaces of precast and cast-in-place manholes and structures with two coats

of bituminous dampproofing at the rate of 30 to 60 ft²/gallon, in accordance with manufacturer's instructions.

3.02 LEAKAGE TESTS

- A. Test each manhole and structure for leakage. The Engineer shall observe each test. Perform exfiltration test as described below:
- B. Assemble manhole in place; fill and point all lifting holes and exterior joints within 6-ft of the ground surface with an approved non-shrinking mortar. Test prior to placing the shelf and invert and before filling and pointing the horizontal joints below 6-ft of depth. Lower ground water table below bottom of the manhole for the duration of the test. Plug all pipes and other openings into the manhole and brace to prevent blow out.
- C. Fill manhole with water to the top of the cone section.
 1. If the excavation has not been backfilled and no water is observed on the exterior surface of the manhole, the manhole is satisfactorily watertight.
 2. If water is observed on the exterior surface or if the manhole excavation has been backfilled, continue the test as follows:
 3. A period of time may be permitted to allow for absorption. Following this period, refill manhole to the top of the cone, if necessary and allow at least 8 hours to pass. At the end of the test period, refill the manhole to the top of the cone again, measuring the volume of water added. Extrapolate the refill amount to a 24-hour leakage rate.
 4. The leakage for each manhole shall not exceed one gallon per vertical foot for a 24-hour period. If the manhole fails this requirement, but the leakage does not exceed three gallons per vertical foot per day, make repairs using approved methods and materials.
 5. If leakage due to a defective section of joint exceeds three gallons per vertical foot per day, the manhole shall be rejected. Uncover the rejected manhole as necessary and disassemble, reconstruct and reseal, or replace it as directed by the Engineer. Retest the manhole and, if satisfactory, fill and paint the interior joints.
- D. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorptions, etc. It will be assumed that all losses of water during the test is a result of leaks through the joints or through the concrete.
- E. An infiltration test may be substituted for an exfiltration test if the ground water table is above the highest joint in the manhole. If there is no leakage into the manhole, the manhole will be considered watertight. If leakage is detected, conduct exfiltration tests as described herein before.
- F. Leakage Test for Structures
 1. Structures shall be visually inspected for possible leaks before backfilling of structures is allowed. Leaking joints shall be sealed using approved methods and materials.
 2. Perform exfiltration tests as described above for manholes on any structure which shows

detectable leakage after the joints have been sealed.

3.03 CLEANING

- A. Thoroughly clean all manholes and structures of all silt, debris, and foreign material of any kind prior to final inspection.

****END OF SECTION****

SANITARY SEWER CONSTRUCTION

PART 1 - GENERAL

1.01 WORK INCLUDED

The work covered in this section includes the furnishing of all labor, tools, equipment, materials and incidentals necessary to construct sewer lines at the location and in accordance with the details shown on the plans. All workmanship shall be first class and conform to accepted practice.

1.02 ORDER OF WORK

Work shall proceed in an orderly and workmanlike manner. The starting point or points for construction and the order in which the work shall be constructed, completed and placed into operation shall be coordinated with the Engineers or their representative. Contractor must keep siltation and bank erosion to an absolute minimum during construction.

1.03 GENERAL METHODS

A. Information Concerning Conditions

The accuracy of information furnished by the Owner, the consulting engineer, or information shown on the plans and specifications as to the underground and surface structures, foundation conditions, character of soil, position and quantity of ground and surface water, rock, etc., shall not relieve the Contractor of his responsibility. The Contractor must satisfy himself by personal examination and by such other means as he may desire with respect to actual conditions in regard to the nature of the ground, subsoil, and water conditions, and in regard to the location of existing underground or subsurface structures.

- B. All existing pipes, drains, or other structures on, above or below ground shall be carefully supported and protected from injury and if injured, they shall be restored in a satisfactory manner by and at the expense of the Contractor.

PART 2 - PRODUCT

2.01 GENERAL

The Contractor shall furnish all materials and incidental items (whether or not they are specifically described herein) necessary to complete all work called for under the contract, except for any items that are specifically listed in these contract documents as being furnished by the Owner.

2.02 GRAVITY SEWER PIPE

All sanitary sewer pipe shall be Polyvinyl Chloride (PVC) or Ductile Iron Pipe (DIP) as shown on the plans or specifically called out otherwise. All materials for sanitary sewer pipe shall be furnished in accordance with the Cherokee County WSA Sewer Specifications, latest edition. A copy of these standards is available on the CCWSA website.

PART 3 - EXECUTION

All sanitary sewer pipe shall be furnished, installed and tested for acceptance in accordance with the Cherokee County WSA Sewer Specifications, latest edition. A copy of these standards is available on the CCWSA website.

****END OF SECTION****



SECTION 02710

SEWER FORCE MAINS

1. SCOPE

This section covers the installation of the force mains including excavation, pipe laying, backfilling, compaction, and other work.

2. PIPE MATERIALS

Except where specifically noted on the Plans, the following types of pipe shall be used:

A. Ductile Iron Pipe

Ductile iron pipe shall be manufactured in accordance with AWWA C150. Ductile iron pipe shall be of the thickness Class 50 minimum. Ductile iron pipe shall be push-on joint. Fittings shall conform to ANSI A21.10 and shall be mechanical joint push-on type unless otherwise shown. Joints shall conform to ANSI A21.11, push-on type unless otherwise shown. Pipe shall have push-on joints and fittings shall have mechanical joints with retainer glands. All retainer glands shall be EBAA MegaLug or approved equal. Pipe interior shall be Protecto 401 ceramic epoxy lined with a minimum thickness of 40 mils and sealed with an approved exterior bituminous seal coat in accordance with AWWA C151.

3. All DIP Force mains shall be furnished, installed, and tested for acceptance in accordance with the latest edition of the CCWSA Sanitary Sewer Standards.

4. POLYETHYLENE ENCASEMENT

All DIP Force Mains shall be encased in polyethylene film, manufactured of virgin polyethylene material conforming to AWWA C105, Section 4.1.1. The polyethylene film shall have a minimum thickness of 8 mil. The polyethylene encasement material shall be provided in tube sizes adequate for the various sizes of pipe and shall be **GREEN in color.**

5. AS BUILT LOCATION

For force mains, the Contractor shall place a vertical piece of 2" diameter PVC pipe on top of the pipe at all bends, fittings, valves, elevation transitions and every 50' along the length of the force main for the purpose of enabling the Contractor's surveyor to locate the force main for "As-Builts". The Contractor will then be responsible for removing the vertical PVC sections after the Contractor's as-built locations have been verified by the Authority. See Section 01050 and/or the CCWSA website for further information regarding the record drawings for force mains.

****END OF SECTION****

SECTION 03000
REINFORCED CONCRETE

PART 1 - GENERAL

1.01 WORK INCLUDED

Concrete, forms, placing of sleeves, pipes, and anchor bolts, finishing, curing, and all equipment and incidentals necessary to do all the concrete work as shown on the drawings or specified.

1.02 REFERENCE STANDARDS

All work hereunder shall comply with the following except as called for otherwise herein:

- A. ACI Standard 301-89 Specifications for Structural Concrete for Buildings.
- B. ACI Standard 318-89 Building Code Requirements for Reinforced Concrete.
- C. ACI Standard 306R-88 Cold Weather Concreting.
- D. ACI Standard 305R-89 Hot Weather Concreting.
- E. ACI Standard 304R-89 Guide for Measuring, Mixing, Transporting and Placing Concrete.

1.03 SUBMITTALS

A. Shop Drawings: Submit complete Shop Drawings including, but not necessarily limited to:

- 1. Location of all proposed construction joints, keying, and water stops;
- 2. Location of all openings, depressions, construction and control joints, trenches, sleeves, inserts, and other items affecting the reinforcement and placing of concrete.

B. Product data: Submit complete product data on the following:

- 1. Complete materials list of items proposed to be furnished and installed under this Section;
- 2. Complete information on cement source of supply, physical and chemical characteristics, transportation and intermediate terminating procedures for mill-to-site handling, and site storage procedures;
- 3. Complete information on aggregate procurement, processing, and storage;
- 4. Complete information on proposed batching and mixing equipment and procedures, including water chilling or other devices or systems to reduce mix temperatures;
- 5. Complete information on concrete handling equipment proposed to be used, including capacities, for chutes, pumps, tremies, buckets, and all other equipment;
- 6. Complete description of proposed curing materials and methods;
- 7. Complete mix designs;
- 8. Remolded joint filler;
- 9. Waterstops;
- 10. Wedge inserts;
- 11. Expansion bolts;
- 12. Anchor bolts;

- 13. Foundation bolts.
- 14. Admixtures
- 15. Hardening and dust-proofing compounds
- 16. Form Ties
- 17. Any gang forming information

C. Do not begin concrete production until all products and mix designs have been reviewed by the engineer.

1.04 CLASSIFICATION

A. The following classes of concrete are included in these specifications and shall be used where specified herein or called for on the plans:

	Class "A" Concrete	Class "B" Concrete
Cement content -Minimum number of sacks (94 lb.) per cubic yard	6	5
Maximum water to cement ratio (gal. water per sack cement)	5.1	6.5
Entrained air	3% - 6%	3% - 6%
Minimum Superplasticizer content per 100 lbs. of cement	45 oz.	0 oz.
Minimum 7 day compressive strength	2,400 psi	1,400 psi
Minimum 28 day compressive strength	4,000 psi	2,500 psi

B. In the absence of contrary designation, concrete used for all construction shall be Class "A".

PART 2 - PRODUCTS

2.01 CEMENT

Unless otherwise specified or shown on the plans, concrete shall be made with the Portland cement conforming to A.S.T.M. Specification C-150, Type I. The lightest colored Portland cement, competitively available shall be used, and the same brand of cement shall be used throughout the entire project.

High early strength Portland cement shall conform to A.S.T.M. Standard Specification #C-150-68, Type III.

2.2 AGGREGATES

A. General: All aggregates shall conform to requirements of ASTM C 33.

B. Fine Aggregate

- 1. The fine aggregate shall consist of clean, hard, durable, uncoated particles of sand. It shall be free from dust mica, shale, alkali, organic matter, loam, soft or flaky particles.
- 2. Deleterious Substances - The fine aggregate shall contain not more than one percent (1%) by weight of clay lumps of more than three percent (3%) by weight of material removed by decantation.

3. Grading - Fine aggregate shall conform to the following requirements:

<u>Total Passing</u>	<u>Percent by Weight</u>
3/8" sieve	100
No. 4 sieve	95 - 100
No. 16 sieve	45 - 95
No. 50 sieve	10 - 30
No. 100 sieve	2 - 8

4. Tests - Fine aggregate shall be subjected to the Colorimetric test for organic impurities and if it produces a color darker than the standard, it shall be rejected. It shall conform in all other respects to A.S.T.M. Designation C-33.

C. Coarse Aggregate

1. Composition and Quality - Coarse aggregate shall be washed gravel or crushed stone and shall consist of hard, tough, uncoated, durable particles. It shall contain no vegetable matter or soft, flaky, thin, or elongated particles. Deleterious substances shall not exceed the following amounts:

Soft fragments	0.20%
Coal and lignite	0.25%
Clay lumps	0.25%
Material passing No. 200 Sieve	1.50%
Thin or elongated pieces (length greater than 5 times the average thickness)	10.00%

The percentage of wear, by the Los Angeles test, shall not exceed 45.

2. Grading - Coarse aggregate shall be well graded between the limits specified below, and shall conform to the limits shown in the following table:

<u>Total Passing</u>	<u>Percent by Weight</u>
2" Sieve	100
1-1/2" Sieve	90 - 100
1" Sieve	55 - 80
3/4" Sieve	35 - 70
1/2" Sieve	20 - 45
3/8" Sieve	10 - 30
No. 4 Sieve	0 - 15
No. 16 Sieve	0 - 1

2.03 WATER

The water used in mixing concrete shall be fresh, clean, potable and free from oil, acid, alkali, organic matter, and deleterious amounts of chloride ion.

2.04 CONCRETE ADMIXTURES

- A. Admixtures shall conform to ASTM C494; Type F for high range water-reducing and Type G for high range water-reducing/set-retarding. Air entraining agents shall conform to ASTM C260. When more than one admixture is used the two products shall be compatible and have a single manufacturer.

- B. All Class "A" Concrete shall contain a high range water-reducing agent (Daracem - 100 or an alternate approved by the Engineer). The dosage of the high range water reducing agent shall be at least 8 oz./100 lbs. of cement, but shall not produce a plasticized slump greater than 8". The high range water reducing agent shall be added at the site prior to concrete placement.
- C. Admixtures, if not specified, may be used only upon written approval of the Engineer and shall be used only as recommended by the Manufacturer. Admixtures shall, when added to the mixture, produce a concrete of specified strength in both 7 and 28 day tests. Documentary evidence of acceptability will be required when new or unknown admixtures are proposed for usage.
- D. Admixtures shall be Grace Construction Products or an alternate approved by the Engineer.

2.05 FORM WORK

- A. Forms shall result in a final structure which conforms to the shape, lines, and dimensions of the members as required by the plans and specifications, and shall be substantial and sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together so as to maintain position and shape. Forms and their supports shall be designed so that previously placed structure will not be damaged.

Form ties shall be so designed that when the forms are removed no metal shall be within 1-1/2 inches of the finished surface. Form ties shall have an approved type waterstop that is an integral part of the tie and made of the same material as the tie. Gang form ties shall be filled from one end with a compressible plug a minimum of 1 1/2 inches from the edge of wall, shall have a bentonite plug in the center of the wall and all voids filled with non-shrink grout. Removal of forms and shores - no construction loads exceeding the dead load plus live load shall be supported on any unshored portion of the structure under construction. No construction loads shall be supported on, nor any shoring removed from, any part of the structure under construction except when that portion of the structure in combination with the remaining forming and shoring system has sufficient strength to support safely its weight and the loads placed thereon. This strength may be demonstrated by job-cured test specimens and by a structural analysis considering the proposed loads in relation to these test strengths and the strength of the forming and shoring system. Such analysis and test data shall be furnished by the contractor to the Engineer when so required. In no case shall forms for walls or columns be removed in less than 36 hours. Form work supporting weight of concrete, such as beams and slabs shall remain until the concrete has attained a minimum of the 28 day design strength.

- B. The design and engineering of the form work, as well as its construction, shall be the responsibility of the Contractor. Except as specifically called for otherwise herein, all form work shall meet the "ACI Standard Recommended Practice for Concrete Form work (ACI 347)".
- C. Chamfer: Unless shown otherwise, form chamfers with 3/4" x 3/4" strips, accurately formed and surfaces to produce uniformly straight lines and tight edge joints on exposed concrete. Extend terminal edges to required limit and miter chamfer strips at changes in direction. All exposed corners shall be chamfered.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Before the placing of any concrete, the footing trenches shall be drained of water and mud film removed and any loose dirt lifted out. Any flow of water shall be diverted by side drains to a sump, or removed by other approved methods, while the concrete is being placed.

- B. Before placing concrete in any forms, the forms shall be cleaned, and all debris shall be removed. All reinforcing shall be checked to be sure that no reinforcing is touching the form or pan sides.
- C. Before placing any concrete, it shall be determined that all work that is to be built into the concrete work is located and installed. All such items shall be placed so as not to interfere with the reinforcing steel.
- D. Wood board forms shall be soaked with water just before the concrete is poured.
- E. Special measures shall be taken in both severe cold and hot weather and shall be in accordance with ACI Recommended Practice (ACI 306-66 and ACI 605-59).
- F. Before placing any new concrete on or against concrete which has set, the existing surfaces shall be thoroughly roughened and cleaned of all foreign matter and "Laitance." Forms shall be retightened and the existing surfaces slushed with a coat of grout. The new concrete shall be placed immediately after grouting, and the work shall be performed in such manner as to insure complete bonding of newly poured concrete to the existing work.

Grout for construction joints shall consist of a mixture of neat cement and water, and shall be applied to the old concrete surface immediately before the new concrete is poured. Grout for setting column bases, wall plates, and beams shall be composed of one part Portland Cement two parts sand, and sufficient water to produce the consistency required.

- G. Where excavations exceeding a depth of five feet are prescribed to be made to install the foundations or any part of the structure of this building, or any retaining walls on the site, the back slope of such excavation shall be at an incline not exceeding one vertical to one and one-half horizontal unless such back slope is sheeted and braced. If sheeting and bracing is to be provided, such sheeting and bracing shall be designed by an Engineer registered in the state of Georgia. The cost of such design work shall be paid for by the Contractor.

3.02 MIXING AND DELIVERY

- A. Machine Mixing: All mixing of concrete shall be done in a batch mixer, of approved design, which will insure a uniform distribution of the material throughout the mass, so that the mixture is uniform in color and homogenous. The entire content of the mixer drum shall be discharged before recharging. All material to be mixed per batch shall not exceed the manufacturers' rated capacity of the mixer.
- B. Time of Mixing: The mixing of each batch shall continue not less than one and one-half (1-1/2) minutes after all the materials, including water, are in the mixer, during which time the mixer shall rotate at a peripheral speed of about two hundred feet (200') per minute.
- C. Mixing at Central Plant: Concrete mixed in a central plant, shall be conveyed to the work in approved mixer trucks which mix the concrete in route to the work. Plant layout and equipment shall meet the approval of the Engineer. Loading tickets shall be initialed and the time of loading stamped thereon. The loading tickets shall be handed to the resident inspector on the work before the load is placed, and no concrete will be accepted which has been in the mixer truck more than one and one-half (1-1/2) hours after the water has been added. In all other respects, ready-mixed concrete shall conform to A.S.T.M. Specification C-94.
- D. Waste concrete shall be deposited and mix trucks washed out only in areas designated by the owner or the engineer.

3.03 SLUMP

- A. The maximum slump allowed for the various types of construction are as follows:

<u>Type of Construction</u>	<u>Maximum Slump</u>
Reinforced Foundation Walls & Footings	4"
Slabs, Beams, Reinforced Walls & Columns	4"
Heavy Mass Construction	2"
All Concrete Plasticized by Admixtures	8"

- B. Slump tests shall be made at the discretion of the Engineer, and concrete having greater slump than specified shall not be incorporated into the work. The Contractor shall furnish slump test cones conforming to the provisions of ASTM C-143.

3.04 PLACING CONCRETE

- A. All concrete shall be placed in daylight, and any portion of the concrete work started shall be started so that it can be completed in daylight. No concrete shall be placed until the foundation, forms, false-work, and the placing of the steel have been approved by the Engineer. Approval by the Engineer in no manner relieves the Contractor of his obligation to produce finished concrete as required by the plans and specifications.
- B. The concrete shall be placed in such a manner as to avoid the possibility of segregation or separation of the aggregates, or the displacement of the reinforcement steel. The concrete shall be placed as near its final resting place as possible. If pipes, troughs, or chutes are used in placing the concrete, they shall be so arranged and used that the concrete is not separated, and shall be kept clean and free of hardened concrete at all times. Troughs and chutes shall be either made of metal or shall be metal lined, and shall extend as nearly as possible to the point of deposit. In walls and columns, the concrete shall not be dropped more than five feet (5') without the use of a tremie. Concrete shall be placed in continuous horizontal layers, approximately 10" to 12" thick, and the batches shall follow each other so closely that each one is placed and compacted before the preceding one has taken an initial set. Succeeding layers shall be placed before the underlying layer has become set, and shall be compacted in a manner that will entirely break up and obliterate the tendency to produce a construction joint between layers. Concrete in beams, girders, columns and walls shall be well spaded at the form surface and all concrete shall be compacted by an approved mechanical type vibrator having a frequency of not less than 7,000 vibrations per minute. The Contractor shall provide the necessary number of vibrators to properly execute the work, and shall have on the job at all times necessary spare vibrators to be used in case of mechanical failure. Construction joints shall be made only at the location as shown on the plans, except by approval of the Engineer.
- C. In making construction joints, the previous work shall be cleaned of all "laitance", and other objectionable material, and shall be brushed with a thin mixture of Portland cement and water immediately before the new concrete is placed.
- D. The operation of placing and compacting the concrete, shall be conducted so as to form a compact, dense, impervious artificial stone of uniform texture, with smooth faces on exposed surfaces. Any section of concrete that is porous, or has been plastered, or is otherwise defective, shall be removed and replaced, in whole or in part, entirely at the contractor's expense, as directed by the Engineer.
- E. Depositing Concrete Under Water: Concrete shall not be exposed to the action of water before

setting, or deposited in the water, except upon the approval of the Engineer, and under his supervision.

F. Cold Weather Placing

1. Comply with ACI 306 to protect all concrete work from physical damage and reduced strength which would be caused by frost, freezing actions, or low temperatures. No concrete shall be placed when the atmosphere temperature is below 40 degrees F.
2. If the temperature drops below forty degrees F. after the concrete has been placed, the Contractor shall provide adequate means for maintaining concrete temperature of not less than 45 degrees F. for a period of five (5) days after the concrete is placed. The contractor shall assume all risk connected with placing concrete in cold weather, and any unsatisfactory work will be rejected. Recording thermometers shall be supplied by the contractor as required by the Engineer.

G. Hot Weather Placing: When hot weather conditions exist which would seriously impair the quality and strength of concrete, place the concrete as follows:

1. Maintain concrete temperature at time of placement below 90 degrees F. Use chilled mixing water or chopped ice to control concrete temperature, provided the water equivalent of the ice is calculated to the total amount of water.
2. Cover reinforcing steel with water-soaked burlap if the steel becomes too hot. Steel temperature shall not exceed the ambient air temperature immediately prior to placement of concrete.
3. Wet forms thoroughly prior to placement of concrete.
4. Use set-control admixtures in the mix.

3.05 PROTECTION AND CORRECTIVE WORK

- A. Workmen shall not walk on concrete during placing or finishing with any earth or foreign matter footwear.
- B. All freshly placed concrete shall be protected from damage or injury due to water, falling objects, persons or anything that might mar or injure the finish surface of the concrete. Any surfaces that are damaged shall be removed and replaced with fresh concrete at the expense of the Contractor.
- C. Care shall be taken in the removal of the forms not to damage the surface of the concrete. Immediately after the forms are removed, all damaged or imperfect work shall be patched. If in the opinion of the Engineer, the patching does not restore the work to the quality specified, the Contractor shall remove and rebuild the work at his expense.
- D. Where concrete or concrete work does not conform to these specifications and where patching is not approved by the Engineer or low strength concrete is not permitted to remain in place, procedures and plans covering all work to be rebuilt shall be submitted by the Contractor to the Engineer before removal and rebuilding is begun. The cost of such plans, as well as the cost of removal and rebuilding shall be at the Contractor's expense.

3.06 FINISHING

- A. Floors, including slabs on ground, shall be finished as follows:
- B. The surfaces of all concrete shall be worked with a wood float in a manner which will compact the concrete and produce a surface free of depressions or inequalities of any kind. Test for

grade (of level) and correct by removing excess or adding and compacting additional concrete.

- C. All interior floor slabs shall receive steel trowel finish as follows: After screeding, slab shall be wood floated to a smooth, plane surface. When concrete has hardened, to prevent excess fines from working to surface, steel trowel to a smooth surface free from defects. A second steel troweling shall be done producing a plane, hard, dense, finished surface. Interior slabs shall also receive a hardening and dust proofing treatment of a colorless aqueous solution of zinc or magnesium fluosilicate applied in strict accordance with manufacturer's recommendations.
- D. Troweling shall not begin until all surface water has disappeared. The drying of the surface moisture before troweling must proceed naturally and must not be hastened by sacking or dusting on of dry sand and cement.
- E. After exterior floors, platforms and steps are struck off smooth with a wood float and received a trowel finish, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use a fiber bristle broom.
- F. Exposed concrete surfaces shall be finished as follows:
 - 1. The exterior surfaces of all concrete shall be thoroughly worked during the placing operation, by the use of a concrete spade of approved type. The working shall force all coarse aggregate from the faces, and work mortar against the forms to produce a smooth finish, free from water and air pockets, or honeycomb. As soon as the concrete has set sufficiently to permit, the forms shall be carefully removed and all depressions resulting from removal of the metal spacers, and all other holes and rough places, shall be carefully pointed with a mortar composed of one part cement and two parts sand. The surface film of all such pointed surfaces shall be carefully removed before setting occurs. The cement in the mortar used for pointing and filling holes shall be of the same brand as the cement incorporated in the concrete work.
 - 2. Surface shall be rubbed smooth with carborundum brick or other abrasive within 36 hours after forms are removed. Surfaces shall be wetted and rubbed until a uniform color and texture is produced. No cement grout or slush shall be used other than the cement paste drawn from the green concrete itself by the rubbing process.
 - 3. Exposed interior and exterior concrete walls and ceilings shall also receive an additional finish of thoro coat products as described in Section 09900. Finish 2 feet below finish grade and 3 feet below low water mark on basins.

G. Unless otherwise directed the following schedule shall be used for concrete finishing:

Sidewalks:	Rough (Broomed)
Exposed Exterior Walls:	Medium (Rubbed)
Interior Structure Walls:	Fine (Rubbed)
Additional Wall Finish:	ThoroCoat applied per manufacturer's recommendations
Slabs - Interior:	Smooth (Troweled)
Slabs - Exterior:	Medium (Fine broomed)

Coordinate the required finish with the Engineer prior to application.

3.07 CURING

A. Curing Materials

1. Liquid curing and sealing compounds shall conform to ASTM C 309, Type 1.
2. Sheet materials shall conform to ASTM C 171.
3. Burlap cloth made from jute or kenaf and weighing approximately 9 oz. per sq. yd for moist curing shall conform to AASHTO M 182 and shall use two layers.
4. Compounds shall be a combination sealer-hardener and dust-proofer.

B. Procedure

Freshly placed concrete shall be protected from wash caused by rain and flowing water. Concrete shall not be allowed to dry out from the time it is placed until seven (7) days thereafter. Curing shall be accomplished by the use of an approved membrane compound to seal the water in the concrete except for surfaces which are to receive future concrete, or mortar. The membrane shall be of a type which will retain ninety-seven (97%) percent of the moisture at a temperature of 135 degree F., with a relative humidity of thirty percent (30%) in the first twenty-four (24) hours. It shall be applied in accordance with the manufacturer's recommendations and in sufficient thickness to effectively hold the water in the concrete, and must have a record of successful use for at least two years.

3.08 JOINTS

A. Construction Joints:

1. Construction joints will not be permitted except as may be shown on the Drawings and on the Contractor's approved placement schedule.
2. If construction joints necessary for the progress of the Work are not shown on the Drawings, show them in complete detail on the Shop Drawings.
3. Provide keyways at least 1-1/2" deep in all construction joints in walls, slabs, and between footings and walls as shown on the plans.

B. Isolation joints in slabs on grade:

Provide isolation joints in slabs on grade at points of contact between slabs on grade and vertical surfaces where indicated.

C. Control joints in slabs on grade (non-watertight):

Control joints for non-watertight slabs on ground shall be 24 gauge, galvanized, preshaped, keyed type. Joints shall be 1/2" less in depth than the slab. Joints shall be held in place with 1" x 1/8" ribbed stakes at 2'-0" o.c. on the female. The male side of the joint shall be greased or sprayed with a bond breaker. Approved joints shall be as follows: Burke Concrete Accessories, Inc., Jahn Concrete Forming Products, or Keyhold, Inc.

3.09 WATER TIGHTNESS

All structures for holding or carrying water, or pits below grade shall be watertight. Where the order of work requires "cold" joints (slab/wall intersections etc.), an approved, rigid waterstop shall be secured to the form work and remain imbedded in the concrete to form a watertight joint with the adjacent pour. Waterstop shall be expandable center bulb type 6 in. wide x 1/4 in. thick minimum unless otherwise specifically shown on the Plans.

3.10 TESTING OF CONCRETE

- A. Testing of concrete will be done under the direction of a laboratory approved by the Engineer. Tests to be paid for by the Contractor.
- B. Samples for strength tests will be taken not less than one per day nor less than once per one hundred (100) cubic yards or more, and on less yardage when required by the Engineer. The tests shall be made in accordance with the procedure set forth in A.S.T.M. C172 for "Standard Method of Making and Storing Compression Test Specimens of Concrete in the Field", and C-39 for "Standard Methods of Test for Compressive Strength Concrete." Tests shall be made by a recognized laboratory approved by the Engineer.

Three certified copies of test results are to be furnished the Engineer with each test. Each test shall consist of at least four specimens, two for field control and two for laboratory control. Each set of four cylinders shall have a numerical designation and each cylinder an alphabetical sub-designation. Thus the first set of four cylinders shall be numbered 1A, 1B, 1C, and 1D.
- C. If the evaluation of the compressive test indicates the concrete has failed to meet the specified strength, core tests shall be made of the in-place concrete. The location and number of such tests to be at the Engineers direction. Tests shall be paid for by the Contractor.
- D. If the core tests fail to verify the strength specified, the Engineer shall effect one of the following procedures:
 - 1. Have the Contractor remove and reconstruct that portion of the structure found to be defective.
 - 2. Accept the concrete in place and issue a change order as set forth in the General Conditions of these specifications.
- E. Tests to determine the entrained air content will be made at the job site. Frequency of testing shall be at the Engineer's discretion as necessary to ensure proper air content. The testing apparatus shall be furnished by the Contractor, concrete supplier or testing laboratory at no cost to the Owner, and testing will be performed by the Contractor in the presence of the Engineer.

****END OF SECTION****

SECTION 03100

CONCRETE FORMWORK

PART 1-GENERAL

The work under this section consists of furnishing all labor, materials equipment and all other items necessary for the complete and approved installation of formwork required for concrete work including anchor bolt installation and shall be in agreement with General and Supplementary Conditions.

1.01 QUALITY ASSURANCE

- A. Materials and work shall conform to the requirements of standards, codes and recommended practices outlined in this section. In conflicts between industry standards, or required standards and this Specification or this Specification and the local code, the more stringent requirement shall govern.

- B. Source Quality Control. Materials and fabrication procedures are subject to inspection and tests at the source and in the field by the A/E and/or the Owner. Such inspection and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements. The Contractor shall promptly remove and replace materials or fabricated components which do not comply.

1.02 APPLICABLE PUBLICATIONS

The publications listed below form a part of this Specification to the extent referenced. The publications are referenced in the text by the basic designation only. All publications shall be the latest edition.

A. American Concrete Institute (ACI):

- 117 – Standard Tolerances for Concrete Construction and Materials.

- 301 – Specifications for Structural Concrete for Buildings.

- 302.1 – Guide for Concrete Floor and Slab Construction.

- 318 – Building Code Requirements for Structural Concrete.

- 347 – Recommended Practice for Concrete Formwork.

- SP-4 – Formwork for Concrete.

1.03 SUBMITTALS

- A. Make submittals in accordance with Division 1.
- B. The Contractor shall state in his bid the number of uses of lumber forms on which his bid is based.
- C. All formwork shop drawings and related computations shall be furnished the A/E for record purposes only. Shop drawings shall cover all formwork required. They shall show general arrangement of forms, sizes and grades of lumber, placement; construction and control joints and their method of forming; locations of inserts, tees,

sleeves, and other related items. Drawings or descriptions of shoring and reshoring methods proposed for floor and roof slabs, spandrel beams, and other horizontal concrete members shall also be furnished.

D. Provide data on waterstops.

1.04 SEQUENCING/SCHEDULING

The Contractor shall schedule delivery and erection of formwork to coincide with reinforcement and concrete placement to ensure continuous work.

PART 2-MATERIALS

2.01 FORMWORK

Formwork shall be designed for loads, lateral pressure and allowable stress in accordance with ACI 301, ACI 347 and ACI SP-4. Design, engineering and construction of the formwork shall be the responsibility of the Contractor.

- A. Form Materials. Forms shall be of wood, plywood or steel and shall be as recommended in ACI 347 and ACI SP-4. The form materials shall be appropriate for the intended finishes as specified in Section 03345 CONCRETE FINISHES.
- B. Permanent Forms. Permanent forms for elevated slabs shall be metal deck forms as specified in Section 05301 STEEL FLOOR OR FORM DECK.
- C. Form Ties. Form ties shall be designed so that the ends or end fasteners can be removed without causing appreciable spalling at the faces of the concrete. After the ends or end fasteners of form ties have been removed, the embedded portion of the ties shall terminate not less than 2 diameters or twice the minimum dimension of the tie from the formed surfaces of concrete to be permanently exposed to view; in no case shall this distance be less than $\frac{3}{4}$ inch. Form ties in structures exposed to hydrostatic pressures (shall have waterstops and the embedded portion of the ties shall terminate not less than 1-1/2 inches from the formed face) (will not be allowed).
- D. Chamfer Strips. Unless noted otherwise on the Drawings all exposed corners of beams, columns, walls, slabs, etc. shall have $\frac{3}{4}$ inch chamfers.
- E. Waterstops: Polyvinyl chloride, 6 inch wide, maximum possible lengths, dumbbell profile with center bubble, preformed corner sections, heat welded jointing.
- F. Accessories. Form accessories shall be of commercially manufactured types suitable for the formwork and the intended usage.
- G. Ornamental Concrete Forms.
- H. Anchor Bolts. Anchor bolts shall be ASTM A307 or A36 with cut threads.

PART 3-EXECUTION

3.01 PREPARATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.
- B. All surfaces of forms and embedded materials shall be cleaned of any accumulated mortar or grout from previous concreting.

- C. All items which are to be embedded in concrete and which must be built into formwork shall be located and readied for installation prior to placement of any concrete. Coordinate all items with the various trades.

3.02 INSTALLATION

- A. Construction and erection of formwork shall be in accordance with ACI 347, ACI SP-4 and as specified herein.
- B. All formwork, supports, braces, shoring, etc. shall be of sufficient strength to properly support the concrete, the construction loads, and any superimposed loads and to maintain the work in perfect alignment until the formwork can be safely removed. Forms shall be sufficiently tight to prevent loss of mortar from the concrete. Chamfer strips shall be placed in the corners of forms and on the edges of formed joints to produce beveled edges on permanently exposed surfaces. To maintain the specified tolerances, the formwork shall be cambered to compensate for anticipated deflections in the formwork prior to hardening of the concrete. Positive means of adjustment (wedges or jacks) of shoes and struts shall be provided and all settlement shall be taken up during concrete placing operation. Temporary openings shall be provided at the base of column forms and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed. At construction joints, contact surface of the form sheathing for flush surfaces exposed to view shall overlap the hardened concrete in the previous placement by not more than one inch. The forms shall be held against the hardened concrete to prevent offsets or loss of mortar at the construction joint and to maintain a true surface. All forms shall be clean and free of sawdust, dirt and debris before concrete placement.
- C. All items to be embedded in the concrete shall be properly located and braced to the formwork. Blockouts or openings necessary for future work shall be properly built into the formwork. Coordinate the location of embedded items and blockouts with other trades involved in the project.
- D. Install waterstops continuous without displacing reinforcement. Heat seal joints watertight.
- E. After cleaning forms and before placing either the reinforcement or the concrete, the surfaces of the forms shall be covered with a coating material that will effectively prevent absorption of moisture and prevent bond with the concrete, and will not stain the concrete surfaces. A field-applied form release agent or sealer or a factory-applied nonabsorptive liner may be used. Manufacturer's recommendations should be followed in the use of coatings, sealers, release agents, and liners, but independent investigation of their performance is recommended before use. Where surface treatments and finishes are to be applied to formed concrete surfaces, adhesion of such surface treatments and finishes shall not be impaired or prevented by use of the coating, sealer, release agent, or liner. Excess form coating material shall not be allowed to stand in puddles in the forms, nor shall such coating be allowed to come in contact with hardened concrete against which fresh concrete is to be placed, or with reinforcement.
- F. The Contractor shall set and maintain concrete forms to ensure that, after removal of the forms and prior to patching and finishing, no portion of the concrete work will exceed any of tolerances specified. Variations in floor levels shall be measured before removal of supporting shores. The Contractor shall be responsible for variations due to deflection, when the latter results from concrete quality or curing other than that which has been specified. The tolerances specified shall not be exceeded by any portion of any concrete surface; the specified tolerance for one element of the structure to exceed its allowable variations.

- G. Flush with water or use Compressed air to remove foreign matter from the formwork. Ensure that the water debris drain to exterior through clean-out ports.
- H. During cold weather, remove ice and snow from within forms. Do not use deicing salts or water to clean out forms, unless formwork and concrete construction proceed within heat enclosure. Use compressed air or other, means to remove foreign matter.
- I. Care shall be taken in the removal of forms so as not to damage the surface of the concrete. Care shall be taken to ensure the complete safety of the structure. In no case shall supporting forms or shoring be removed until members have acquired sufficient strength to support their weight and imposed loads of safety. Immediately after the forms are removed, all fins and honeycombs shall be removed and surfaces shall be pointed up to fill form tie holes and voids. The work shall be thoroughly inspected for damage or imperfections. Damaged or imperfect work shall be repaired to the satisfaction of the Specifications, Owner and A/E.

3.03 TOLERANCES

- A. Tolerance for the formal surfaces, footings, stairs, and embedded items shall be as specified in ACI 301, ACI, 318 and ACI 117. Elevated slabs shall be Class BX Surface Finish Tolerance as specified in ACI 302.1R.
- B. Anchor bolt placement shall be within 1/8 inch center to center of any two anchor bolts in a group, within ¼ inch center to center of adjacent groups, and ¼ inch within specified elevation.

3.04 FIELD QUALITY CONTROL

The formwork is subject to qualify assurance inspection by the Owner and/or the A/E prior to concrete placement. Such inspection shall not relieve the Contractor of the primary responsibility for field quality control. Inspections will be for strength, stability, plumbness, alignment, embedded items, blockouts/openings and cleanliness. The Contractor shall correct deficiencies in formwork which inspections have indicated to be not in compliance with requirements.

****END OF SECTION****

SECTION 03200

CONCRETE REINFORCEMENT

1. DESCRIPTION

- A. Work Included: Provide complete, in place, all steel required for reinforcement of cast-in-place concrete as shown on the Drawings.

2. SUBMITTALS

- A. Shop Drawings: Within 30 calendar days after award of the Contract, submit complete shop drawings of all material proposed to be furnished and installed under this Section.
1. Show schedules, stirrup spacing, diagrams of bent bars and arrangement and assemblies.
 2. Make Shop Drawings in accordance with ACI 315.
- B. Mill Certificates: Accompanying the Shop Drawings, submit steel producer's certificates of mill analysis, tensile, and bend tests for reinforcing steel.

3. PRODUCT HANDLING

- A. Delivery: Deliver reinforcement to the job site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.
- B. Storage: Store reinforcement above the surface of the ground upon wooden platforms or other supports in a manner which will prevent damage and accumulation of dirt and excessive rust. The surface of the ground beneath all stored reinforcement shall be covered with plastic sheeting to further assure isolation from dirt and dust.

4. MATERIALS

- A. Reinforcing bars: Comply with ASTM A 615, 60.
- B. Welded wire fabric: Comply with ASTM A 185.
- C. Supports for reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place:
1. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, and other unacceptable materials.
 2. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support legs.

3. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with either hot-dip galvanized or plastic protected legs.

5. FABRICATION

- A. General: Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with CRSI Manual. In case of fabricating errors, do not rebend or straighten reinforcement in a manner that will injure or weaken the material.
- B. Unacceptable Materials: Reinforcement with any of the following defects will not be permitted in the Work.
 1. Bar lengths, depths, and bends exceeding specified fabrication tolerances.
 2. Bend or kinks not indicated on Drawings or final Shop Drawings.
 3. Bars with reduced cross-section due to excessive rusting or other cause.

6. INSPECTION

Examine the foundation, formwork, and the conditions under which concrete reinforcement is to be placed, and correct conditions which would prevent proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

7. INSTALLATION

- A. General
 1. Comply with the specified standards for details and methods of reinforcement placement and supports, and as herein specified.
 2. Clean reinforcement to remove loose rust and mill scale, earth, and other materials which reduce or destroy bond with concrete.
 3. Position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers as required.
 4. Place reinforcement to obtain the minimum coverage for concrete protection. Arrange, space, and securely tie bars and bar supports together with 16 gage wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.
 5. Install welded wire fabrics in as long lengths as practicable. Lap adjoining pieces at least one full mesh.

6. Provide sufficient numbers of supports and of strength to carry reinforcements. Do not place reinforcing bars more than 2" beyond that last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
 - B. Splices: Provide standard reinforcement splices by lapping ends, placing bars in contact, and tightly wire tying. See splice schedule on Drawings. Bars marked continuous shall be lapped as required by splice schedule, and at corners, corner bars shall be provided.
8. BAR COVER

Reinforcing bars shall be fabricated, tied and supported to ensure a protective concrete cover as shown on structural drawings.

****END OF SECTION****

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1-GENERAL

1.01 WORK INCLUDED

- A. Concrete, placing of sleeves, pipes, and anchor bolts, finishing, curing, and all equipment and incidentals necessary to do all the concrete work as shown on the drawings or specified.

1.02 RELATED WORK

- A. Concrete Formwork is included in Section 03100.
- B. Concrete Reinforcement is included in Section 03200
- C. Grout is included in Section 03600.

1.03 SUBMITTALS

- A. Submit in accordance with Section 01300, complete shop drawings and product data including, but not necessarily limited to:
 - 1. Location of all proposed construction joints, keying, and water stops
 - 2. Location of all openings, depressions, construction and control joints, trenches, sleeves, inserts, and other items affecting the reinforcement and placing of concrete.
 - 3. Complete materials list of items proposed to be furnished and installed under this Section
 - 4. Complete information on cement source of supply, physical and chemical characteristics, transportation and intermediate terminating procedures for mill-to-site handling, and site storage procedures
 - 5. Complete information on aggregate procurement, processing, and storage
 - 6. Complete information on proposed batching and mixing equipment and procedures, including water chilling or other devices or systems to reduce mix temperatures
 - 7. Complete information on concrete handling equipment proposed to be used, including capacities, for chutes, pumps, tremies, buckets, and all other equipment
 - 8. Complete description of proposed curing materials and methods
 - 9. Complete mix designs
 - 10. Remolded joint filler
 - 11. Waterstops
 - 12. Wedge inserts
 - 13. Expansion bolts
 - 14. Anchor bolts
 - 15. Foundation bolts

16. Admixtures
17. Hardening and dust-proofing compounds
18. Form Ties
19. Any gang forming information

B. Test Reports

1. Fine aggregates – sieve analysis, physical properties, and deleterious substances
2. Coarse aggregates - sieve analysis, physical properties, and deleterious substances
3. Cements – chemical analysis and physical properties for each type.
4. Proposed concrete mixes – compressive strength, lump, shrinkage, and air content.

C. Certifications

1. Certify admixtures used in the same concrete mix are compatible with each other and the aggregates.

D. Do not begin concrete production until all products and mix designs have been reviewed by the engineer.

1.04 REFERENCE STANDARDS

A. Design, manufacturing and assembly of elements of the products herein specified shall be in accordance with the standards of the below listed organizations.

B. American Society for Testing and Materials (ASTM)

1. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
2. ASTM C33 - Standard Specification for Concrete Aggregate.
3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C42 - Standard Test Method for Obtaining and testing Drilled Cores and Sawed Beams of Concrete.
5. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
6. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
7. ASTM C150 - Standard Specification for Portland Cement.
8. ASTM C157 - Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
9. ASTM C171 - Standard Specification for Sheet materials for Curing Concrete.
10. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
11. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

12. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 13. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 14. ASTM C494 - Standard Specification for chemical Admixtures for Concrete.
 15. ASTM C596 - Standard Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement.
- C. American Concrete Institute (ACI)
1. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
 2. ACI 301 - Specifications for Structural Concrete for Buildings
 3. ACI 304R – Guide for Measuring, Mixing, Transporting and Placing Concrete.
 4. ACI 304.2R – Placing Concrete by Pumping.
 5. ACI 305R – Hot Weather Concreting
 6. ACI 306R - Cold Weather Concreting
 7. ACI 318 – Building Code Requirements for Structural Concrete.
- D. Where reference is made to a standard of one of the above, or other organizations, the version of the standard in effect at the time of bid opening shall apply.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Cement: Store in weathertight buildings, bins or silos to provide protection from dampness and contamination.
- B. Aggregate: Arrange and use stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregate. Build stockpiles in successive horizontal layers, not exceeding 3-ft. in thickness. Complete each layer before the next layer is started. Do not use frozen or partially frozen aggregate.
- C. Sand: . Arrange and use stockpiles to avoid contamination. Allow sand to drain to a uniform moisture content before using. Do not use frozen or partially frozen aggregates.
- D. Admixtures: Store in closed containers to avoid contamination, evaporation, or damage. Provide suitable agitating equipment to assure uniform dispersion of ingredients in admixture solutions that tend to separate. Protect liquid admixtures from freezing and other temperature changes that could adversely affect their characteristics.
- E. Sheet Curing Material: Store in weathertight buildings or off the ground under cover.
- F. Liquid Curing Compound: Store in closed containers.

PART 2 - PRODUCTS

2.01 CEMENT

- A. Unless otherwise specified or shown on the plans, concrete shall be made with the Portland cement conforming to ASTM Specification C-150, Type I. The lightest

colored Portland cement, competitively available shall be used, and the same brand of cement shall be used throughout the entire project.

- B. High early strength Portland cement shall conform to ASTM Standard Specification C150, Type III.

2.02 AGGREGATES

- A. General: All aggregates shall conform to requirements of ASTM C 33.

- B. Fine Aggregate

1. The fine aggregate shall consist of clean, hard, durable, uncoated particles of sand. It shall be free from dust mica, shale, alkali, organic matter, loam, soft or flaky particles.
2. Deleterious Substances - The fine aggregate shall contain not more than one percent (1%) by weight of clay lumps of more than three percent (3%) by weight of material removed by decantation.
3. Grading - Fine aggregate shall conform to the following requirements:

<u>Total Passing</u>	<u>Percent by Weight</u>
3/8-in. sieve	100
No. 4 sieve.....	95 - 100
No. 16 sieve.....	45 - 95
No. 50 sieve.....	10 - 30
No. 100 sieve.....	2 - 8

4. Tests - Fine aggregate shall be subjected to the Colorimetric test for organic impurities and if it produces a color darker than the standard, it shall be rejected. It shall conform in all other respects to ASTM Designation C 33.

- C. Coarse Aggregate

1. Composition and Quality - Coarse aggregate shall be washed gravel or crushed stone and shall consist of hard, tough, uncoated, durable particles. It shall contain no vegetable matter or soft, flaky, thin, or elongated particles. Deleterious substances shall not exceed the following amounts:

- a. Soft fragments 0.20%
- b. Coal and lignite 0.25%
- c. Clay lumps..... 0.25%
- d. Material passing No. 200 Sieve 1.50%
- e. Thin or elongated pieces (length greater than 5 times the average thickness) 10 %

- D. Grading - Coarse aggregate shall be well graded between the limits specified below:

<u>Total Passing</u>	<u>Percent by Weight</u>
2-in. Sieve.....	100
1-1/2-in. Sieve	90 - 100
1-in. Sieve.....	55 - 80

¾-in. Sieve.....	35 - 70
½-in. Sieve.....	20 - 45
3/8-in. Sieve.....	10 - 30
No. 4 Sieve	0 - 15
No. 16 Sieve	0 - 1

2.03 WATER

- A. The water used in mixing concrete shall be fresh, clean, potable and free from oil, acid, alkali, organic matter, and deleterious amounts of chloride ion.

2.04 CONCRETE ADMIXTURES

- A. Admixtures shall conform to ASTM C 494; Type F for high range water reducing and Type G for high range water-reducing/set-retarding. Air entraining agents shall conform to ASTM C 260. When more than one admixture is used the two products shall be compatible and have a single manufacturer.
- B. All Class "A" Concrete shall contain a (Daracem - 100 or an alternate approved by the Engineer) high range water-reducing agent. The dosage of the high range water reducing agent shall be at least 8 oz./100 lbs. of cement, but shall not produce a plasticized slump greater than 8-in. The high range water reducing agent shall be added at the site prior to concrete placement.
- C. Admixtures, if not specified, may be used only upon written approval of the Engineer and shall be used only as recommended by the manufacturer. Admixtures shall, when added to the mixture, produce a concrete of specified strength in both 7 and 28 day tests. Documentary evidence of acceptability will be required when new or unknown admixtures are proposed for usage.
- D. Admixtures shall be Grace Construction Products or an alternate approved by the Engineer.

2.05 MIXES

- A. The following classes of concrete are included in these specifications and shall be used where specified herein or called for on the plans:
- B. Class A Concrete
 - 1. Cement content -Minimum number of sacks (94 lb. ea) per cubic yard: 6
 - 2. Maximum water/cement ratio (gal. of water per sack cement): 5.1
 - 3. Entrained air: 3-6%
 - 4. Minimum Superplasticizer (8 oz. per 100 lbs. of cement): 45 oz.
 - 5. Minimum 7 day compressive strength: 2,400 psi
 - 6. Minimum 28 day compressive strength: 4,000 psi
- C. Class B Concrete
 - 1. Cement content -Minimum number of sacks (94 lb. ea) per cubic yard: 5

2. Maximum water/cement ratio (gal. of water per sack cement): 6.5
 3. Entrained air: 3-6%
 4. Minimum Superplasticizer (8 oz. per 100 lbs. of cement): 0 oz
 5. Minimum 7 day compressive strength: 1,400 psi
 6. Minimum 28 day compressive strength: 2,500 psi
- D. In the absence of contrary designation, concrete used for all construction shall be Class "A".

PART 3 - EXECUTION

3.01 PREPARATION

- A. Before the placing of any concrete, the footing trenches shall be drained of water and mud film removed and any loose dirt lifted out. Any flow of water shall be diverted by side drains to a sump, or removed by other approved methods, while the concrete is being placed.
- B. Before placing concrete in any forms, the forms shall be cleaned, and all debris shall be removed. All reinforcing shall be checked to be sure that the reinforcing is not touching the form or pan sides.
- C. Before placing any concrete, it shall be determined that all work that is to be built into the concrete work is located and installed. All such items shall be placed so as not to interfere with the reinforcing steel.
- D. Wood board forms shall be soaked with water just before the concrete is poured.
- E. Special measures shall be taken in both severe cold and hot weather and shall be in accordance with ACI Recommended Practice.
- F. Before placing any new concrete on or against concrete that has set, the existing surfaces shall be thoroughly roughened and cleaned of all foreign matter and "Laitance." Forms shall be retightened and the existing surfaces slushed with a coat of grout. The new concrete shall be placed immediately after grouting, and the work shall be performed in such manner as to insure complete bonding of newly poured concrete to the existing work.
- G. Grout for construction joints shall consist of a mixture of neat cement and water, and shall be applied to the old concrete surface immediately before the new concrete is poured. Grout for setting column bases, wall plates, and beams shall be composed of one part Portland cement two parts sand, and sufficient water to produce the consistency required.
- H. Where excavations exceeding a depth of five feet are prescribed to be made to install the foundations or any part of the structure of this building, or any retaining walls on the site, the back slope of such excavation shall be at an incline not exceeding one vertical to one and one-half horizontal unless such back slope is sheeted and braced. If sheeting and bracing is to be provided, such sheeting and bracing shall be designed by an Engineer registered in the state of Georgia. Design shall provide for such pressures presented in the latest edition of the CRSI Design Handbook, unless a registered soils engineer determines more specific pressures. The cost of such design work shall be paid for by the Contractor.

3.02 MIXING AND DELIVERY

- A. Machine Mixing: All mixing of concrete shall be done in a batch mixer, of approved design, which will insure a uniform distribution of the material throughout the mass, so that the mixture is uniform in color and homogenous. The entire content of the mixer drum shall be discharged before recharging. All material to be mixed per batch shall not exceed the manufacturers' rated capacity of the mixer.
- B. Time of Mixing: The mixing of each batch shall continue not less than one and one-half (1-1/2) minutes after all the materials, including water, are in the mixer, during which time the mixer shall rotate at a peripheral speed of about two hundred (200) feet per minute.
- C. Mixing at Central Plant: Concrete mixed in a central plant, shall be conveyed to the work in approved mixer trucks that mix the concrete in route to the work. Plant layout and equipment shall meet the approval of the Engineer. Loading tickets shall be initialed and the time of loading stamped thereon. The loading tickets shall be handed to the Engineer on the work before the load is placed, and no concrete will be accepted which has been in the mixer truck more than one and one-half (1-1/2) hours after the water has been added. In all other respects, ready mixed concrete shall conform to ASTM Specification C 94.
- D. Waste concrete shall be deposited and mix trucks washed out only in areas designated by the owner or the engineer.

3.03 SLUMP

- A. The maximum slump allowed for the various types of construction are as follows:

<u>Type of Construction</u>	<u>Maximum Slump</u>
Reinforced Foundation Walls & Footings	4-in.
Slabs, Beams, Reinforced Walls & Columns.....	4-in.
Heavy Mass Construction	2-in.
All Concrete Plasticized by Admixtures	8-in.

- B. Slump tests shall be made at the discretion of the Engineer, and concrete having greater slump than specified shall not be incorporated into the work. The Contractor shall furnish slump test cones conforming to the provisions of ASTM C 143.

3.04 PLACING CONCRETE

- A. All concrete shall be placed in daylight, and any portion of the concrete work started shall be started so that it can be completed in daylight. No concrete shall be placed until the foundation, forms, false-work, and the placing of the steel have been approved by the Engineer. Approval by the Engineer does not relieve the Contractor of his obligation to produce finished concrete as required.
- B. The concrete shall be placed in such a manner as to avoid the possibility of segregation of the aggregates, or the displacement of the reinforcement steel. The concrete shall be placed as near its final resting place as possible. If pipes, troughs, or chutes are used in placing the concrete, they shall be arranged and used so the concrete is not separated, and shall be kept clean and free of hardened concrete at all times. Troughs and chutes shall be either made of metal or shall be metal lined, and shall extend as nearly as

possible to the point of deposit.

1. In walls and columns, the concrete shall not be dropped more than five (5) feet without the use of a tremie. Concrete shall be placed in continuous horizontal layers, approximately 10-in. to 12-in thick, and the batches shall follow each other so closely that each one is placed and compacted before the preceding one has taken an initial set. Succeeding layers shall be placed before the underlying layer has become set, and shall be compacted in a manner that will entirely break up and obliterate the tendency to produce a construction joint between layers.
 2. Concrete in beams, girders, columns and walls shall be well spaded at the form surface and all concrete shall be compacted by an approved mechanical type vibrator having a frequency of not less than 7,000 vibrations per minute. The Contractor shall provide the necessary number of vibrators to properly execute the work, and shall have on the job at all times necessary spare vibrators to be used in case of mechanical failure. Construction joints shall be made only at the location as shown on the plans, except by approval of the Engineer.
- C. In making construction joints, the previous work shall be cleaned of all "laitance", and other objectionable material, and shall be brushed with a thin mixture of Portland cement and water immediately before the new concrete is placed.
- D. The operation of placing and compacting the concrete shall be conducted so as to form a compact, dense, impervious artificial stone of uniform texture, with smooth faces on exposed surfaces. Any section of concrete that is porous, or has been plastered, or is otherwise defective, shall be removed and replaced, in whole or in part, entirely at the contractor's expense, as directed by the Engineer.
- E. Depositing Concrete Under Water: Concrete shall not be exposed to the action of water before setting, or deposited in the water, except upon the approval of the Engineer, and under his supervision.
- F. Cold Weather Placing
1. Comply with ACI 306 to protect all concrete work from physical damage and reduced strength that would be caused by frost, freezing actions, or low temperatures. No concrete shall be placed when the atmosphere temperature is below 40° F.
 2. If the temperature drops below 40° F after the concrete has been placed, the Contractor shall provide adequate means for maintaining concrete temperature of not less than 45° F for a period of five (5) days after the concrete is placed. The contractor shall assume all risk connected with placing concrete in cold weather, and any unsatisfactory work will be rejected. Recording thermometers shall be supplied by the contractor as required by the Engineer.
- G. Hot Weather Placing: When hot weather conditions exist which would seriously impair the quality and strength of concrete, place the concrete as follows:
1. Maintain concrete temperature at time of placement below 90° F. Use chilled mixing water or chopped ice to control concrete temperature, provided the water equivalent of the ice is calculated to the total amount of water.
 2. Cover reinforcing steel with water soaked burlap if the steel becomes too hot. Steel temperature shall not exceed the ambient air temperature immediately prior to placement of concrete.
 3. Wet forms thoroughly prior to placement of concrete.

4. Use set control admixtures in the mix.

3.05 PROTECTION AND CORRECTIVE WORK

- A. Workmen shall not walk on concrete during placing or finishing with any earth or foreign matter footwear.
- B. All freshly placed concrete shall be protected from damage or injury due to water, falling objects, persons or anything that might mar or injure the finish surface of the concrete. Any surfaces that are damaged shall be removed and replaced with fresh concrete at the expense of the Contractor.
- C. Care shall be taken in the removal of the forms not to damage the surface of the concrete. Immediately after the forms are removed, all damaged or imperfect work shall be patched. If in the opinion of the Engineer, the patching does not restore the work to the quality specified, the Contractor shall remove and rebuild the work at his expense.
- D. Where plans call for walls to be shored before backfill is made against them, the walls are to be shored to resist the active pressure of the earth as tabulated in the latest edition of the CRSI Design Handbook. Such shoring is to remain in place until the wall is "tied in" to the floor slab on ground. Such walls are not to be construed as "free standing".
- E. Where concrete or concrete work does not conform to these specifications and where patching is not approved by the Engineer or low strength concrete is not permitted to remain in place, procedures and plans covering all work to be rebuilt shall be submitted by the Contractor to the Engineer before removal and rebuilding is begun. The cost of such plans, as well as the cost of removal and rebuilding shall be at the Contractor's expense.

3.06 FINISHING

- A. Floors, including slabs on ground, shall be finished as follows:
 1. The surfaces of all concrete shall be worked with a wood float in a manner that will compact the concrete and produce a surface free of depressions or inequalities of any kind. Test for grade (of level) and correct by removing excess or adding and compacting additional concrete.
 2. All interior floor slabs shall receive steel trowel finish as follows:
 - a. After screeding, slab shall be wood floated to a smooth, plane surface.
 - b. When concrete has hardened, to prevent excess fines from working to surface, steel trowel to a smooth surface free from defects. A second steel troweling shall be done producing a plane, hard, dense, finished surface.
 - c. Interior slabs shall also receive a hardening and dust proofing treatment of a colorless aqueous solution of zinc or magnesium fluosilicate applied in strict accordance with manufacturer's recommendations.
 - d. Troweling shall not begin until all surface water has disappeared. The drying of the surface moisture before troweling must proceed naturally and must not be hastened by sacking or dusting on of dry sand and

cement.

3. After exterior floors, platforms and steps are struck off smooth with a wood float and received a trowel finish, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use a fiber bristle broom.
4. Exposed concrete surfaces shall be finished as follows:
 - a. The exterior surfaces of all concrete shall be thoroughly worked during the placing operation, by the use of a concrete spade of approved type. The working shall force all coarse aggregate from the faces, and work mortar against the forms to produce a smooth finish, free from water and air pockets, or honeycomb.
 - b. After the concrete has set sufficiently to permit, the forms shall be carefully removed and all depressions resulting from removal of the metal spacers, and all other holes and rough places, shall be carefully pointed with a mortar composed of one part cement and two parts sand.
 - c. The surface film of all such pointed surfaces shall be carefully removed before setting occurs. The cement in the mortar used for pointing and filling holes shall be of the same brand as the cement incorporated in the concrete work.
 - d. Surface shall be rubbed smooth with carborundum brick or other abrasive within 36 hours after forms are removed. Surfaces shall be wetted and rubbed until a uniform color and texture is produced. No cement grout or slush shall be used other than the cement paste drawn from the green concrete itself by the rubbing process.
5. Exposed interior and exterior concrete walls and ceilings shall also receive an additional finish of thoro coat products as described in Section 09902. Finish 2 feet below finish grade and 3 feet below low water mark on basins.

B. Unless otherwise directed the following schedule shall be used for concrete finishing:

1. Sidewalks Rough (Broomed)
2. Exposed Exterior Walls..... Medium (Rubbed)
3. Interior Structure Walls..... Fine (Rubbed)
4. Additional Wall Finish..... ThoroCoat per manufacturer's recommendations
5. Slabs - Interior Smooth (Troweled)
6. Slabs - Exterior Medium (Fine broomed)

C. Coordinate the required finish with the Engineer prior to application.

3.07 CURING

A. Curing Materials

1. Liquid curing and sealing compounds shall conform to ASTM C 309, Type 1.
2. Sheet materials shall conform to ASTM C 171.
3. Burlap cloth made from jute or kenaf and weighing approximately 9 oz. per sq yd for moist curing shall conform to AASHTO M 182 and shall use two layers.

4. Compounds shall be a combination sealer-hardener and dust-proofer.

B. Procedure

1. Freshly placed concrete shall be protected from wash caused by rain and flowing water.
2. Concrete shall not be allowed to dry out from the time it is placed until seven (7) days thereafter.
3. Curing shall be accomplished by the use of an approved membrane compound to seal the water in the concrete except for surfaces that are to receive future concrete, or mortar.
4. The membrane shall be of a type that will retain ninety-seven percent (97%) of the moisture at a temperature of 135° F, with a relative humidity of thirty percent (30%) in the first twenty four (24) hours. It shall be applied in accordance with the manufacturer's recommendations and in sufficient thickness to effectively hold the water in the concrete, and must have a record of successful use for at least two years.

3.08 JOINTS

A. Construction Joints:

1. Construction joints will not be permitted except as may be shown on the Drawings and on the Contractor's approved placement schedule.
2. If construction joints necessary for the progress of the Work are not shown on the Drawings, show them in complete detail on the Shop Drawings.
3. Provide keyways at least 1-1/2-in. deep in all construction joints in walls, slabs, and between footings and walls as shown on the plans.

B. Isolation joints in slabs on grade:

1. Provide isolation joints in slabs on grade at points of contact between slabs on grade and vertical surfaces where indicated.

C. Control joints in slabs on grade (non watertight):

1. Control joints for non watertight slabs on ground shall be 24 gauge, galvanized, preshaped, keyed type. Joints shall be 1/2-in. less in depth than the slab. Joints shall be held in place with 1-in. x 1/8-in. ribbed stakes at 2-ft.-0-in. on center on the female side. The male side of the joint shall be greased or sprayed with a bond breaker.
2. Approved joints shall be as follows: Burke Concrete Accessories, Inc., Jahn Concrete Forming Products, or Keyhold, Inc.

3.09 WATER TIGHTNESS

- A. All structures for holding or carrying water, or pits below grade shall be watertight.
- B. Where the order of work requires "cold" joints (slab/wall intersections etc.), an approved, rigid waterstop shall be secured to the form work and remain imbedded in the concrete to form a watertight joint with the adjacent pour.
- C. Waterstop shall be expandable center bulb type 6 in. wide x 1/4-in. thick minimum unless otherwise specifically shown on the Plans.

3.10 TESTING OF CONCRETE

- A. Testing of concrete will be done under the direction of a laboratory approved by the Engineer. Tests to be paid for by the Contractor.
- B. Samples for strength tests will be taken not less than one per day nor less than once per one hundred (100) cubic yards or more, and on less yardage when required by the Engineer. The tests shall be made in accordance with the procedure set forth in ASTM C 172 for Standard Method of Making and Storing Compression Test Specimens of Concrete in the Field, and C 39 for Standard Methods of Test for Compressive Strength Concrete. Tests shall be made by a recognized laboratory approved by the Engineer.
- C. Three certified copies of test results shall be furnished to the Engineer with each test. Each test shall consist of at least four specimens, two for field control and two for laboratory control. Each set of four cylinders shall have a numerical designation and each cylinder an alphabetical sub-designation. Thus the first set of four cylinders shall be numbered 1A, 1B, 1C, and 1D.
- D. If the evaluation of the compressive test indicates the concrete has failed to meet the specified strength, core tests shall be made of the in-place concrete. The location and number of such tests to be at the Engineers direction. Tests shall be paid for by the Contractor.
- E. If the core tests fail to verify the strength specified, the Engineer shall effect one of the following procedures:
 - 1. Have the Contractor remove and reconstruct that portion of the structure found to be defective.
 - 2. Accept the concrete in place and issue a change order as set forth in the General Conditions of these specifications.
- F. Tests to determine the entrained air content will be made at the job site. Frequency of testing shall be at the Engineer's discretion as necessary to ensure proper air content. The testing apparatus shall be furnished by the Contractor, concrete supplier or testing laboratory at no cost to the Owner, and testing will be performed by the Contractor in the presence of the Engineer.

****END OF SECTION****

SECTION 03410

PRE-CAST-PRESTRESSED CONCRETE

PART 1 – GENERAL

1.01 SCOPE

This section covers the design, materials, fabrication, erection, and related operations involved in providing all precast-prestressed concrete products shown on the plans and specified herein.

1.02 REFERENCE STANDARDS

All work hereinafter shall comply with applicable portions of the latest editions of the following:

- A. American Concrete Institute (ACI) Publications.
- B. American Society for Testing and Materials (ASTM) Publications.
- C. American Welding Society (AWS) Publications.
- D. Prestressed Concrete Institute (PCI) Publications.

1.03 QUALITY ASSURANCE

A. Acceptable Manufacturers and Erectors: Shall have had a minimum of 5 years experience in precast structural concrete work of the quality and scope required on this project. The producer shall have an established quality assurance program in effective operation at his plant attested to be a current enrollment of the plant in the PCI "Certification Program for Quality Control" or a Quality Control Program acceptable to the Engineer.

B. Design

Structural members have been indicated on the drawings by general size and depth. The structural analysis and design of these items as well as lifting devices for all prestressed concrete members shall be performed by the manufacturer of the prestressed materials and subject to approval of Engineer.

Design shall be in accordance with ACI 318, latest edition, and under the supervision of a Professional Engineer registered in the state where the project is located.

Superimposed Design Loads shall be in accordance with applicable Building Code Requirements and as shown on the drawings. Dead loads shall be calculated by the design engineer and included in the design as necessary.

Camber shall be uniform. Differential camber between slabs shall not exceed 1/8" per 10'-0" of length with a total maximum of 1/2". Maximum deflections, under design loads, shall not exceed L/360 of the span or the design camber plus 1/4"

whichever is greater, unless otherwise determined and approved by the Engineer. (L is clear span in inches.)

Where the end of a prestressed unit is exposed to weathering, the strands shall be cut off 1" from the end of the unit and the hole grouted flush with waterproof mastic grout. Where not exposed to weather, the strands shall be cut off flush with end of unit.

Before shipment, all concrete members shall be inspected to determine that materials and workmanship conform to the requirements of these specifications.

An acceptable finish for formed surfaces NOT EXPOSED TO VIEW will be smooth, with scattered small surface holes created by entrapped air bubbles and normal form joint marks. Minor chips and spalls occurring at the joints in chamfer strips will be permitted.

C. Allowable Tolerances

Dimensions and cambers shall be within the tolerances as described in PCI MNL-116, Division V, Section 5.

Deflection: Deflection under design live load shall not exceed calculated deflection by more than 10 percent.

Deflection Recovery: Deflection under one and one-half times the live load (applied without shock and in a manner calculated to avoid arching action) shall be measured. Upon removal of load, at least 80 percent of the measured deflection shall be recovered.

Bearing for precast members shall be as calculated for the design loads without local overstressing of the members.

D. Sampling and Testing

1. General

Samples and tests required below and other tests are to be made by and at the Contractor's expense. The tests shall be performed by an independent commercial testing laboratory or by the manufacturer's lab, subject to approval by the engineer. Compressive strength tests for initial prestress may be performed in the manufacturer's plant laboratory. Certified copies of test reports shall be furnished as required in this Specification, and shall include all test data results.

2. Concrete Testing

During the progress of the work, plastic concrete, as delivered to the casting site, shall be sampled and tested for slump, air content and compressive strength in accordance with ACI 381, Part 2, Chapter 3, and Part 3, Chapter 4. No fewer than 6 cylinders shall be made during each concreting cycle. Not more than 1 test in 10 shall fall below the specified strength.

3. Slump Tests

Slump tests shall be in accordance with ASTM C 143.

4. Failure to Meet Strength Requirements

If compressive strength tests fail to meet the above requirements, the Engineer may require load tests to be made in accordance with ACI 318. Units failing to meet requirements of the load tests shall not be used. Load tests shall be performed at the expense of the Contractor.

1.04 SUBMITTALS

A. Shop Drawings

Furnish complete details of design, manufacture, fabrication, installation and erection in accordance with the contract conditions. Location of all inserts and openings shall be shown.

B. Design computations shall be submitted with shop drawings for approval prior to manufacture of any units and shall bear the seal of the Professional Engineer registered in the state of Georgia who performed or approved the design. All design loads shall be clearly shown.

C. All Prestressed concrete units shall be properly identified by a specific mark, to appear both on the shop drawings and on the manufactured units. These identifying marks are to be clearly visible to facilitate proper erection and installation.

D. All connections, bearings, and anchorage details shall be shown on the shop drawings. The Prestressed concrete manufacturer, subject to approval of Engineer will be permitted to modify any details shown on the drawings provided such modifications will be equally or more efficient, and more consistent with the latest recommended practices of the Prestressed Concrete Institute, and at no additional cost to the Owner. All cast-in connection components shall be designed with positive anchorage, which shall be accomplished by having the anchors attached to or around reinforcing steel wherever possible.

E. Design loads, used in design of the prestressed concrete section, shall be indicated on the shop drawings.

F. Samples

No less than 3 sample members for each finish specified, 12 inches by 12 inches, shall be submitted to the Engineer for approval of color and surface texture prior to commencement of manufacture. Production of units shall not proceed until the large sample unit has been approved.

G. Certificates of Conformance

Before delivery of materials and equipment, 4 notarized certificates attesting that materials and equipment meet the requirements specified shall be submitted to the engineer for approval.

H. Certified Test Reports

Before delivery of materials and equipment, 4 certified copies of the reports of all tests (required in referenced publications or) specified herein shall be submitted to the Engineer for approval. Testing shall have been performed in an independent laboratory suitable for performance of the tests and acceptable to the Engineer. The tests shall have been performed within 1 year of submittal of reports for approval. Tests reports shall be accompanied by notarized certificates from the manufacturer certifying that the tested material and equipment is of the same type, quality, manufacture, and make as that proposed to be supplied.

I. Weldability

If it is intended to weld mild reinforcing steel, the Contractor shall submit to the Engineer for approval certified laboratory test reports from an independent testing laboratory indicating the Weldability of the reinforcing steel before its incorporation into the members.

J. Prestressing Steel

Certified laboratory test reports from an independent testing laboratory of the ultimate strength and typical stress-strain curves shall be submitted to the Engineer for approval.

K. Contractor-Furnished Mix Design

The required concrete mix design for each type of concrete shall be prepared by an independent testing laboratory and shall be submitted to the Engineer for approval.

L. Curing Method

Prior to the manufacture of units, the method of curing and details of curing shall be submitted to the Engineer for approval.

1.05 DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage

Precast Prestressed members shall be inspected upon delivery to the erection site and stored in a manner that will prevent staining and damage.

Substantially damaged, cracked, or broken units, which are deemed unsuitable for the intended use of the member, shall be rejected and removed from the site.

The Engineer's decision will be final in determining unsuitable units.

B. Handling

Prestressed concrete members shall be lifted and supported during transportation only at the lifting and/or support points shown on the Shop Drawings. Only lifting devices embedded in these sections by the manufacturer shall be used, unless specific authorization to use other lifting points is received from the manufacturer.

Proper equipment shall be used to transport the prestressed concrete sections to the job site. Trucks and trailers with sufficient capacity to handle the heaviest sections specified, without overloading the access routes, must be used. Units damaged due to cracking or twisting will be rejected whether damaged on site, enroute or at the plant.

Proper access on the job site shall be provided by the contractor to permit transportation units to proceed under their own power to a location accessible to erection units.

All columns shall be delivered to job site wrapped with a suitable cover for protection from staining and shipping.

Columns shall be straight, free of chips or spalls suitable for exposed architectural use in the finished structure where exposed. Mildew, mold or algae stains shall be removed by suitable wash after the erection is completed.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portland Cement

ASTM C 150, Type I. All cement used shall be obtained from a single mill. Type III cement may be used when approved at no increase in cost to the Owner. Use regular cement as necessary to meet color requirements. When precast units are required to match finish of cast-in-place concrete, the cement shall be of the same type, brand name, and source as that used in the cast-in-place work.

B. Aggregates

Concrete Aggregates: ASTM C 33.

Lightweight Concrete Aggregates: ASTM C 330.

Fine: Regular Sand

C. Concrete Aggregates

Shall be clean, hard, strong, and durable inert material free from injurious deleterious material.

D. Water used in mixing concrete shall be clean and free from deleterious amounts of acids, alkalis or organic materials.

- E. The finish for all exposed surfaces shall be architectural Standard Finish as specified in the part entitled Finishing of this specification section.
- F. Admixtures, including air entraining (if used); ASTM C 260 (air entraining); ASTM C 494 (chemical). All admixtures shall have prior approval of the Engineer, shall be from one source, and shall be certified by the manufacturer to be free of chlorides. All admixtures shall be added at the mixer.
- G. Reinforcing

Precast units shall be reinforced as indicated on Drawings or as required for structural stresses, temperature changes and handling.

- 1. Steel Reinforcement: ASTM A 615, ASTM A 616, ASTM A 617, Grade 60.
- 2. Welded Wire Fabric Reinforcement: ASTM A 185.
- 3. Prestressing Steel
 - a. High Tensile Stress-Relieved Wire Standard: ASTM A 416 (nominal 250 ksi or 270 ksi); or be manufactured in accordance with this specification if provided in a larger size and/or higher strength. The wire shall be free of substances that would prevent bond to the concrete.
 - b. High Tensile Stress-Relieved Wire: ASTM A 421.

H. Forms

Forms shall be so designed and aligned that they will not restrict the longitudinal movement of the section when the Prestressing force is transferred.

Forms are preferable of permanent type, such as steel. Concrete forms or wood forms of a quality to produce a smooth finished product may also be used, when approved by the Engineer.

- I. Form oil, or parting compound, shall not impair future coating of the concrete surfaces.

J. Miscellaneous Connections

All anchors, dowels, bolts steel welding inserts, and connecting plates indicated and/or necessary in connection with the fabrication and erection of precast concrete members shall be provided. They shall be positioned and shall be held in position rigidly to prevent displacement while concrete is being placed. On-site and off-site welding shall be in accordance with AWS D1.1 and AWS D12.1, as applicable.

2.02 PRECAST TRIM

Precast concrete sills, coping, trim and lintels shall be provided as shown on the drawings. All exterior sills, coping and trim shall be constructed of white Portland cement and light granite aggregate. Interior lintels shall be constructed of gray Portland cement and marble aggregates. Lintels in concrete block walls shall have exposed

surfaces matching block surface and texture. All exposed surfaces shall be ground and treated with a water repellent material.

2.03 BEARING PADS OR PLATES

Steel bearing plates and neoprene rubber pads (or pads of other specified material) of required size and design shall be furnished at each support point as shown on drawings. All steel used in bearing plates, embedded plates, etc. shall comply with ASTM A 36, unless noted otherwise. Special protective coating for metal must be provided, i.e. galvanized, primed, plated, etc. as approved by the engineer for use in continuous moist atmospheric surroundings.

2.04 SPECIFIED CAST-IN INSERTS

Inserts or cast-in attachments as required by other trades shall be purchased and furnished to manufacturer by trades involved and supplied to meet production.

2.05 EMBEDDED WELD PLATES, SCREW INSERTS, BOLTS AND OTHER CONNECTIONS

All embedded connections, when required on the plans, will be cast into the prestressed concrete sections by the prestressed concrete manufacturer. Such inserts shall be located on the approved shop drawings and be verified by the General Contractor or by the appropriate subcontractor. Where there is a possibility of exposure to high humidity or exterior atmosphere, all inserts or accessories shall be galvanized.

2.06 FIELD PLACED INSERTS

Inserts such as hand drilled, power drilled, or power driven inserts and stubs, may be placed in Prestressed concrete sections by trade involved, where required, provided installation of these inserts does not interfere with the Prestressing steel. Location shall adhere to same tolerances as listed for powder-activated fasteners.

2.07 PRECAST PARKING BUMPERS

Provide one (1) precast concrete parking bumper for each new parking space as detailed on the drawings.

2.08 MIXES

A. Mixing Procedures: same as for cast-in-place concrete.

B. Concrete Properties

Water-cement ratio: maximum 40 pounds of water to 100 pounds of cement.

Air-entrainment: 5% +/- 1%.

Strength: minimum of 5000-psi compressive strength at 28 days.

Do not use calcium chloride or other salts.

C. Contractor-Furnished Mix Design

A concrete mix design shall be prepared for each type of concrete used in the work. The design shall be prepared in accordance with ACI 318. The concrete may be proportioned from additional data derived from ACI 211.1 and ACI 214, and from ACI 211.2 for lightweight concrete for an assumed coefficient of variation of 15 percent and a probability of 1 test in 10 falling below the specified strength, f_c' , provided that mix designs reflect actual concrete plant standard deviations and the resulting production concrete conforms to the specified requirements. The mix-design shall be based on current materials previously evaluated by the concrete producer whose established methods of statistical quality control is in conformance with ACI 318. In the absence of such data, the Contractor shall sample and test the concrete for the design of concrete in accordance with ACI 318 Part 3, Chapter 4. Concrete shall have a 5000 pounds per square inch (psi) compressive strength, f_c' at 28 days, with graded aggregates. Air-entrained concrete may be approved, provided the air-entraining agent is added to the mixer to produce 5 percent of air by volume, plus or minus 1 percent.

2.09 FABRICATION

A. Forms

Forms shall be well braced and stiffened against deformation, shall be accurately constructed, shall be water-tight, and for precasting operations, shall be supported on unyielding casting beds. The forms shall be such as to produce a smooth dense surface. A bond-breaking substance may be applied to the forms before pretensioning steel is placed; if so, the form surfaces shall be covered with paper, plastic, or other suitable material if required, to prevent contamination of the strands while they are placed. Exposed edges of columns, girders, and struts shall be chamfered. Form ties shall be either the threaded or snap-off type, so that no form wires or metal pieces will be left within 1-½ inches of the surfaces.

B. Tolerances

Member dimensions and camber shall be within the tolerances described in PCI MNL-116, Division V, Section 5.

C. Placing of Reinforcement

Steel reinforcement shall be fabricated as shown and placed in position in the forms within the tolerances specified in ACI 318. Reinforcement shall be adequately secured so as to remain in the proper position during placement of the concrete. Where reinforcement is comprised of wire fabric and reinforcing bars, it shall be preassembled by a template or jig before placing in the forms. Bars that are to be used as connection bars between precast and cast-in-place construction shall have the extension exposed. Mortar from precasting operations adhering to protruding bars shall be removed.

Prestressing strands shall be installed along the lines shown. Curvature of drape of the strands shall be established and maintained by means of approved hold-down devices.

Splicing of steel connections and of non-prestressed reinforcement at connection of member shall be in accordance with ACI 318. Wire fabric and bars shall be held in proper position until the welding is completed. Welding of Prestressing steel is not permitted.

D. Inserts

All inserts shall be firmly positioned so as not to become displaced during the placing of concrete. Anchor bolts and bearing plates shall be located with special accuracy. Built-in fixtures shall be placed where they do not affect the position of the main reinforcement of the placing of concrete.

E. Placement of Concrete

Concrete shall not be deposited in the forms until the reinforcement, anchorages, and forms have been inspected and approved. Conveying concrete to the casting site shall be done as rapidly as practicable. The method of conveying the concrete shall not use a greater slump than that required for placing. Depositing a large quantity at any point and running it or working it along the forms shall not be permitted. Special care shall be taken to fill all parts of the forms, to work the coarse aggregate back from the face, and to force the concrete under and around the Prestressing strands and reinforcing bars without displacing them.

F. Consolidation of Concrete

All concrete shall be consolidated in the forms in accordance with ACI 309. For external form vibration, forms must be of design adequate to prevent distortion or failure.

G. Use accurate molds designed to withstand high frequency vibration. Vibration shall be continuous during casting process until the full thickness is reached.

H. Curing

Curing shall be accomplished in accordance with PCI MNL-116, Division II, Section 4. The casting bed for concrete members cured by steam shall be enclosed completely with a suitable enclosure to minimize moisturized heat losses. Curing methods shall be maintained until the specified strength for detensioning has been reached. Precast units shall have an absorption of not more than 5% by weight after immersion in water for 48 hours, in accordance with ASTM C-97.

I. Prestressing

1. General

Anchorage for tensioning the Prestressing steel shall be of an approved type. The tension to which the steel is to be prestressed shall be measured by elongation of the steel and verified by the jack pressure reading on a calibrated gauge of approved type. Means shall be provided for measuring elongation of the steel to at least the nearest 1/8-inch. When the gauge reading and elongation

measurement disagree by more than 5 percent, the cause of the discrepancy shall be found and corrected.

Strands for precast-prestressed members shall be given an initial stress equal to 1 percent of the design load after which alignment shall be checked for conformity to the drawings. The total Prestressing force shall then be applied gradually in accordance with the approved Prestressing sequence.

2. Detensioning

Transfer to prestress shall not be made until the concrete strength has reached 3500 psi. Transfer to prestress may be accomplished by gradual release of the tensioning jacks or by burning of strands in accordance with the approved detensioning sequence. Where the burning method is used, the sequence of cutting strands shall be such as to prevent severe unbalance of the loading. Prior to transfer of prestress, forms shall be loosened, or removed if necessary, to allow free movement of the casting. Shock release of the strands will not be permitted.

J. Finishing

Honeycombing and shipped corners shall be cleaned and patched in accordance with PCI MNL-116. No honeycombing or other void reaching into the Prestressing steel shall be patched without permission of the Engineer.

1. Structural members will be accepted with form-finished appearance but with any leakage fins removed. All faces shall have true, well-defined surfaces. Rubbing or grinding shall correct any exposed ragged edges.
2. Standard Finish: Small surface holes caused by air bubbles, normal form joint marks, and minor chips and spalls will be tolerated, but no major or unsightly imperfections, honeycombs, or structural defects will be accepted.
3. Grade B Finish: All air pockets and holes over ¼ inch in diameter shall be filled with a sand-cement paste. All form offsets or fins over 1/8 inch shall be ground smooth. In addition, the members shall have a smooth rubbed finish.
4. Members requiring an architectural finish are indicated and specified finishing requirements are: regular concrete with a smooth finish.
5. Exposed Vertical End Finish

Strands shall be recessed and the ends of the member shall receive a rubbed finish.

6. Unformed Surfaces

Unformed surfaces of prestressed concrete products shall be finished as follows:

- a. Roof Slabs

The unformed surfaces for roof slabs shall be given a finish suitable for the application of fill materials, vapor barrier, and insulation.

- b. Floor Slabs shall be roughened to receive composite toppings insuring good bond between the precast units and poured-in-place were applicable.

K. Cracks in Precast Concrete

Precast concrete containing hair cracks, which are visible but not measurably by ordinary means, may be accepted, provided moist atmospheric conditions are not present. Cracks of width measurable by ordinary means (0.01 inch wide and over) shall cause rejection.

PART 3 – EXECUTION

3.01 ERECTION

A. General

Erection of precast prestressed members shall be in accordance with the approved shop drawings. Prior to fabrication, the method proposed for the lifting, transporting, and placing of such members shall be approved by the Engineer. Precast members shall not be shipped from the plant site of erected until test cylinders show that the concrete has attained the required strength. All prestressed concrete members shall be erected into final position and all connections completed under the direct guidance and supervision of an employee of the manufacturer, whether the manufacturer utilizes his own personnel and equipment for erecting or employs a subcontractor for his work. This man shall be competent and shall have approved field experience in the fabrication and erection of this type structure. His on-the-job-site time requirement for supervision depends on complexity of job and experience of erection force supervision.

B. Erection of Composite Structure

Half grinders shall be placed on the lugs provided on columns and shall be sufficiently shored at approved points along its entire length. Welds, where required, shall be made at the end of the half girder at the anchors provided in a sequence as determined and approved by the Engineer. An approved non-shrink grout shall be placed when specified between the end of the half girder and face of column, and care shall be taken to insure that this grouting is solid between the two faces. The shoring shall remain in place until the cast-in-place concrete has attained a minimum strength as specified.

All other girders and beams shall be placed on the lugs and seats provided in a sequence determined and approved by the Engineer.

Related Cast-in-Place concrete shall not be placed until approved by the Engineer representative who will be notified a minimum of 48 hours prior to pour in order that he may perform the necessary inspection.

C. Erection of Non-Composite Structure

All girders and beams shall be placed on the lugs and seats provided and connections shall be made at all anchors provided.

Double tees and single tees shall be erected and connections made as specified.

D. Remove lifting hooks or sleeves from roof slabs and any other members in which they would hamper other trades. Lifting devices removed from surfaces exposed in the finished work shall be cut off below the finished surface and the resultant hole shall be patched with Class "M" grout to match the adjoining surfaces.

E. Leveling and plumbing of the prestressed concrete structure shall be the responsibility of the Contractor. When erection is performed by the manufacturer it shall be as follows:

1. The Contractor shall have all surfaces prepared to receive the prestressed concrete structure true to line and grade and confirmed by Structural Engineer.

Before the manufacturer commences erection he shall check all surfaces, elevations and connection components and advise Contractor of erecting any prestressed concrete components.

2. The manufacturer shall erect the prestressed concrete structure true to line and grade. Before the General Contractor does any work on the structure (including concrete topping in composite), he shall check the structure and require that any corrections necessary be made prior to his doing any work. Once the Contractor begins construction on a portion of the structure, he accepts responsibility for that particular portion.

F. The Contractor shall provide proper access on the job site for erecting equipment.

G. Welding

Welding of connections and reinforcing splices in precast members shall be in accordance with AWS D12.1. Splicing of Prestressing strands will not be permitted. All exposed steel shall be given a rust inhibitive treatment after welding.

Welding shall be performed by certified welders and shall be at least equal to the standards and proficiency required for certification by American Welding Society and conformity to applicable specifications of the American Welding Society. Welding shall be performed with proper safeguards to prevent the straining and smoking of the concrete surfaces by the welding operation.

H. Bearing Surfaces

Bearing surfaces shall be level and free from irregularities. Irregularities in bearing surfaces shall be leveled with a stiff cement mortar.

I. Mortar shall be allowed to harden before installing the units. Units shall be installed at right angles to bearings, drawn up tight without forcing or distortion and with side plumb.

J. Camber

Differential camber between adjacent units shall be within the limits specified in PCI MNL-116, Division V, Section 5, Slab ends shall be aligned. Underside of slabs shall present true ceiling surface.

K. Openings

All openings larger than 8" x 8" will be fabricated into the prestressed concrete section as required for skylights, vents, fans, etc., and these openings shall be specifically indicated and located on the shop drawings. Openings cast in slabs are to be treated as rough openings, with trim plates, flanges, boxes, molding or other architectural treatment to provide finished appearance. The Contractor must verify location of the necessary rough openings, and this information provided to manufacturer for initial shop drawings.

Deck openings for plumbing and heating pipes, electrical conduits, outlet boxes and similar items with a maximum dimension of less than 8" shall be cut in the field by each subcontractor as required for his installation. Holes to be cut in flange portion will be no nearer the centerline of stem than 3" in double tees and drilling with a diamond tipped core drill in the field, by the various trades requiring them. Prestressing steel shall not be cut unless indicated that it is to be cut on the shop drawings. However, no field holes or cuts may be made in the prestress members without prior approval of the Engineer.

Holes to be cut in the stems of single or double tees units shall be no larger than 1 ½" and located after verification of strand locations with Engineer and manufacturer to eliminate conflicts with strand or reinforcing. In no case shall a cable or a reinforcing bar be cut without written approval of the Engineer.

No holes shall be cut through girders and beams in the field without prior approval of the Engineer.

L. Powder Activated Fasteners

Powder Activated fasteners in slabs of double and single tees shall be no nearer the ends of edges than 4". Location of powder activated fasteners to be used on the sides of the stems of prestressed members shall be determined, and location approved by the Engineer. In no circumstances shall a powder activated fastener be used in the bottom of the stem of a double or single tee or bottom surface of a beam or girder unless approved by the Engineer.

Special caution shall be taken when using powder activated fasteners in prestressed components due to extreme hardness of the concrete.

M. Grouting

1. Keyways between units and other spaces shall be cleaned and filled solidly with grout. Grout that may have seeped through to surfaces in spaces below shall be removed before hardening.
2. Grout shall consist of a mixture of cementitious materials and aggregate as specified hereinafter; water shall be added in sufficient quantity to produce a fluid mixture. Fine grout shall be provided in grout spaces less than 2 inches in any horizontal dimension or in which clearance between reinforcing and masonry is less than $\frac{3}{4}$ inch. Coarse grout shall be provided in grout spaces 2 inches or greater in any horizontal dimensions or in which clearance between members is not less than $\frac{3}{4}$ inch.
3. See section entitled "Nonmetallic Grouting" of these Specifications.
4. Caulking and Sealants

Seals, gaskets, sealant and sealant backup shall be placed in vertical and horizontal joints between units in accordance with drawing details and as specified in section entitled "Sealants" of these Specifications.

5. Concrete Topping

Concrete topping shall be applied continuously to tops of floor and/or roof slabs over the entire span where shown on the Drawings. Tops of slabs shall be clean and free of any material that would adversely affect bond and shall be wetter thoroughly with no standing water before placing topping. Concrete topping shall be as shown on the drawings.

3.02 CLEANING

After the completion of setting, all pieces shall be cleaned with fiber brushes using soapy powder. The pieces shall then be rinsed with clear water. Cleaning shall commence at the top and continue progressively down the face of the product

****END OF SECTION****

SECTION 03602
NONMETALLIC GROUTING

PART 1 - GENERAL

1.01 SCOPE

This specification section describes nonmetallic grout and grouting methods to be used in setting motors, compressors, pumps, aerators, vessels, tanks, pipe supports, structures, and other miscellaneous items of equipment that require grout between their base plate, bedplate, or soleplate and the top of the concrete surface to which they are to be anchored.

1.02 GENERAL

- A. The Contractor shall furnish all labor, grouting materials, water, equipment, forms, and other items of necessary or convenient to the Contractor for the proper preparation, placement, and curing of grout.
- B. Nonshrink, epoxy, and sand-cement grouts shall be stored, mixed, handled, and placed in accordance with recommendations of the grout manufacturer and the American Concrete Institute, as applicable.
- C. No grout shall be placed until the place of grouting has been inspected and approved by Engineer.

1.03 SUBMITTALS

- A. Prior to placement of any nonshrink or epoxy grout, the Contractor shall submit to the Engineer complete engineering and product data on the grout, including manufacturer's recommendations for mixing, placement, and curing.
- B. The Contractor shall also submit to the engineer written evidence that the grout, cement, and aggregate is in conformance with the material and mechanical requirements specified herein. Certified copies of independent laboratory test results or mill tests results for the grout, cement, and/or aggregate supplier may be considered evidence of compliance provided such tests are performed in accordance with the appropriate ASTM or Corps of Engineers testing standards by experienced, competent personnel. In case of doubt as to the accuracy or adequacy of mill tests, the Engineer may require that the Contractor furnish test reports from an independent testing laboratory on samples of grout, cement, and/or aggregate.

1.04 SAFETY

- A. Proper precautions shall be taken to protect workers during handling of epoxy resins and hardeners. All mixing and placement of epoxy grouts shall be done in well-ventilated areas. The specific safety recommendations of the manufacturer shall be strictly adhered to.

PART 2 - PRODUCTS

2.01 NONSHRINK GROUT

All pumps, compressors, motors, and other items of heavy equipment shall be grouted in place with a nonmetallic, noncorrosive, nongaseous, nonshrink grout requiring no cutback or protective coating. Nonshrink grout shall show zero shrinkage from the placement volume or initial expansion volume as determined by ASTM 827, and shall have an initial set time at 70° F of not less than 45 minutes as determined by ASTM C 191. When tested in accordance with ASTM C 109, nonshrink grout shall have a one-day compressive strength of not less than 2,000 psi and a 28-

day compressive strength of not less than 9,000 at a flow of not less than 100 percent determined in accordance with Corps of Engineers Specification CRD-C-621. The grout shall contain no corrosive irons, calcium chloride, oxidizing catalysts, gas-forming agents, harmful aluminums, or corrosive chemicals and shall be resistant to oil, water, and sewage. Grout shall be premixed and shall require only the addition of water prior to placement. Grout shall be delivered to the job site in unopened, plastic-lined bags and shall have the manufacturer's mixing instructions printed on the back of each bag. Nonshrink grout shall be EUCO N-S Grout as manufactured by the Euclid Chemical Company, Masterflow 713 Grout as manufactured by Master Builders Company, and Upcon High Flow Grout as manufactured by UPCO Division of Emhart Chemical Company.

2.02 SAND-CEMENT GROUT

- A. Column base plates, pipe support base plates, tanks, and miscellaneous small items of equipment shall be grouted in place using a sand-cement grout consisting of 1 part Portland cement, 2 parts fine aggregate, and a maximum of 4.5 gallons of water per sack (cubic foot) of cement. Portland cement shall be Type III conforming to ASTM C 150. Fine aggregate shall be natural siliceous sand, consisting of hard, clean, sharp, dense, durable, and uncoated particles.
- B. Fine aggregate shall be free from organic material and injurious amounts of deleterious substances and shall be graded as follows:

Sieve No.	Size	Percent (By Weight) Passing
4		100
8		95 to 100
16		60 to 100
30		35 to 70
50		15 to 35
100		2 to 15

- C. Except, as modified herein, fine aggregate shall conform to the requirements of ASTM C 144.
- D. Fine aggregate to be used with epoxy binders shall be dried prior to use remove any free moisture

2.03 EPOXY GROUT

Epoxy grout shall be used in special equipment grouting applications required high bonding or tensile strength where shown on the Drawings or directed by the Engineer. Epoxy grout shall be made from a two-component, 100 percent solid, polyamide epoxy binder and a fine aggregate conforming to the requirements specified herein for sand-cement grout. Epoxy grout shall consist of not less than 1 part nor more than 2 parts, by weight, fine aggregate to 1 part epoxy binder. When cured at a temperature of 73° F, neat epoxy binder shall have a 1-day compressive strength of not less than 5,000 psi and a 28-day compressive strength of not less than 12,000 psi when tested in accordance with ASTM D 695, and shall have a 14-day tensile strength of not less than 3,000 psi when tested in accordance with ASTM D 638. Polyamide epoxy binders shall be Sika "Sikadur

Hi-Mod,” Adhesive Engineering “Concressive 1001 LPL or 101 Regular,” or equal.

2.04 WATER

Water used in the preparation of nonshrink and sand-cement grout shall be clean, potable water, free from oil, alkali, organic matter, and other deleterious substances.

PART 3 - EXECUTION

3.01 STORAGE

All grout shall be stored above ground and shall be protected at all times from moisture, high humidity, oil, and extremes of temperature. Grout or cement, which has been re-sacked or has become caked or lumpy, shall not be used.

3.02 FOUNDATION

- A. Prior to setting equipment or placing grout, the foundation to receive grout shall be chipped or sandblasted so as to expose the coarse aggregate and create a roughen condition. All surfaces to be in contact with the grout, including the bottom of the base plates or soleplates, shall be thoroughly cleaned until free of all oil, grease, laitance, dust, curing compounds, and other foreign substances. If the surface is to receive nonshrink or sand-cement grout, the roughened surface shall be washed with liberal amounts of clean water and shall be soaked for at least 24 hours immediately preceding grouting. Prior to placement all free water shall be removed using air hose or other suitable method.
- B. Surfaces to receive an epoxy grout shall be completely dry and free from all visible moisture. Where it is impractical to obtain a moisture-free surface, the Engineer may authorize the use of epoxy grout on damp surfaces provided the epoxy formulation is moisture-compatible. When applying grouts to damp surfaces all free water shall be removed and the epoxy formulation shall be carefully selected so that localized boiling of entrapped moisture due to excessive exotherm does not occur.

3.03 MIXING

- A. Specific recommendations and instructions of the grout manufacturer shall be strictly adhered to in all proportioning, mixing, and placing of grout. The grout shall be mixed, as close to the point of use as is practical. A mechanical mortar mixer may be used for mixing large quantities of nonshrink or sand-cement grout. No more grout shall be mixed than can be placed in the time preceding initial set. Grout that has stiffened prior to placement shall be discarded. Only that amount of water required to produce the necessary degree of flow ability shall be used. The grout mixture shall not be retempered by adding water.
- B. Components of epoxy grout systems shall be accurately proportioned and thoroughly mixed so as to produce uniform and homogenous mixture. Accuracy of proportioning of epoxy compounds shall be plus or minus 5 percent of the manufacturer’s specified mixing ratio. Mixing of small quantities (up to one quart) of epoxy grout may be accomplished by hand, using spatulas, palette knives or similar devices. For larger volumes, mechanically driven tumbling or paddle-type mixers shall be used. Paddle-type mixers shall be driven by a low speed (400-600 rpm) motor to prevent introduction of excessive entrained air into the mixture. Mixing shall continue until the mixture is uniform and homogenous, but in no case less than 3 minutes. The manufacturer’s recommended temperature range for mixing the epoxy grout shall be followed in all field mixing.

- C. After mixing, epoxy grout shall be allowed to stand for approximately 5 minutes to allow initial air release.

3.04 PLACEMENT

- A. Grout shall be carefully placed by troweling, ramming, or pouring, as is most suited to the application. So that all voids and cavities between the foundation and equipment base plate or bedplate are filled. Air-relief holes shall be provided if necessary to eliminate entrapped air. If a pourable or flowable grout is required, suitable forms shall be provided for containing the grout. Forms shall be securely anchored and caulked to prevent leakage of grout. Grout shall be placed from one side only. Forms shall be of sufficient height to allow at least 6 inches of head on the grout above the bottom of the base plate on the side where the grout is placed. Grout shall be placed until it protrudes from the entire perimeter area. Base plates shall be located so as to provide a minimum clearance of one inch between the foundation and base plate. The temperature of the foundation and base plate or soleplate shall be maintained above 45°F during placement and for at least 24 hours thereafter. Heating of foundation and base plate or soleplate shall be accomplished using heated enclosures, heat lamps, or radiant heater so as to achieve uniform heating. Use of direct flame shall be prohibited. Concrete structures shall be heated a minimum of 4 hours prior to grouting to ensure proper heating of the concrete mass. Temperature of heated surfaces shall not exceed 100°F at the time of placement. When placing nonshrink or sand-cement grout under unusually hot or cold weather conditions, grouting practices shall comply with the requirements of ACL 305 and 306, respectively.
- B. Epoxy grout formulations shall possess exothermal properties compatible with the anticipated substrate and placement conditions. Where large masses of epoxy are involved or if ambient or substrate temperatures are high, relatively low exothermic formulations shall be used. Conversely, where very small quantities or thin films of epoxy are involved or if ambient or substrate temperatures are low, a high exothermic formulation shall be used.
- C. When placing epoxy grouts by pouring, care shall be taken to ensure that segregation of aggregate and epoxy binder or entrapment of entrained air does not occur prior to initial set. To prevent this condition, epoxy grout shall be placed in successive lifts under the base plate or bedplate not to exceed 1-inch in thickness.

3.05 FINISHING AND CURING

- A. Forms shall be left in place until the grout is hardened enough so that it cannot flow. Unconfined edges of grout shall be cut off flush or beveled and shall be trowelled to produce a smooth finish. Wedges and shims used in leveling rotating, vibrating, or other heavy items of equipment shall be removed after the grout has hardened 3 days. All voids shall be regouted using the same grouting material. Removal of shims and wedges from column base plates and pipe support base plates is optional. Anchor bolts shall not be pulled up to final torques until shims and wedges have been removed and the grout is hard enough to permit equipment operation.
- B. After placement, exposed edges of water-cured grout shall be wet cured by covering with wet burlap, wet sand, or polyethylene film for at least 7 days. During cold weather grout shall be maintained at a temperature for a period of time following placement that will ensure proper hardening and curing.

****END OF SECTION****

SECTION 04100

MORTARS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Furnish labor, equipment and materials to install unit masonry and brick mortar.

1.02 QUALITY CRITERIA

- A. Unless specifically specified otherwise, all quality control recommendations of the Brick Institute of America, Technical Notes, latest edition shall be adhered to as though incorporated herein.
- B. Only one brand of masons cement shall be used throughout the project, all masons cement shall be supplied by the manufacturer of Concrete Masonry Units.

1.03 SUBMITTALS

- A. Submit manufacturer's product specifications and mixing and installation instructions for each manufactured product.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver manufactured materials in original unopened containers displaying product name, type, and grade and where applicable, mixing instructions.
- B. Store materials to prevent inclusion of foreign materials and cover to protect from moisture and contamination.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Prepared masonry cement shall be premixed and shall meet the requirements of ASTM C91 for type N and type S mortars.
- B. Aggregate for mortar shall be clean, hard, natural washed sand meeting ASTM C144.
- C. Portland cement shall meet the requirements of ASTM C-150.
- D. Water shall be clean, potable and free from deleterious amounts of alkalies, acids and organic materials.
- E. Mortar color for brick shall be selected by the Owner. Site mixing of mortar coloring will not be allowed. Mortar for standard (natural grey) concrete masonry units shall be natural, requiring no coloring.

2.02 PROPORTIONS

A. Proportion materials by volume in accordance with the following requirements of ASTM C-270.

1) Type N Mortar

- One part masonry cement

- Three parts sand

2) Type S Mortar

- One part masonry cement

- One-half part portland cement

- Four and one-half sand

OR

- One part masonry cement Type S

- Three parts sand

PART 3 - EXECUTION

3.01 MIXING

A. Mix mortar in power-drive, drum type mixers. Mix mortar minimum of five minutes after addition of all materials.

3.02 PLACING MORTAR

A. Placement of mortar shall be in accordance with the unit masonry sections of these specifications.

B. Schedule of mortar type usage:

1) Type S: Exterior walls above and below grade.

2) Type N: Interior partitions.

C. Retemper mortar as necessary to keep plastic. Use no mortar after setting has begun or after 2 1/2 hours of initial mixing.

****END OF SECTION****

SECTION 05651
ALUMINUM HATCHES

PART 1 - GENERAL

1.01 DESCRIPTION

Furnish labor, equipment and material to install aluminum hatches of the size and location as shown on the plans, or as described herein.

1.02 SUBMITTALS

Submit shop drawings and manufacturers data for all materials supplied under this Section as described in Section 01340.

PART 2 - PRODUCTS

2.01 MATERIALS

The hatches shall be equal to Bilco Company Type "J" (single leaf) or Type "JD" (double leaf), Halliday Products, or approved alternate. Door shall be 1/4" aluminum diamond pattern plate, alloy 6061-t6, reinforced to withstand a live load of 300 pounds per square foot. Frame shall be an extrusion, alloy 6063-t6, with a continuous anchor feature incorporated. Frame is designed to direct rainwater via the channel frame to drain connection. Door shall be equipped with a minimum of two heavy duty aluminum hinges with stainless steel pins so designed as to allow the cover to hinge 180 degrees and cone to rest on the floor slab a recessed watertight stainless steel handle will be provided to lift and close the cover.

PART 3 - EXECUTION

- A. Installation shall be in accordance with manufacturer's instructions.
- B. Manufacturer shall guarantee against defects in material or workmanship for a period of five years.
- C. The contractor shall furnish piping embedded in the concrete to drain hatches.

END OF SECTION

SECTION 06050

FASTENERS AND SUPPORTS

PART 1 GENERAL

1.01 DESCRIPTION

- A. Furnish labor, equipment and materials to install all nails, screws, bolts, lag screws and similar fittings indicated or required for the proper completion of the work.
- B. All fasteners and supports described on the drawings and not necessarily named therein, shall be provided as shown and are subject to applicable requirements of this section.

PART 2 PRODUCTS

2.01 FASTENERS AND SUPPORTS

- A. Threaded fasteners shall be steel. All bolts and nuts on wood shall have standard washers.
- B. Nuts and bolts exposed to the weather shall be zinc coated. Anchor bolts not otherwise shown shall be 8" long with 2" bend end, 1/2" in diameter.
- C. Anchors, plugs and shields shall be selected for strength and permanence with installed in the indicated materials.
- D. Nails and spikes shall conform to Federal Specification FF-N-105B.
- E. Mastics shall meet the requirements of the American Plywood Association Specification AFC-01 and be phenol resorcinol type when used on pressure treated wood products.
- F. All tamper-proof screws and fasteners shall be "socket top" design.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install fasteners and supports as indicated on the drawings and as per manufacturer instructions.
- B. Selection of size and type nails shall be in accordance with "Recommended Nailing Schedule", 1970 Issue, Manual for House Framing. Fasteners for Exterior use shall be aluminum or galvanized steel casing nails.
- C. Power driven devices may be used to anchor to concrete or steel.

****END OF SECTION****

SECTION 07100
WATERPROOFING AND DAMPPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this Section.

1.02 DESCRIPTION OF WORK

- A. Furnish labor, material and equipment to apply waterproofing and damp proofing materials as herein specified in locations as specified and/or shown on the Drawings.
- B. Waterproofing shall be applied to the following construction.
- C. Exterior face of concrete walls and masonry block walls exposed to grade where the interior finished floor is below grade including any locations opposite a wet wall condition. Areas including but not limited to are below grade areas in the chemical building and pump building including wet well next to dry side, and various vaults and pits.
- E. Apply membrane vapor barrier beneath all interior concrete floor slabs on grade.

1.03 QUALITY ASSURANCE

- A. For the purpose of establishing the design and quality of waterproofing products, these specifications are based on products manufactured Koppers Company. Additional manufacturers approved as equals are:

Grace Construction Products

J and P Petroleum Products

Sonneborn

Manufacturers having products similar in design, function and quality may submit for approval.

1.04 SUBMITTALS

Submit materials list of products and manufacturers printed recommendations for application.

1.05 JOB CONDITIONS

- A. Materials shall be delivered to site in manufacturers standard containers and protected from the elements until application.
- B. Inspect surfaces to which materials are to be applied for conditions adversely affecting the finished work. Do not apply materials until surfaces are properly repaired or replaced.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Below grade waterproofing of concrete surfaces shall be coated with Bitumastic No. 50 as manufactured by Koppers.
- B. Membrane vapor barrier: 6 mil. polyethylene.

PART 3 - EXECUTION

3.1 BELOW GRADE WATERPROOFING

Concrete surface must be free from all sharp projections, dirt, dust and loose materials. Point and patch all areas including all voids and holes. Apply two coats of coating at the rate of 60 s.f./gal. The first coat must be thoroughly dry before the application of the second coat with a minimum of 24 hours between coats.

3.02 INSTALLATION OF MEMBRANE VAPOR BARRIER

- A. Install vapor barrier over compacted, clean earth, free of debris and protrusions.
- B. Install vapor barrier with edges lapped 6" and sealed with mastic over entire 6" of lap. Apply membrane in 96" width. Lay membrane with seams perpendicular to and lapped in the direction of the pour.
- C. Where expansion joints are indicated in slab, lay vapor barrier continuous under expansion joint filler.
- D. Seal openings in vapor barrier around pipes and other protrusions with mastic. Fold corners to form complete envelope.
- E. Protect installation from damage until concrete slab is in place.
- F. Turn vapor barrier down foundation wall minimum of 4".

****END OF SECTION****

SECTION 07110

MEMBRANE WATERPROOFING

PART 1 GENERAL

1.01 DESCRIPTION

- A. Furnish labor, material, equipment and services to apply membrane waterproofing systems as herein specified in locations scheduled or shown on the drawings.
- B. Waterproofing membranes shall be applied to the following construction areas:
 - 1. Exterior face of concrete and masonry walls exposed to grade where finish floor occurs below grade.

1.02 QUALITY ASSURANCE

- A. For the purpose of establishing the design and quality of waterproofing products, these specifications are based on products and manufacturers listed herein. Manufacturer's having products similar in design, function and quality may submit for approval.
- B. For each type of waterproofing work, obtain all materials from a single manufacturer.
- C. Installer of products must show evident of minimum three years experience in installation of same or very similar types of materials and be acceptable to the product manufacturer.

1.03 SUBMITTALS

- A. Submit materials list of products and manufacturer printed recommendations for applications.

1.04 JOB CONDITIONS

- A. Materials shall be delivered to site in manufacturer's standard containers and protected from the elements until application.
- B. Inspect surfaces to which materials are to be applied for conditions adversely affecting the finished work. Do not apply materials until surfaces are properly repaired or replaced.
- C. Environmental Conditions: Proceed with waterproofing and associated work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations and warranty requirements.
- D. Proceed with work only after substrate construction, openings and penetrating work have been completed.

1.05 WARRANTY

- A. Special Product Warranty: Submit a written warranty, executed by manufacturer, agreeing to repair or replace sheet membrane waterproofing that fails in material or workmanship within five (5) years after date of Substantial Completion. This Warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 PRODUCTS

2.01 BELOW GRADE WATERPROOFING

- A. Below grade waterproofing shall consist of self-adhering membrane of rubberized asphalt integrally bonded to polyethylene sheeting, formed into uniform flexible sheets of not less than 56 mils thick, complying with the following:
1. Tensile Strength: 250 psi minimum, ASTM D 412
 2. Ultimate Elongation: 300 percent minimum, ASTM D 412
 3. Pliability Temperature: minus 25 degrees F.; ASTM D146
 4. Hydrostatic Head Resistance: 150 Feet minimum
 5. Water Absorption: Not more than 0.5 percent weight gain after 48 hours of immersion at 70 degrees F.; ASTM 570.
- B. Subject to compliance with requirements, provide one of the following:
1. Bituthene; W.R. Grace & Co.
 2. Buramem 700-SM; Pecora Corporation
 3. MEL-ROL; W.R. Meadows, Inc.
 4. Miradri; Mirafi, Inc.
 5. Polyguard 650; Polyguard Products, Inc.
- C. Provide types of adhesive compound and tapes recommended by waterproofing sheet manufacturer for bonding to substrate, for waterproof sealing of seams in membrane, and for waterproof sealing of joints between membrane and flashing, adjoining surfaces, and projections through membrane.
- D. Provide type of concrete primer recommended by manufacturer of sheet waterproofing material for application required.

- E. Provide types of flexible sheet flashing material as recommended by waterproofing manufacturer.
- F. Provide type of protection board and application adhesive as recommended by waterproofing sheet manufacturer.

PART 3 EXECUTION

3.01 GENERAL

- A. Waterproofing materials shall be applied in strict accordance with the manufacturer's printed instruction for the specific application.

3.02 INSTALLATION OF BELOW GRADE WATERPROOFING

- A. Examine surfaces designated to receive work described in this section for conditions which would adversely affect the finished work. Repair or replace surfaces not meeting tolerances or quality requirements imposed within specifications governing substrate construction prior to start of this work.
- B. Surfaces to receive waterproofing shall be broom clean, and free of voids, loose aggregate, fins or projections, or other deleterious materials.
- C. Prepare surfaces in accordance with manufacturer's printed instructions prior to application of waterproofing.
- D. Primer shall be applied at a coverage rate recommended by the manufacturer.
- E. Seal to projections through membrane and seal seams.
- F. Top seal edge of membrane by termination in reglet, where applicable, otherwise finish under flashing or behind wall veneer finish. Caulk any exposed edges with mastic or sealant. Coat any exposed membrane sheet or flashing materials. comply with waterproofing sheet manufacturer's recommendations for application and cure of coating.
- G. Where expansion joints occur, install joint filler as recommended by manufacturer, with protruding rounded surface. Apply continuous 8 inch wide strip of membrane on joint, followed by membrane application.
- H. Install protection board over completed membrane, complying with manufacturer's recommendations for both waterproofing sheet and protection course materials.

3.03 INSTALLATION OF WATERSTOP

- A. Position waterstop correctly with bulb on centerline of expansion joint. No splices are allowed.

****END OF SECTION****

SECTION 07160

BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 DESCRIPTION

A. Furnish labor, material and equipment to apply bituminous dampproofing materials as herein specified in locations shown on drawings.

B. Apply dampproofing to exterior face of interior masonry wythe in exterior double wythe walls.

1.02 QUALITY ASSURANCE

A. For the purpose of establishing the design and quality of dampproofing products, these specifications are based on products manufactured by Sonneborn-Contech and W.R. Meadows, Inc. Manufacturers having; products similar in design, function and quality may submit for approval.

B. For each type of dampproofing work, obtain all materials from a single manufacturer.

1.03 SUBMITTALS

A. Submit materials list of products and manufacturer printed recommendations for applications.

1.04 JOB CONDITIONS

A. Materials shall be delivered to site in manufacturer standard containers and protected from the elements until application.

B. Inspect surfaces to which materials are to be applied for conditions adversely affecting the finished work. Do not apply materials until surfaces are properly repaired or replaced.

C. Environmental Conditions: Install materials only when ambient temperature exceed 40 degrees F.

D. Surfaces to receive dampproofing shall be dry prior to application of primer or dampproofing.

PART 2 PRODUCTS

2.01 DAMPPROOFING

A. Cavity wall dampproofing shall be a brushed or sprayed on asphalt emulsion conforming to ASTM D-1227-82, Type I, and Federal Specifications SS-R-1781, Type I.

B. Acceptable Products:

1. Hydrocide 700B semi-mastic as manufactured by Sonneborn.
2. Sealmastic Asphalt Emulsion, Type 2 as manufactured by W.R. Meadows, Inc.

PART 3 EXECUTION

3.01 INSTALLATION OF CAVITY WALL DAMPPROOFING

A. Dampproofing materials shall be applied in strict accordance with the manufacturer's printed instructions for the specific application.

B. Spray or brush apply dampproofing at a minimum rate of one gallon per 30-35 sq. ft. of surface area.

****END OF SECTION****

SECTION 07175

WATER REPELLENTS

PART 1 - GENERAL

1.01 DESCRIPTION

Furnish labor, equipment and materials to apply water repellent to all new exterior surfaces.

1.02 QUALITY ASSURANCE

Installer: A firm with not less than 3 years of successful experience in application of water repellents of types required on substrates similar to those of this project.

1.03 PROJECT MOCK-UP

Apply water repellent to mock-up as directed. Mock-up to be approved before proceeding with installation. Comply with installation requirements of this section.

1.04 SUBMITTALS

Product Data: Submit manufacturer's specifications, installation instructions, and general recommendations for water repellents. Include data substantiating that materials are recommended by manufacturer for applications indicated and comply with requirements.

1.05 JOB CONDITIONS

Weather and Substrate Conditions: Do not proceed with application of water repellent (except with written recommendation of manufacturer), when ambient temperature is less than 50° F (10° C), or when substrate surfaces have cured for less than a period of 2 months, or when rain or temperatures below 40° F (4° C), are predicted for a period of 24 hours, or earlier than 3 days after surfaces became wet from rainfall of other moisture sources, or when substrate is frozen, or surface temperature of less than 40° F (4° C).

PART 2 - PRODUCTS

2.01 SOLVENT BASED SILICONE SEALER

- A. Provide a 5.0% concentration of polymerized silicone resins in hydrocarbon solvents, complying with FS SS-W-110.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

Applied Polymers

Anti-Hydro Waterproofing Co.

CGM Inc.

Euclid Chemical Co.

Nox-Chem Co.

Protex Industries

- C. Contractor Options (Proprietary): At Contractor's option, provide one of the following products in lieu of generic types of liquid water repellent specified in this section, and include manufacturer's certification to effect that product complies with or exceeds required performances as indicated for generic types: Clear Double 7; Hydrozo Coating CO. Chem-Trete BSM; Dynamit Nobel of America, Inc. Sure-Kleem Weather Seal 224; ProSoCo, Inc. Or approved equal.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clean substrate of substances which might interfere with penetration/adhesion of water repellents. Test for moisture content, in accordance with repellent manufacturer's instructions, to ensure that surface is sufficiently dry.
- B. Coordination with Sealants: Where feasible, delay application of water repellents until installation of sealants has been completed in joints adjoining surfaces to be coated with repellent.
- C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass where there is possibility of water repellent being deposited on surfaces. Cover live plant materials with drop cloths. Clean water repellent from adjoining surfaces immediately after spillage. Comply with manufacturer's recommendations for cleaning.

3.02 INSTALLATION

- A. Apply a heavy saturation spray coating of water repellent on surfaces indicated for treatment using low pressure spray equipment. Comply with manufacturer's instructions and recommendations, using airless spraying procedure unless other wise indicated.
- B. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's instruction for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if printed recommendations are not applicable to project conditions.

****END OF SECTION****

SECTION 07193

PLASTIC VAPOR BARRIERS

PART 1 GENERAL

1.01 DESCRIPTION

- A. Furnish labor, material and equipment to apply plastic vapor barrier materials as herein specified in locations shown on drawings.
- B. Apply plastic vapor barrier beneath all interior concrete floor slabs.

1.02 QUALITY ASSURANCE

- A. For the purpose of establishing the design and quality of vapor barrier products, these specifications are based on products manufactured by Griffolyn Products. Manufacturers having products similar in design, function and quality may submit for approval.
- B. For each type of vapor barrier work, obtain all materials from a single manufacturer.

1.03 SUBMITTALS

- A. Submit materials list of products and manufacturer's printed recommendations for application.

1.04 JOB CONDITIONS

- A. Materials shall be delivered to site in manufacturer's standard containers and protected from the elements until application.
- B. Inspect surfaces to which materials are to be applied for conditions adversely affecting the finished work. Do not apply materials until surfaces are properly repaired or replaced.
- C. Environmental Conditions: Install materials only when ambient temperature exceeds 40 degrees F.

PART 2 PRODUCTS

2.01 PLASTIC VAPOR BARRIER

- A. Plastic Vapor Barrier: 5 ply nylon cord reinforced polyethylene film under floor slab on grade.
- B. Product shall be Griffolyn Products T-85 or approved equal conforming to the following:
 - 1. Tear Straight: 185 lbs
 - 2. Elongation per Federal Standard 406: 190%
 - 3. Weight per 1000 sq. ft.: 38 lbs/MSF

2.02 ACCESSORIES

- A. Tape recommended by manufacturer as compatible with vapor barrier.

PART 3 EXECUTION

3.01 INSTALLATION OF PLASTIC VAPOR BARRIER

- A. Install vapor barrier over 4" gravel base, free of debris and protrusions.
- B. Install vapor barrier with edges lapped 12" and sealed with mastic over entire 12" of lap. Apply plastic barrier in 96" width. Lay plastic barrier with seams perpendicular to and lapped in the direction of the pour.
- C. Where expansion joints are indicated in slab, lay vapor barrier continuous under expansion joint filler.
- D. Seal openings in vapor barrier around pipes and other protrusions with mastic. Fold corners to form complete envelope.
- E. Protect installation from damage until concrete slab is in place.
- F. Turn vapor barrier down foundation wall minimum of 4".

****END OF SECTION****

SECTION 09900

PAINTING

PART 1 - GENERAL

1.01 WORK INCLUDED

Furnish all labor, materials, tools and scaffolding as required to paint or otherwise finish all exposed piping, interior and exterior concrete block, structural steel, galvanized steel, and miscellaneous materials not factory finished and exposed to view both on the inside and outside.

1.02 QUALITY ASSURANCE

Work shall be performed by skilled applicators thoroughly trained in necessary crafts and completely familiar with specific requirements and methods specified herein.

- A. Manufacturer's representative shall be available to advise applicator on proper application techniques and procedures.
- B. Materials for each coating system shall be those of a single manufacturer.
- C. Paint systems for field-applied finish coats shall be compatible with shop-applied primers.

1.03 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
- B. Federal Test Methods for the Performance of Paints and Coatings.
- C. Steel Structures Painting Council (SSPC)

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's descriptive data fully describing each product including solids by volume and unthinned volatile organic compounds (VOC)'s. Include manufacturer's recommendations for mixing, thinning, and curing.
- B. Certificates: Submit manufacturer's certified test reports confirming compliance with the specified performance requirements under Paragraph 2.3.
- C. Colors: Submit 4 color charts for color selection.
- D. Lead Content: Submit manufacturers certification that products to be supplied are lead free (less than 600 ppm lead).
- E. Submit 2 copies of the Material Data Safety for each type of paint.

1.05 PRODUCT DELIVERY, STORAGE, HANDLING

- A. Deliver materials in factory-sealed containers with manufacturer's labels intact and legible.

- B. Store materials in protected area at a temperature between 35 degrees F. and 110 degrees F.

1.06 JOB CONDITIONS

- A. Apply coatings only under the following prevailing conditions:
 - 1. The air and surface to be painted temperatures are not below 50 F. or above 120 F.
 - 2. Relative humidity is not above 85 percent and the surface to be painted temperature is at least 5 degrees Fahrenheit above the dew point.
- B. Protect all surfaces not to be coated.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products specified herein are manufactured by TNEMEC Company Inc., Kansas City, Missouri and are specified for identification of paint types, and as standards of quality, not necessarily as brand preference.
- B. Equivalent materials of other manufacturers may be submitted for prior approval. Pre-approved manufacturers not listed in the paint schedule are: Induron and ACRO Protective Coatings. All alternate coatings must be the same generic type as the coatings specified.

2.02 MATERIALS

- A. Materials shall be first line products of the manufacturer used. The manufacturer's catalog numbers are only for the purpose of identifying the item. Suppliers shall be as listed herein or an alternate approved by the Engineer.
- B. Unless otherwise specified, paints to be used for final coats shall be available in a full range of colors and shades, 15 different colors minimum.

2.03 REQUIREMENTS

- A. Coatings in contact with potable water shall be NSF certified.
- B. Materials shall be first line products of the manufacturer used. The manufacturer's catalog numbers are only for the purpose of identifying the item. Suppliers shall be as listed herein or an alternate approved by the Engineer.
- C. Bidders desiring to use coatings other than those specified shall submit their proposal in writing to the Engineer at least five working days prior to bid openings. Substitutions which decrease the film thickness, number of coats applied, change the generic type of coating, or fail to meet the performance criteria of the specified materials will not be approved. Prime and finish coats of all surfaces shall be furnished by the same manufacturer.
- D. Requests for substitutions shall include manufacturer's literature for each product giving the name, generic type, descriptive information, and evidence of satisfactory past performance. Submittals

shall include the following performance data as certified by a qualified testing laboratory:

1. Abrasion - Fed. Test Method Std. No.141, Method 6192, CS-17 Wheel, 1,000 Grams Load.
 2. Adhesion - Elcometer Adhesion Tester
 3. Exposure - Cyclic Corrosion / Weathering Test: Expose panels to 200-hour periods of wet/dry corrosion cycling followed by 200-hours UV condensation exposure. Exposure cabinet conforming to ASTM G 53, four hour UV exposure with UVA-340 bulbs at 60° C, cycled with a four-hour condensation period for five complete periods, 2000 hours total. Test shall be by an independent lab and include the materials specified.
 4. Hardness - ASTM D3363-74
 5. Humidity - ASTM D2247-68
 6. Salt Spray (Fog) - ASTM B117-85
 7. Graffiti Resistance - Fed. Test Method TT-C-550C, 4.4.5.2 and 4.4.5.3
- E. Primers and Paints containing lead or chromates may not be used.
- F. When concrete block is to be painted, the contractor shall first submit two block samples painted with the specified blockfiller and finish coats. The Engineer shall approve or reject the samples. If the samples are rejected the Engineer shall indicate the reasons for rejection and the contractor shall make corrections in his application method and submit a new sample. Once accepted the samples will become reference standards by which all block must be painted.

2.04 PAINT SCHEDULE

A. *Interior and Exterior Ductile Iron Pipe and Fittings Non-immersion.*

1st Coat Tnemec: Series 66, 1 coat 3.0-5.0 mils.

2nd Coat Tnemec: Series 66, 1 coat 3.0-5.0 mils.

3rd Coat Tnemec: Acrylic Polyurethane, 1 coat 2.0-3.0 mils.

Total Paint system 8.0-13.0 mils.

The pipe manufacturer's shop coating may substitute for the first coat provided it is compatible with the second coat listed and is not a type of coal tar coating.

B. *Immersion Service Ductile Iron Pipe and Fittings*

1st Coat Tnemec: Series 69 High Build Epoxline , 1 coat 4.0-6.0 mils.

2nd Coat Tnemec: Series 69, 1 coat 4.0-6.0 mils.

Total Paint system 8.0-12.0 mils.

The pipe manufacturer's shop coating may substitute for the first coat provided it is compatible with the second coat listed and is not a type of coal tar coating.

C. *Exterior Exposed Structural Steel, Steel Pipe, Equipment, and Miscellaneous metals.*

1. *Non-Immersion*

1st Coat Tnemec: Series 66 HiBuild Epoxoline 4.0-6.0 mils. DFT

2nd Coat Tnemec: Series 75 Polyurethane, 1 Coat 2.0-3.0 mils. DFT

Total System 6.0 to 9.0 mils DFT

2. *Immersion*

1st Coat Tnemec: Series 66 HiBuild Epoxoline 3.0-5.0 mils. DFT

2nd Coat Tnemec: Series 66 HiBuild Epoxoline 4.0-6.0 mils. DFT

Total System 8.0 to 12.0 mils DFT

D. *Galvanized Steel and Aluminum*

1. *Non-Immersion*

1st Coat Tnemec: Series 66 HiBuild Epoxoline 3.0-4.0 mil.

2nd Coat Tnemec: Series 75 Polyurethane, 1 Coat 2.0-3.0 mils. DFT

2. *Immersion*

1st Coat Tnemec: Series 66 HiBuild Epoxoline 4.0-6.0 mils. DFT

2nd Coat Tnemec: Series 66 HiBuild Epoxoline 4.0-6.0 mils. DFT

E. *PVC Pipe*

1st Coat Tnemec: Series 66 Hi-Build Epoxoline 2.0-3.0 mils. DFT

2nd Coat Tnemec: Series 75 Endura Shield 2.0-3.0 mils. DFT

Note: Stop paint 2" from all pvc valves, unions, or any threaded fitting. Do not paint pvc valves or unions.

F. *Interior Concrete Block*

1st Coat Tnemec: Series 130 Envirofil Masonry Filler 1 - gal./70 ft²

2nd Coat Tnemec: Series 113 Tneme-Tufcoat 4.0 to 6.0 mils. DFT

3rd Coat Tnemec: Series 113 Tneme-Tufcoat 4.0 to 6.0 mils. DFT

No additional payment will be made for extra coats of block primer/filler required to achieve a smooth surface. Block filler shall not be sprayed on.

G. *Exterior Finished Concrete Block*

- 1st Coat Tnemec: Series 130 Envirofil Masonry Filler 1 - gal./70 ft²
- 2nd Coat Tnemec: Series 180 Tneme-Tufcoat 4.0 to 6.0 mils. DFT
- 3rd Coat Tnemec: Series 180 Tneme-Tufcoat 4.0 to 6.0 mils. DFT

No additional payment will be made for extra coats of block primer/filler required to achieve a smooth surface. Block filler shall not be sprayed on.

H. *Interior Wood*

- 1st Coat Series 36 Under Coat 2.0 to 3.5 mils DFT
- 2nd Coat Series 7 Tnme-Cryl 2.0 to 3.5 mils DFT

I. *Exterior Wood*

- 1st Coat Series 36 Under Coat 2.0 to 3.5 mils DFT
- 2nd Coat Series 113 Tnme-Cryl 4.0 to 6.0 mils DFT

J. *Gypsum Board*

- 1st Coat Series 7 Tnme-Cryl 2.0 to 3.0 mils DFT
- 2nd Coat Series 7 Tnme-Cryl 2.0 to 3.0 mils DFT

K. *Concrete walls and ceilings*

Interior

- 2 Coats Thoroseal at 2.0#/square yard mixed with Acryl 60 and water at 1 part acryl and 2 parts water.

Exterior

- 1st coat Thoroseal at 2.0 #/square yard mixed with Acryl 60 and water at 1 part acryl and 2 parts water.
- 2nd coat Thorocoat at 80 sq. ft. per gallon.

Thorocoat products shall be brush or roller applied.

L. *Pre-Cast Concrete walls and ceilings*

Interior

1st Coat Tnemec: Series 130 Envirofil Masonry Filler 1 - gal./70 ft²

2nd Coat Tnemec: Series 113 Tneme-Tufcoat 4.0 to 6.0 mils. DFT

3rd Coat Tnemec: Series 113 Tneme-Tufcoat 4.0 to 6.0 mils. DFT

No additional payment will be made for extra coats of block primer/filler required to achieve a smooth surface. Block filler shall not be sprayed on.

Exterior

1st coat Thoroseal at 2.0 #/square yard mixed with Acryl 60 and water at 1 part acryl and 2 parts water.

2nd coat Thorocoat at 80 sq. ft. per gallon.

Thorocoat products shall be brush or roller applied.

2.05 FINISH APPEARANCE

Paint finishes must be uniform in color, texture, and general appearance. No additional compensation will be made for extra coats required to achieve the required DFT mil thickness, a uniform color, or a uniform appearance.

2.06 MATERIAL PREPARATION

- A. Mix and thin materials according to manufacturer's latest printed instructions.
- B. Do not use materials beyond manufacturer's recommended shelf life.
- C. Do not use mixed materials beyond manufacturer's recommended pot life.

PART 3 - EXECUTION

3.01 PRE-WORK INSPECTION

- A. Examine surfaces to be coated and report conditions that would adversely affect appearance or performance of coating systems and which cannot be put into an acceptable condition by preparatory work specified in Paragraph 3.02.
- B. Do not proceed with surface preparation and application until surface is acceptable or authorization to proceed is given by the Engineer.
- C. Dry film thicknesses of shop-primed equipment will be taken and logged so as to avoid any questions once finish coats are applied.

3.02 SURFACE PREPARATION

- A. General
 - 1. Verify that all surfaces to be coated are dry, clean and free of dust, rust, dirt, oil, grease or

other contaminants that would adversely affect the performance of the coatings.

2. Field blast cleaning for all surfaces shall be by dry method unless otherwise directed.
3. Particle size of abrasive used in blast cleaning shall be that which will produce a 1 1/2 - 2 mil (37.5 microns - 50.0 microns) surface profile.
4. Abrasive used in blast cleaning operations shall be new, washed, graded, low silica, and free of contaminants that would interfere with adhesion of coatings and shall not be reused unless specifically approved by the engineer. Copper slag is not allowed.
5. During blast cleaning operations, caution shall be taken to insure that existing coatings are not exposed to abrasion or contamination from blast cleaning.

B. Ferrous Metal - Non-Immersion

Steel Structures Painting Council - Commercial Blast Cleaning (SSPC-SP6).

C. Ferrous Metal - Immersion

1. Steel Structures Painting Council - Near White Blast Cleaning (SSPC-SP10).
2. Slag and weld metal accumulation and spatters not removed by the fabricator, erector or installer shall be removed by chipping and grinding. Weld seams and sharp edges shall be peened or ground as required by the Engineer.

D. Galvanized Metal

Steel Structures Painting Council - Solvent Cleaning (SSPC-SP1).

E. Ductile Iron Pipe

Surface should be clean, dry and free of asphaltic coating.

F. PVC Pipe

Surfaces should be clean dry and scarified.

G. Mill Coated Steel Pipe - Non-Immersion

Steel Structures Painting Council - Commercial Blast Cleaning (SSPC-SP6)

H. Mill Coated Steel Pipe - Immersion

Steel Structures Painting Council - Near White Blast Cleaning (SSPC-SP10).

I. Concrete Block

1. Surface shall be rubbed with an abrasive stone or concrete block piece to remove mortar splatter, concrete build up, and other irregularities that would adversely affect the finished surface.

2. Surface should be clean and dry, free of oils, adhesives, dirt and other materials that would adversely affect the coating to be applied.

3.03 APPLICATION

- A. Materials shall be mixed, thinned and applied according to the manufacturer's latest printed instructions.
- B. All weld seams shall receive a brush coat of the specified product thinned, prior to application of the first complete coat.
- C. Touch-up all areas of damages shop primer prior to application of first complete coat.
- D. Make finish coats smooth, uniform in thickness and color, and free of brush marks, laps, runs, dry spray, overspray and skipped or missed areas.

3.04 INSPECTION

- A. Request acceptance of surface preparation by the Engineer prior to applying the first coat.
- B. Request acceptance of each coat before applying next coat.
- C. Correct work that is not acceptable under the requirements of this contract, and request reinspection.

3.05 CLEANING

- A. Remove paint spatters from adjoining surfaces not scheduled to be painted.
- B. Repair damage to coatings or surfaces caused by cleaning operations.
- C. Remove debris from job site and leave storage areas clean.

3.06 PAINTING SCHEDULE

A. Proposed Construction

All new construction, equipment and existing structures shall be painted, unless otherwise indicated. Items to be painted shall include but not be limited to; concrete block, gypsum board, concrete walls, pre-cast concrete, ceilings, metal doors and frames, miscellaneous metals, pumps, valves, fittings, piping and equipment. Colors shall be as selected by the Owner.

The following color scheme shall be used on all piping. The color of piping not listed below shall be selected from the color chart supplied by the manufacturer.

Interior Walls & Ceilings	Light Grey
Doors	Light Grey
Drains	Black

Potable Water	Dark Blue
Sewer/Forcemain	Dark Gray
Air	Dark Green

Piping listed previously shall have lettering indicating the material in the pipe, and an arrow indicating the direction of flow, of the material in the pipe. Arrows shall be spaced not more than 25' apart, one arrow and description must be visible in each room regardless of spacing. The lettering size shall vary for different pipe sizes as follows:

<u>Pipe Dia.</u>	<u>Lettering Size</u>
1" to 3"	3/4"
+3" to 6"	2"
+6" to 18"	4"
+18"	6"

****END OF SECTION****

SECTION 11000

EQUIPMENT GENERAL

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work Covered: All equipment supplied under this contract shall comply with this specification unless otherwise noted.
- B. Related work described elsewhere: See specific equipment specification for referenced work.

1.02 QUALITY ASSURANCE

- A. Qualifications of Manufacturer: All equipment shall be produced by manufacturers regularly engaged in the manufacture of the specified products. The manufacturers listed are used to establish a standard of quality. Other manufacturers of equal quality may be approved.
- B. Acceptable Manufacturer: See specific equipment specification for acceptable manufacturer.
- C. Reference Standards: See specific equipment specification for referenced specifications.

1.03 SUBMITTALS

- A. General: Comply with the provisions of Section 01340
- B. Product Data: Within 90 calendar days after award of the Contract, submit:
 - 1. Complete list of all materials proposed to be furnished and installed under this Section.
 - 2. Certification from the manufacturer of each product that the products meet all the requirements of these specifications.
 - 3. Shop Drawings showing all details of the proposed installations.
- C. Operation and maintenance data as described in Section 01730.

1.04 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.
- B. Storage: Provide a storage area for stockpiled products acceptable to equipment manufacturer which shall protect equipment from weather and physical damage prior to installation.
- C. Replacements: In the event of damage, immediately make all repairs and replacements

necessary to the approval of the Engineer and at no additional cost to the Owner.

1.05 PRE-SELECTED EQUIPMENT

See specific equipment specification.

PART 2 - PRODUCTS

See specific equipment specification.

PART 3 - INSTALLATION PROCEDURE

- 3.01 Layout and install support anchors in accordance with equipment manufacturer's recommendations and anchor setting plan .
- 3.02 Follow equipment manufacturer's recommendations for startup. The manufacturer shall submit to the engineer a copy of the startup report including any recommendations or deficiencies in installation.
- 3.03 Services:
 1. The manufacturer shall provide one (1) trip (one 8 hour day) to the project site for equipment installation assistance to the contractor by a qualified factory authorized representative.
 2. After the contractor has installed the equipment, the equipment manufacturer shall furnish one (1) trip (one 8 hour day) to inspect the equipment and to supervise field testing and start-up with the contractor. The manufacturer shall submit a written report of the start-up completion along with any recommendations or remedial worked required. The report shall be submitted to the engineer for review.
 3. After the equipment has been placed into operation, during the second trip, the manufacturer shall furnish one 8 hour day for owner training, as scheduled by the owner.
 4. After the equipment has been placed into operation by the owner for a minimum of 90 calendar days, the equipment manufacturer shall provide one eight hour day of equipment follow-up for equipment inspection and owner review. This shall visit shall be scheduled by the owner.

PART 4 - WARRANTY

Warrant all parts to be free from defects in materials and workmanship for a period of one year after start-up. Furnish replacement parts to the Owner for any items found to be defective within the one year warranty period.

****END OF SECTION****

SECTION 11200

PUMPS

PART 1 - GENERAL

1.01 DESCRIPTION

Each pump assembly shall consist of but not be limited to; base elbow, motor, impeller, guide rail system and cables. Pump assembly shall be as manufactured by Flygt Corporation or engineered approved alternate.

RELATED WORK SPECIFIED ELSEWHERE

- A. Shop Drawings, Product Data and Samples - Section 01340
- B. Operating and Maintenance Manual - Section 01730
- C. Lift Station Control - Section 16990

1.02 PUMP WARRANTY

Pump manufacturer shall warrant the units being supplied to the owner against defects in workmanship and material for a period of one (1) year under normal use, operation and service from date of substantial completion. The warranty shall be in printed form and apply to all similar units.

1.03 DESIGN DATA

- A. Pump manufacturer shall provide the necessary adapters and/or parts so that the base elbow and rail system will accept the initial pump and the future pump with no changes in the assembly, which would require the pump station to be shut down. The Owner will only need to replace the pumps and no other part of the pumping assembly. Pump assembly shall be Flygt NP3171.185SH with base elbow.
- B. Design data and performance requirements are specified on the attached Submersible Pump Schedule.
- C. Pumps shall be designed for continuous operation at any point over the full operating range. Guarantees shall be based on design conditions specified on the Submersible Pump Schedule.
- D. The pumps shall have a decreasing-head capacity characteristic curve between shut-off and maximum capacity.
- E. Pumps shall operate smoothly throughout the range required to reach operating speed and to function at operating at operating speed without vibration, cavitation, noise or undue heating.
- F. Running clearances shall be large enough to minimize the possibility of seizure when in service.
- G. Pump motors shall be selected to prevent the motors from overloading at any point on the pump curve, using the installed impeller.

1.04 SUBMITTALS

- A. Shop Drawings shall be submitted in accordance with requirements of the section entitled , “Shop Drawings, Product Data and Samples” of these Specifications.
- B. Operation and Maintenance Manuals shall be submitted in accordance with requirements of the section entitled, “Operating and Maintenance Manual” of these specifications.
- C. Performance curves submitted to the engineer shall depict:
 - 1. Head plotted against capacity.
 - 2. RPM.
 - 3. Combined weight of pump and motor.
 - 4. Impeller diameter.
 - 5. Largest spherical solid that can be passed.
 - 6. Area of the eye of impeller in square inches.
 - 7. Clearly marked operating points.
 - 8. Maximum Hp motor that could be utilized.
 - 9. Shut-off head.
 - 10. Kilowatt usage at design conditions.

PART 2 – EQUIPMENT

2.01 MATERIALS AND EQUIPMENT

- A. This section is intended to give a general description of what is required, but does not cover all details which will vary in accordance with the requirements of the equipment as offered. It is, however, intended to cover all materials, equipment and appurtenances for the complete pumping units as herein specified, whether specifically mentioned in this Section or not.
- B. For all units there shall be furnished and installed all necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in this Section or not and as required for an installation incorporating the highest standards for the type of service.
- C. The pumping units required under this Section shall be complete including pumps and motors with proper alignment and balancing of the individual units. All parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness and to be especially adapted for the work to be done. Ample room shall be provided for inspection, repairs, and adjustments.
- D. Each foundation base for each pump shall be designed to be rigidly and accurately anchored into position. The Manufacturer shall furnish all necessary foundation bolts, plates, nuts, and

washers for installation by the CONTRACTOR. Anchor bolts and accessories shall be Type 316 stainless steel.

- E. Stainless steel nameplates giving the name of the Manufacturer, the rated capacity, head, speed, and all other pertinent data shall be permanently attached to each pump and/or motor.
- F. All electrical materials and equipment shall be UL listed, NEMA rated, and shall otherwise be equal to that supplied under Division 16, where applicable.

2.02 PUMPING SYSTEM - GENERAL

- A. The pumping system shall be designed to accept a Flygt Series NP3171.185SH to meet the present and future conditions. The pump shall be totally submersible, non-clog centrifugal pump with submersible close coupled motor designed to pump unscreened sewage. The pumps shall be automatically connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. Lifting the pump from their discharge connection of the wet well shall require neither the removal of any bolts, nuts or other fastenings nor the need for personnel to enter the wet well.
- B. The pump Manufacturer shall factory test all pumps prior to shipment in accordance with the standards of the Hydraulic Institute. Certified copies of the test report shall be furnished to the Engineer.

2.03 PUMP CONSTRUCTION

- A. The overall pump design shall combine high efficiency, low required NPSH, large sphere passage and the ability to handle high solids concentrations efficiently. The impeller/casing design shall result in a passage free of surfaces to which solid or fibrous materials can adhere. The design shall permit low liquid velocities and gradual acceleration and change of flow direction of the pumped media.
- B. Impellers shall be constructed of ASTM A 48 Class 35 gray cast iron. The impeller shall be of a centrifugal double shrouded, non-clog type, capable of passing fibrous material and 3.5-in (minimum) diameter solids.
- C. A wear ring system shall be installed to provide efficient sealing between the volute and the impeller. Each pump shall be equipped with a nitrile rubber coated steel ring insert that is drive fitted into the volute inlet. Pump shall be fitted with a rotating stainless steel wear ring heat-shrink fitted onto the inlet of the impeller.
- D. All external pump and motor parts shall be of close grained cast iron, ASTM A48 Class 35B, with all parts coming into contact with wastewater protected by corrosion resistant coatings. All external bolts and nuts shall be of Type 316 stainless steel.
- E. A sliding guide bracket shall be an integral part of the pumping unit. The pump casing shall have a machined connection system to attach to the ASTM A48, Class 35B cast iron discharge connection. The sealing of the pumping unit to the discharge connection shall be accomplished by a machined, metal-to-metal, watertight contact. Sealing of the pump discharge flange to the discharge connection with a diaphragm, O-ring, or profile gasket will not be acceptable. The discharge connection shall be bolted to the floor of the sump with

Type 316 stainless steel anchor bolts and so designed as to receive the pump connection without the need of any bolts or nuts. The pump shall be tightly sealed against the discharge connection and shall be accomplished by a simple linear downward motion of the pump with the pumping unit guided by two 3-inch diameter, Schedule 40, Type 316 stainless steel guides. No portion of the pump shall bear directly on the floor of the sump.

- F. The minimum discharge size for the pumps shall be the minimum allowable nominal diameter of the discharge connection provided for attachment of the discharge piping except as allowed otherwise by these specifications. The diameter of the opening at the connection between the pump and the discharge connection should normally be the same as the specified minimum discharge size.
- G. Each pump shall be fitted with 36 inches of ½ -in minimum Type 316 stainless steel chain of adequate strength to lift double the pump's weight. The lifting chain's combined length shall be equal to the wet well depth (top slab finished grade to wet well bottom) plus two feet to permit raising the pump for inspection and removal.
- H. The lifting chain shall be attached to a bail on the pump. Eyebolts will not be considered as an acceptable alternate to a lifting bail.

2.04 SUBMERSIBLE MOTORS

- A. Pump motor shall be housed in an air filled watertight casing, and shall have Class F insulated windings that shall be moisture resistant. The stator shall be dipped and baked three times in Class F varnish and heat shrunk fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. Motors shall be NEMA Design B with a 1.15 service factor based upon the nameplate horsepower rating or squirrel-cage induction type design. De-rating the motors to achieve the specified service factor will not be acceptable. The motor shall be rated at 155° C or better while operating in an ambient temperature of 40° C. The motor shall be NEMA Code Letter F, G or H, or better. Motor shall be non-overloading and capable of 15 starts per hour minimum. Motor shall be provided with the following minimum efficiency and power factor at various load conditions.

	1/1 - LOAD	¾ - LOAD	½ -LOAD
Motor COS PHI	0.87	0.84	0.76
Motor Efficiency	93.5%	93.5%	93.5%

- B. Pump motor shall have cooling characteristics suitable to permit continuous operation in a totally, partially or non-submerged condition. The motor shall incorporate three ambient temperature compensated overheat sensing devices, one in each motor winding. These devices shall trip at 125° C. The device shall be wired into the pump controls in a manner such that if either device operates, the pump will shut down. The temperature device shall be self-resetting.
- C. Provide a Float Leak Sensor to detect water in the stator chamber. Upon activation, the system will shut down the motor.

- D. Unless otherwise noted or shown on the Drawings, motor shall be rated at 480 volts, 3-phase.
- E. The pump motor shall be capable of running continuously in a totally dry condition under full load without damage for extended periods, and shall be non-overloading within the range of operation between shutoff and the low head run-out conditions shown on the pump station data table.
- F. The pump/motor shaft shall be constructed of Type 329 or Type 420 Stainless Steel. ASTM A-572 Grade 50 carbon steel is an acceptable alternate if the shaft is isolated from the pumped liquid by means of the lower mechanical seal and a sealing arrangement at the impeller locking screw. When operating at the pump design point, the shaft shall have a maximum deflection of 0.2 mm at the lower seal face and a maximum deflection of 0.45 mm at the wear ring area. The shaft shall rotate on permanently lubricated ball bearings properly sized to withstand the axial and radial forces. The Minimum L-10 bearing life shall be at least 50,000 hours.
- G. The pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydrodynamically lubricates the lapped seal faces. The lower of the tandem set of seals shall function as the primary barrier between the pumped liquid and the stator housing and shall consist of one stationary and one positively driven rotating tungsten-carbide ring. The upper, secondary seal shall be located between the lubricant chamber and the motor housing and shall contain one stationary tungsten-carbide seal ring and one positively driven rotating tungsten-carbide ring. Each interface shall be held in contact by its own spring system. The seals shall not require maintenance or adjustment, but shall be easily inspected and replaceable. Shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower units are not acceptable nor equal to the dual independent seal specified.
- H. The pump motor with its appurtenances and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65-ft. All mated surfaces shall be machined, fitted with O-rings for watertight sealing. A float leakage sensor shall be provided in each motor stator chamber to detect the leakage of water into the chambers and send an alarm signal to the control system.
- I. The pump shall be provided with a cable entry design that shall preclude specific torque requirements to insure a water tight and submersible seal. The cable entry shall be comprised of a single cylindrical elastomer grommet flanked by stainless steel washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the entry body containing a strain relief function separate from the function of sealing the cable. The cable entry junction chamber and motor shall be separated by a terminal board, which shall isolate the motor interior from foreign material gaining access to the pump motor top. The cable entry system shall be field serviceable. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.
- J. The pump shall be supplied with power and sensor conductors encapsulated in a single cable. Pump motor cables shall be sized to meet applicable NEC and ICEA standards and also meet with P-MSHA Approval. The cable shall have an outer jacket of oil resistant chloroprene rubber and the tinned copper conductors shall be insulated with ethylene-propylene rubber (EPR). The filler and conductor separator materials shall be of non-wicking vulcanized

rubber. One of the conductors shall include markings on its insulation so that the cable may be identified in the event the external marking becomes unreadable. Provide Type 316 stainless steel Kellum support grips for each cable.

2.05 ACCESS GUIDES

- A. The pumping station shall be furnished with the necessary stainless steel upper guide holder .
- B. Lower guide holders shall be integral with the discharge connection. Guide bars shall be 3-inch diameter Schedule 40, Type 316 stainless steel pipe of the length required by the Drawings.
- C. Intermediate guide brackets shall be furnished and installed so that the maximum length of unsupported guide bars will be 15 feet or less, and shall be fabricated of Type 316 stainless steel.
- D. Stainless steel cable holders including the cable hooks shall be fabricated from Type 316 stainless steel plate. Sharp corners and edges shall be ground smooth to prevent abrasion and cutting of electrical cable insulation. The cable holder shall be of sufficient length and strength to provide support for each separate cable, except that the pump power and lift cables may use the same hook position, provided the cables do not foul one another and the lift cable is easily accessed from the hatch opening.

2.06 GENERAL PUMP REQUIREMENTS

- A. Materials for miscellaneous internal parts, which are not specified shall be of material equal in corrosion resistance to impeller.
- B. The casing design pressure shall be 1 ½ times the shut-off conditions for the maximum diameter impeller.
- C. The entire rotating assembly (impeller and shaft) shall be statically and dynamically balanced such that undue vibration or other unsatisfactory characteristics will not result when the pump is in operation.
- D. Shafts shall be designed to transmit full-driven horsepower required by the maximum diameter impeller with which the pump can be fitted when pumping water.
- E. The direction of the starting jerk shall be cleanly marked on the pumping casing.
- F. The interior and exterior surface of the pump casing shall be ground and rubbed smooth.
- G. All discharge connections shall be flanged, drilled, and faced to size in accordance with ANSI standards and latest revisions as applicable.

2.07 PUMP SCHEDULE

- A. The pump schedule shall be as follows:

ITEM	CRITERIA
Number of Pumps	2 – NP3171.185SH Type
Primary Duty Point for Initial Condition	335 gpm @ 166 TDH
Secondary Duty Point for Future Condition	380 gpm @ 184 TDH
Pump Duty Point (RPM)	3520 max
Minimum Motor HorsePower	35 HP @ 480 Volts with a 1.15 S.F.
Minimum Efficiency @ Duty Point	48.5 %
Suction/Discharge	4"
Shutoff Head	200 FT

2.08 MAINTENANCE

A. SPARE PARTS

1. Furnish the following spare parts in accordance with the requirements of Section 1600
 - a. One set of upper and lower mechanical seals for each size pump.
 - b. Two complete sets of all gaskets, O-rings, etc. for each pump.
 - c. One set of cable entry washers/grommets for each pump.
 - d. One set of wearing rings for each pump.
 - e. One set of inspection plugs and washers for each pump.
 - f. One set of impeller bolts and keys for each pump.
 - g. One set of upper and lower bearings for each pump.
2. Spare parts shall be properly bound and labeled for easy identification without opening the package and suitably protected for long term storage in a humid environment.

2.09 SHOP PAINTING

- A. Before exposure to weather and prior to shop painting, all surfaces shall be thoroughly cleaned, dry and free from all mill-scale, rust, grease, dirt and other foreign matter.
- B. All pumps and motors shall be shop coated.

- C. All nameplates shall be properly protected during painting.
- D. Gears, bearing surfaces, and similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be of the type required to prevent corrosion during the period of storage and shall be satisfactory to protect the pumps up to the time of the final acceptance test.

2.10 PUMP STATION CONTROLS

- A. Pump manufacturer shall provide control panel see section entitled "Lift Station Control" of these specifications.
- B. Provide a Multitrode sensor, MTR3 relays and CAS units for installation in lift station control panel specified in the section entitled "Lift Station Control " of these specifications.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation shall be in strict accordance with the Manufacturer's instructions and recommendations and the approved shop drawings in the locations shown on the Drawings. The CONTRACTOR shall furnish all required oil and grease for initial operation, if required, in accordance with the Manufacturer's recommendations. Anchor bolts shall be set in accordance with the Manufacturer's recommendations.
- B. Upon completion of each pump station, the Manufacturer shall inspect the installation and submit 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, lubrication and care of each unit.

3.02 INSPECTION AND TESTING

A. GENERAL

1. The Engineer shall have the right to inspect, test or witness tests of all materials or equipment to be furnished under these Specifications, prior to their shipment from the point of assembly.
2. The Engineer shall be notified in writing prior to initial shipment or testing, in ample time so that the Engineer can make arrangements for inspection.
3. The pump Manufacturer shall perform the following test on each pump prior to shipment from factory:
 - a. Megger motor and pump for insulation breaks or moisture.
 - b. Prior to submergence, the pump shall be run dry and checked for correct rotation.
 - c. Pump shall be run for a minimum of 30 minutes in a submerged condition.
 - d. The pump shall be removed from test tank, meggered immediately for moisture and

upper and lower seal unit shall be checked for water intrusion.

- e. A written certification test report regarding the above tests shall be supplied with each pump at the time of shipment.
4. As specified in Paragraph 3.01 B., the Manufacturer shall furnish the services of a factory Service Technician who shall have complete knowledge of proper operation and maintenance to inspect the final installation and supervise the test run of the equipment. The Manufacturer shall include in his price, a minimum of eight (8) hours of a Service Technician's time per pumping station.
5. Field tests shall not be conducted until such time that the entire installation is complete and ready for testing.
6. In the event that the equipment does not meet the Final Acceptance Test, the CONTRACTOR shall, at his own expense, make such changes and adjustments in the equipment that he deems necessary and shall conduct further tests until the Engineer indicates full satisfaction and written certification is received thereof.

B. PUMPS

1. After all pumps have been completely installed, and working under the direction of the CONTRACTOR, conduct in the presence of the Engineer such tests as are necessary to indicate that pumps conform to the Specifications. Field tests shall include all pumps included under this Section. The CONTRACTOR shall supply all electric power, water, labor, equipment and incidentals required to complete the field tests.
2. The Final Acceptance Test shall demonstrate that all items of these Specifications have been met by the equipment as installed and shall include, but not be limited to, the following tests:
 - a. That the quick release lift out feature functions properly and allows the pump to be raised and lowered without draining the pit.
 - b. That all units have been properly installed and are in correct alignment.
 - c. That the units operate without overheating or overloading any parts and without objectionable vibration.
 - d. That there are no mechanical defects in any of the parts.
 - e. That the pumps can deliver the specified pressure and flow.
 - f. That the pump sensors and controls perform satisfactorily as to sequence control, correct start and stop elevations, and proper level alarm functions.
3. If the pump performance does not meet the Specifications, corrective measures shall be taken or pumps shall be removed and replaced with pumps that satisfy the conditions specified. A 24-hour operating period of the pumps will be required before acceptance.

C. MOTORS

1. The CONTRACTOR shall check all motors for correct clearance and alignment and for correct lubrication in accordance with Manufacturer's instructions. The CONTRACTOR shall check direction of rotation of all motors and reverse connections if necessary.

****END OF SECTION****

SECTION 11500

WETWELL

PART 1 - GENERAL

1.01 DESCRIPTION

Contractor shall provide and install fiberglass wetwell for lift station as shown on the detailed drawings.

PUMP WARRANTY

Wetwell manufacturer shall warrant the units being supplied to the owner against defects in workmanship and material for a period of one (1) year under normal use, operation and service from date of substantial completion. The warranty shall be in printed form and apply to all similar units.

1.02 DESIGN DATA

A. General – Fiberglass reinforced polyester wetwells shall be manufactured from commercial grade polyester resin or vinyl ester resin, with fiberglass reinforcements. The resin system shall be suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid as well as other gases associated with the wastewater collection systems. The wetwell shall be a one piece unit manufactured by L.F. Manufacturing, Inc. of Giddings, Texas or an approved equal.

B. Materials

1. Resin: The resins used shall be a commercial grade unsaturated polyester resin.
2. Reinforcing Materials: The reinforcing materials shall be commercial Grade E type glass in the form of mat, continuous roving, chopped roving, roving fabric or a combination of the above, having a coupling agent that will provide a suitable bond between the glass reinforcement and the resin.
3. Surfacing Materials: If reinforcing materials are used on the surface exposed to the contained substance, it shall be a commercial grade chemical-resistant glass that will provide a suitable bond with the resin and leave a resin rich surface.
4. Fillers and Additives: Fillers, when used, shall be inert to the environment and wetwell construction. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by the specific manufacturing process to be used. The resulting reinforced plastic material must meet the requirement of this specification.

C. Fabrication

1. Exterior Surface: The exterior surface shall be relatively smooth with no sharp projections. Handwork finish is acceptable if enough resin is present to eliminate fiber show. The exterior surface shall be free from blisters larger than ½ inch in diameter, delamination and fiber show. For a UV inhibitor, the resin on the exterior surface of the wetwell shall have gray pigment added for a minimum thickness of 0.125 inches.
2. Interior Surface: The interior surface shall be resin rich with no exposed fibers. The surface shall be free of grazing, delamination and blisters larger than ½ inch in diameter, and wrinkles of 1/8 inch or greater in depth. Surface pits shall be permitted up to 6 square feet if they are less than ¾ inch in diameter and less than 1/16" deep.

3. **Fiberglass Reinforced Bottom:** The bottom to be fabricated using fiberglass material as stated in Section B above. Material and installation to meet all physical requirements as per Section D below. Bottom to be attached to wetwell pipe with fiberglass layup to comply with ASTM D3299 specifications. When reinforcement is necessary for strength, the reinforcement shall be fiberglass channel laminated to wetwell bottom per ASTM D3299.
4. **Integral Internal Fiberglass Fillet:** Fiberglass wetwells and basins may have an internal sloped fillet bottom. The fillet shall be constructed of the same fiberglass material as the wetwell and shall be integral to the wetwell. The fiberglass fillet shall have a 1:1 slope and shall not interfere with pump mounting in the wetwell.
5. **Fiberglass Reinforced Top:** The fiberglass wetwell top shall be fabricated using fiberglass material as stated in Section B above. Material and installation to meet all physical requirements as per Section D below. Top to be attached to wetwell pipe with fiberglass layup to comply with ASTM D3299 specifications. When reinforcement is necessary for strength, the reinforcement shall be fiberglass channel laminated to wetwell top per ASTM D3299.
6. **Installation of Stubouts:** Effluent, service, or discharge lines may be factory installed. Approved methods are PVC sewer pipe, Inserta-Tee fittings, or Kor-N-Seal boots. Installation of stubouts to be fiberglass layup to comply with ASTM D399 specifications.
7. **Defects Not Permitted:**
 - a. **Exposed Fibers:** glass fibers not wet out with resin
 - b. **Resin Runs:** runs of resin or sand on the surface
 - c. **Dry areas:** areas with glass not wet out with resin
 - d. **Delamination:** separation in the laminate
 - e. **Blisters:** light colored areas larger than ½” diameter
 - f. **Crazing:** cracks caused by sharp projectiles
 - g. **Pits or voids:** air pockets
 - h. **Wrinkles:** smooth irregularities in the surface
 - i. **Sharp Projection:** fiber or resin projections necessitating gloves for handling.

D. Physical Requirements

1. **Load Rating:** The complete wetwell shall have a minimum dynamic load rating of 16,000 ft-lbs when tested in accordance with Section E below. To establish this rating, the complete wetwell shall not leak, crack, or suffer other damage when load tested to 40,000 ft-lbs and shall not deflect vertically downward more than ¼ inch at the point of load application when loaded to 24,000 lbs.
2. **Stiffness:** The wetwell cylinder shall have a minimum pipe-stiffness value shown in Table 1 when tested in accordance with Section E below.

Table # 1 Stiffness Requirements

Length (Ft)	F/AY – PSI
10-20	2.01
21-30	3.02
31-40	5.24

3. Physical Properties:

	Hoop Direction	Axial Direction
a. Tensile Strength (psi)	18,000	5,000
b. Tensile Modules (psi)	800,000	700,000
c. Flexural Strength (psi)	26,000	4,500
d. Flexural Modules (psi)		
i. No Ribs (48", 60", 72")	1,400,000	700,000
ii. With Ribs (96", 144")	700,000	700,000

E. Test Methods

Tests shall be performed as specified in ASTM D3753, latest edition, Section 8.

F. Installation

1. General: The limit of excavation shall be such to allow for placing and removing forms, installing sheeting, shoring, bracing, etc. The Contractor shall pile excavated material in a manner that will not endanger the work and will avoid obstructing sidewalks, driveways, power poles, etc. Drainage shall be kept clear.
2. Vertical Sides: When necessary to protect existing or proposed structures or other improvements, the Contractor shall maintain vertical sides of the excavation. The limit shall not exceed three feet outside the footing on a vertical plane parallel to the footing except where specifically approved otherwise by the Engineer. The Contractor shall provide and install any sheeting, shoring and bracing as necessary to provide a safe work area as required to protect workers, structures, equipment, power poles, etc. The Contractor shall be responsible for the design and adequacy of all sheeting, shoring and bracing. The sheeting, shoring and bracing shall be removed as the excavation is backfilled in such a manner as to prevent injurious caving.
3. Sloping Sides: Where sufficient space is available, the Contractor shall be allowed to back slope the sides of the excavation. The back slope shall be such that the excavation shall be safe from caving. The type of material being excavated shall govern the back slope used, but in any case the back slope shall be no steeper than 1 foot horizontal to 1 foot vertical.
4. Dewatering: The Contractor shall keep the excavation free from water by use of cofferdams, bailing, pumping, well pointing or any combination as the particular situation may warrant. All dewatering devices shall be installed in such a manner as to provide clearance for construction, removal of forms, and inspection of exterior of form work. It is the intent of these specification that the foundation be placed on a firm dry bed. The foundation bed shall be kept in a dewatered condition a sufficient period of time to insure the safety of the structure. All dewatering methods and procedures are subject to the approval of the Engineer. The excavation shall be protected from excessive rainfall, drainage and drying. The excavation shall be inspected and approved by the Engineer before work on the structure is started. It is the intent of these specifications that the Contractor provide a relatively smooth, firm foundation bed for footings and slabs that bear directly on the undisturbed earth without additional cost to the Owner, regardless of the soil conditions encountered. The Engineer will

be the sole judge as to whether these conditions have been met. The Contractor shall pile excavated material in a manner that will not endanger the work.

5. Unauthorized Over Excavation: Excavation for slabs, footings, etc. that bear on earth shall not be carried below the elevation shown on the drawings. In the event the excavation is carried on below the indicated elevation, the Contractor shall bring the slab, footing, etc. to the required grade by filling with concrete having a minimum compressive strength of at least 3000 psi at 28 days.
6. Handling: Do not drop or impact the wetwell. Wetwells shall be chocked if stored horizontally. If wetwells must be moved by rolling, the ground transversed shall be smooth and free of rocks, debris, etc. FRP wetwells may be lifted by the installation of two lifting lugs as specified by the manufacturer on the outside surface near the top or by a sling or "choker" connection around the center. Use of chains or cables in contact with the wetwell surface is prohibited. Wetwells may be lifted horizontally using one support point.
7. Open Bottom Wetwell Installation: Bottom of excavation should be compacted to 95% standard proctor density. Pour reinforced concrete base one foot deep and at least two feet larger than the fiberglass wetwell outside diameter. As soon as the concrete has set up enough to support the fiberglass wetwell, lower the wetwell into place. Pour a minimum of one foot of reinforced concrete on the inside, also a minimum of one foot deep and two feet from the fiberglass wetwell wall on the outside of the wetwell. Insert ram neck type sealant on the outside of fiberglass wet well around the bottom where the fiberglass and concrete come together.
8. Cutouts: Cutouts in wetwell wall should be made with proper cutting tools, such as jigsaw or hole saw. Do not use axe or other impact type tools.
9. Installation of Sewer Pipe:
 - a. Type 1 – Make the cutout in the wetwell wall, the outside diameter of the pipe plus 0.5" maximum. Slip pipe into position. Apply industrial grade silicone around the pipe next to the wetwell wall cutout on the inside and on the outside. Cover the outside silicone area with epoxy grout and backfill.
 - b. Type 2 – Make the cutout in the wetwell wall, the outside diameter of the pipe plus 0.5" maximum. Grind the outside surface of the pipe and both the inside and outside surfaces of the cutout in the wetwell wall. (Apply a priming agent to any PVC pipe that might be used before fiberglass lay-up.) Insert the pipe through the cutout in the wall of the wetwell. Apply fiberglass putty to the inside and the outside of the wetwell wall cutout, filling openings between the pipe and the cutout. Make a good radius for the fiberglass lay-up. After putty has set up, fiberglass the pipe into place. Use one layer of woven roving sandwiched between two layers of fiberglass mat. Allow fiberglass to completely set up before backfilling. Fiberglass layup method must comply with ASTM D3299.
 - c. Type 3 – Install Insert-A Tee type fitting per manufacturer's instruction. (Fowler Mfg. Co, PO Box 767, Hillsboro, Or. 97123., Phone 503-359-5417) or approved equal.
10. Closed Bottom Wetwell Installation: Bottom of excavation should be compacted to 95% standard proctor density. Wetwells with diameters up to 54 inches and depths no greater than 12 feet may be placed on a base of 6" of crushed stone. Wetwells with depths greater than 12 feet should have a poured reinforced concrete base at least one foot deep and at least two feet larger than the fiberglass wetwell outside diameter. The fiberglass wetwell shall be lowered

into the wet concrete and brought to plumb. Pour reinforced concrete over the anti-flotation flange. The concrete shall be a minimum of one foot deep and two feet from the outside wall of the wet well. More concrete may be required in high water table areas. In high water table areas, consult with the design Engineer for backfill requirements.

11. Internal Bottom Ribs: Wetwells with internal bottom stiffening ribs will require that concrete be poured on the inside of the wetwell to a depth equal to that of the stiffening ribs. This is typically 4 to 6 inches.
12. Fiberglass Wetwell Top: The fiberglass top may have stubouts installed or may have a raised fiberglass collar around the hatch opening. The fiberglass top has been designed to withstand the weight of a concrete reinforced slab to be installed over it.
13. Backfill:
 - a. Backfill Material – Unless otherwise shown on the drawings, sand or crushed stone shall be used for backfill around the wetwell for a distance of two feet from the outside surface and extending from the bottom of the excavation to the bottom of the top slab. Suitable material chosen from the excavation may be used for the remainder of the backfill. The material chosen shall be free of large lumps or clods which will not readily break down under compaction. This material will be subject to approval by the Engineer. Backfill material shall be free from vegetation or other extraneous material. Excavated materials which are to be used for fill or backfill may be stockpiled on the site. Location of stockpiles shall be approved by the Engineer. Top soil should be stockpiled separately and used for finished grading around the structure.
 - b. Schedule of Backfilling – The Contractor may begin backfilling of wetwell as soon as the concrete has been allowed to cure and the forms removed.
 - c. Backfill Lifts – Backfill shall be placed in layers of not more than 12 loose measure inches and mechanically tamped to at least 95% Standard Proctor Density. Flooding will not be permitted. Backfill shall be placed in such a manner as to prevent any wedging action against the structure.
14. Top Slab Support: When installing a fiberglass wetwell without a fiberglass top, pour a concrete reinforced concrete slab support a minimum of two feet outside of the fiberglass wetwell wall and a minimum of six inches thick. The slab shall be specified and designed by the Engineer.
15. Marking and Identification: Each wetwell shall be marked with the following information:
 - a. Manufacturer's Name or Trademark
 - b. Manufacturing Special Number
 - c. Total Length and Nominal Diameter.

****END OF SECTION****

SECTION 15000

MECHANICAL - GENERAL

PART 1 - GENERAL

1.01 REQUIREMENTS

- A. All systems shall be installed complete and ready for operation. The Contractor shall be held strictly responsible for the quality of materials and their workmanlike installation and for the initial operation of the system.
- B. The entire work must be executed in a neat, substantial and workmanlike manner, according to the plans and specifications. This Contractor is to include everything dependent upon them and necessary for the entire finishing and completion of the work with the material best suited for the purpose. Interpretations of the plans and specifications, if in doubt, must be resolved prior to beginning work.

1.02 PERMITS AND INSPECTIONS

- A. The Contractor shall secure and pay for all permits and inspections by the City, County, and State Authorities having jurisdiction.
- B. All work shall be done in accordance with The Standard Plumbing Code and the State of Georgia Mechanical Code.
- C. Applications for permits shall be paid for and obtained by the Contractor prior to beginning work.
- D. Tap fees, meter fees, and special assessments not a part of inspection fees shall be paid by the General Contractor.

1.03 DRAWINGS AND SPECIFICATIONS

- A. In case supplementary drawings or specification are furnished later as clarifications to the design, they shall be accepted and incorporated as if originally issued. Changes to the drawings and specifications shall be reviewed by the Engineer.
- B. This Contractor shall refer to the architectural interior details, floor plans, elevations, and to the structural, plumbing, and electrical drawings and coordinate his work with that of the other trades to avoid interference, etc. The plans are diagrammatic and show generally the locations of the equipment, pipe lines, ducts, and other material, but are not to be scaled. All dimensions, and existing conditions, etc., shall be checked at the site.

1.04 TOOLS, EQUIPMENT AND MATERIALS

Furnish all tools, machinery, hoists, equipment and all material for the proper completion of the work.

1.05 CUTTING AND PATCHING

Perform all the cutting necessary for the installation of the work, but do not cut the work of other trades without the written consent of the Architect or his representative. Repair all cutting by patching or reinforcing to the satisfaction of the Architect or his representative. Notify the construction superintendent of all cutting or patching and reinforcing planned prior to actual cutting or patching.

1.06 SAFETY

- A. Assure that operation of the building mechanical system shall be supervised by competent personnel and adequate mechanical and electrical safety devices, as called for in these specifications or on the drawings, shall be installed and operating. Notify the Architect in writing of any potentially hazardous mechanical equipment operation for which adequate safeguards cannot be maintained.
- B. Provide sufficient guard lights, warnings, barriers, and safeguards for the proper protection of all persons against the occurrence of injury to any person during the progress of the work. If such injury shall occur caused by carelessness or neglect of this Subcontractor or his employees or agents, then he alone shall be held responsible, and he shall provide defense to all others enjoined in any legal action.
- C. Provide shoring and bracing for all excavations deeper than five feet, and assure a safe excavation procedure. No person shall be assigned work in such deeper excavations except for the purposes of shoring and bracing. Provide sloping sides away from the trenches as needed to prevent cave-ins. Supervise all excavations to assure that proper safety precautions are followed and that safe work is performed.

1.07 SUBSTITUTIONS

- A. Where material or equipment is specified herein or on drawings by manufacturer's name and or part number, this shall denote the minimum requirements as to quality, capacity, type, shape, weight, material, function and/or performance. Listings of brand names and model numbers are for the purposes of establishing a standard for performance.
- B. Substitutions of material or equipment may be made, provided that Architect's requirements for 10-day prior approval (if required) have been met, and provided that product data submitted to the Architect has been reviewed and found to be acceptable for installation. In such allowed substitutions, contractor shall bear all responsibility and expense for making required changes to the space, connections, structure, and electrical systems. Subcontractor shall also be responsible for providing all coordination of other trades for the changing of their work to accept the changes caused by the substitution.

1.08 SUBMITTALS

- A. Submit five copies of submittals for review by the Architect and Engineer. Review provides a guidance to the subcontractor to assist in accomplishing the intent of the drawings and specifications. Subcontractor alone is responsible for complying with the plans and specifications.

1.09 GUARANTEES

- A. This subcontractor shall provide a written guarantee to the Owner that he will promptly repair or replace for a period of one year after the date of final approval by the Government inspection agency any faulty material or items that do not comply with specifications, including workmanship.

****END OF SECTION****

SECTION 15050

LIFT STATION PIPING MATERIAL AND INSTALLATION

1. REQUIREMENTS
 - A. The general provision of the contract including the Conditions of the contract (General, Supplementary and Other Conditions) apply to work specified in this Division.
2. CODES
 - A. The plumbing installation and equipment shall conform to the State of Georgia Plumbing Code as in effect at the time the plumbing permit is issued.
3. PERMITS AND INSPECTIONS
 - A. Obtain all permits and inspections for the installation of this work and pay all charges incident thereto. Deliver to the Owner all certificates of said inspections issued by authorities having jurisdiction.
4. EXCAVATION, TRENCHING, AND BACKFILLING
 - A. Perform all excavation to install piping herein specified. All excavated materials not be used for backfilling shall be removed and disposed. All excavation shall be made by open cut. No tunneling shall be done.
 - B. The bottom of the trenches shall be graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length, except for the portions of the pipe sections excavated for sealing of pipe joints. Depressions for joints shall be dug after the trench bottom has been graded. Overdepths shall be backfilled with loose, granular, moist earth, tamped.
 - C. The trenches shall not be backfilled until all specified pressure tests are performed. Trenches shall be backfilled with the excavated materials, free from large clods of earth and stones, deposited in 6" layers and tamped until the pipe has a cover of not less than the adjacent existing ground, but not greater than 2" above the existing ground. The backfilling shall be carried on simultaneously on both sides of the trench so that injurious side pressures do not occur. The compaction of the filled trench shall be at least equal to that of the surrounding undisturbed material. Settling the backfill with water will not be permitted. Reopen any trenches not meeting compaction requirements or where settlement occurs, refill, compact, and restore the surface to the grade and compaction specified above.
5. SHOP DRAWINGS
 - A. Submit for approval by the Engineer a complete schedule and data of materials and equipment to be incorporated in the work. Submittals shall be supported by descriptive

material, catalog cuts, diagrams, performance curves, and charts published by the manufacturer to show performance to specification and drawing requirements; model numbers alone will not be acceptable.

B. Each individual submittal item for materials and equipment shall be marked to show specification section and paragraph number which pertains to the item. Failure to mark submittals in accordance with the above format shall be due cause for rejection of submittals.

C. Submittals shall be made for each of the following items. (5 copies each).

1. Valves
2. Pipe Supports
3. Insulation Mastics
4. Pressure Relief Valve
5. Hydrants
6. Hose Bibs and Vacuum Breakers
7. Shock Absorbers
8. Plumbing
9. Cleanouts
10. Drains
11. Gates
12. Pressure Switches
13. Air & Vacuum Valves

6. PAINTING

A. Factory painted equipment that has been scratched, marred, or rusted shall be cleaned and repainted to match original color.

7. CLEANING AND ADJUSTING

A. All equipment, pipe, valves, and fittings shall be cleaned of grease, oil, paint spots, metal cuttings, sludge, and construction debris. All adjustable fittings shall be adjusted for correct operation.

8. OPERATION AND MAINTENANCE INSTRUCTIONS

A. Operating and Maintenance Instructions, printed and bound in hard cover three ring loose leaf notebooks, shall be provided for the items listed below; 5 separate copies shall be provided. Each notebook shall be provided within an identifying label under a clear plastic shield on the front cover which shall identify the Project, General Contractor, Plumbing Contractor (with telephone number) and Date.

1. Valves
2. Gates
3. Hydrants

4. Piping Fixtures
5. Copy of Original Warranty for each item

B. Prior to the final inspection and at a time designated by the Engineer, the services of a competent representative shall be provided by the Contractor to instruct the Owner in the Operation and Maintenance of all equipment.

9. GUARANTY

A. The components of the Piping Systems furnished under this division of the specifications shall be guaranteed for a period of one year from the date of final acceptance, against defective materials, installation and workmanship. Upon receipt of notice from the Owner or Engineer of failure of any part of the equipment during the guaranty period, the affected part or parts shall be replaced promptly. This includes removing the defective part or parts, and replacing and installing the new part or parts at no expense to the Owner or Engineer.

****END OF SECTION****

SECTION 15060
PIPE COUPLINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included:

The work covered by this Section includes furnishing all labor, equipment and materials required to furnish and install pipe couplings and flanged adapters as shown on the Drawings, specified herein, or required for proper installation of piping and equipment.

1.02 QUALITY ASSURANCE

A. Qualifications of installer:

1. For the actual fabrication, installation, and testing of work under this Section, use only thoroughly trained and experienced workmen completely familiar with the items required and the manufacturer's current recommended methods of installation.

B. Acceptable Manufacturers:

Pipe couplings and flanged adapters shall be as manufactured by EBAA Iron, Inc., Dresser Industries, Inc., or alternate approved by the engineer.

C. Reference Standards

1. American Society of Testing Materials (ASTM)
2. American National Standards Institute (ANSI)
3. American Water Works Association (AWWA)
4. American Standards Association (ASA)

PART 2 - PRODUCT

2.01 PIPE COUPLINGS

A. General

Unless otherwise shown or specified, pipe couplings shall be of a gasketed, sleeve type, with diameter to properly fit the pipe. Each coupling shall consist of one (1) steel middle ring, two (2) steel followers, two (2) rubber-compound wedge section gaskets, and sufficient trackhead steel bolts to properly compress the gaskets.

B. Design

1. The middle ring and followers of the coupling shall be true circular sections free from irregularities, flat spots, or surface defects. They shall be formed from mill sections with the follower-ring section of such design as to provide confinement of the gasket. Middle rings shall not be provided with pipe stops.
2. Coupling bolts shall be of the elliptic-neck trackhead design with rolled threads. All bolt holes in the followers shall be oval.
3. Gaskets shall be composed of crude or synthetic rubber base compounded with other products to produce a material, which will not deteriorate with age, from heat, or exposure to air under normal working conditions. It shall also possess the quality of resilience and

ability to resist cold flow of the material so that the joint will remain sealed and tight indefinitely when subjected to shock, vibration pulsation, and temperature or other adjustments of the pipe line.

4. Pipe couplings shall be harnessed for all pressure pipelines. Dimensions, sizes, spacing, and materials for lugs, tie bolts, washers, and nuts shall conform to the standards of EBAA Iron, Inc., Dresser Industries, or equal, for pipe size, wall thickness, and for the working pressure required. Not less than two (2) bolts shall be furnished for each coupling.

2.02 FLANGED ADAPTERS

- A. Flanged adapters consisting of a flanged steel nipple and compression end connection shall be provided where indicated on the Drawings or required. Flanges shall be drilled as specified for ductile iron pipe. The compression fitting shall consist of a gasket, follower-ring and track-head bolts as specified for flexible couplings.
- B. Design
 1. Flanged adapters shall be harnessed for all pressure pipelines. Harnessing shall be comprised of flanged adapters furnished with bolts extending to adjacent pipe flanges for ductile iron pipelines; where the distance between the flanged coupling adapter and the adjacent pipe flange is greater than 2 feet, the bolts may be extended to steel lugs provided on the adjacent may be extended to steel lugs provided on the adjacent pipe flanges. Dimensions, sizes, spacing and materials for tie bolts, washers and nuts shall conform to the standards of EBAA Iron, Inc., Dresser Industries, or approved alternate, for pipe size, wall thickness and working pressures. Not less than four (4) bolts shall be furnished for each adapter.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Pipe couplings and adapters shall be installed where shown on the Drawings, or required. Couplings and adapters shall be installed in strict conformance with the manufacturer's instructions.
- B. Pipe ends shall be cleaned, brushed, or filed to produce a mating surface for the gasket that is free from dirt, rust, chuck marks, mill scores, dents, burrs or other foreign substances that would impede proper gasket seating.
- C. A lubricant recommended by the coupling manufacturer shall be used in seating all gaskets.
- D. On pipe couplings, bolts shall be tightened diametrically opposite each other and in progression so that the inner rims project an equal distance over the flares of the middle ring at all points. Bolts shall be tightened sufficiently to incur a watertight joint but shall not be tightened beyond the point of stretching.
- E. All exposed couplings and flanged adapters shall be painted in accordance with the manufacturer's requirements. All buried couplings shall be given a heavy coat of an approved bitumastic paint after the joints are completed.

****END OF SECTION****

SECTION 15062
DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A Furnish all labor, equipment and materials required to furnish, install, test and place in satisfactory service all ductile iron pipe, ductile iron pipe fittings, wall pipes and sleeves, special fittings, gaskets, bolts and accessories and all comparable cast iron fittings at the locations specified, shown on the Drawings or as otherwise directed by the Engineer.

1.02 GENERAL

All Ductile Iron Pipe and/or fittings utilized for sanitary sewers shall be furnished, installed and tested for acceptance in accordance with the latest edition of the CCWSA Sanitary Sewer Standards.

END OF SECTION

SECTION 15063

COPPER PIPE

1. DESCRIPTION

A. Work Included: Furnish all labor, equipment and materials required to furnish, install, test and place in satisfactory service all copper piping including all fittings, sleeves, unions and accessories, as specified herein, as shown on the drawings or as required for a complete installation.

1. The Contractor's attention is called to the fact that all copper pipe is not necessarily shown on the drawings, which are more or less schematic. However, the contractor shall furnish and install all pipe fittings and do all piping work indicated or required for the proper operation of all equipment and services requiring such piping.

2. GENERAL

All copper piping used for water service shall meet the requirements for materials, installation and testing as specified in the latest edition of the CCWSA Water Specifications.

****END OF SECTION****

SECTION 15094

PIPE SUPPORTS AND HANGERS

PART 1 – GENERAL

1.01 DESCRIPTION

This section covers all pipe supports, hangers and brackets necessary to install piping furnished under these Contract Documents. The Contractor shall furnish and install all foundations, anchor bolts, pipe supports, shims, hangers, clamps and hardware required for a complete installation as shown on the Drawings and/or specified herein.

1.02 SHOP DRAWINGS AND ENGINEERING DATA

Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of the section entitled “Shop Drawings, Product Data and Samples” of these Specifications.

1.03 STORAGE AND PROTECTION

Pipe supports and accessories shall be stored and protected in accordance with the requirements of the section entitled “General Equipment Stipulations” of these Specifications.

1.04 SHOP PAINTING

Fabricated pipe supports and accessories, except where shown on the Drawings to be galvanized, shall be cleaned and shop primed in accordance with requirements of the section entitled “Painting” of these Specifications.

1.05 GURANTEE

Provide a guarantee against defective equipment and workmanship in accordance with requirements of the section entitled “Warranties and Bonds” of these Specifications.

PART 2 – PRODUCT

2.01 MATERIALS

A. All supports and hangers shall meet the following material requirements:

1. All structural steel shall conform to ASTM A 36.
2. All pipe support columns shall conform to ASTM 53, Grade B, and shall be minimum schedule 40.
3. All embedded anchor bolt materials shall conform to ASTM A 193, Grade B8; ASTM A 276, Type 304; or IFI-104, Grade 304. Nuts shall be heavy hex nuts conforming to ASTM A 194, Grade 8 or IFI-104, Grade 304. Minimum anchor bolt size for pipe supports shall be ½ - inch diameter.
4. All rod and bolting materials in contact with cold piping (less than - 20°F) shall conform to ASTM A 320, Grade B8. Nuts shall be heavy hex nuts conforming to ASTM A 194, Grade 8 or 8T.
5. All rod and bolting materials shall conform to ASTM A 307. Grade B. Nuts shall be heavy hex nuts conforming to ASTM A 307.

6. All carbon steel or malleable iron straps, hangers, clamps, U-bolts, and other hardware in contact with the pipe shall be shop primed, except where specified or shown on the Drawings to be galvanized.
7. Expansion type anchor bolts shall be of stainless steel construction and shall comply with Federal Specification FF-S-325.
8. Long runs of pipe subject to expansion shall be hung by means of adjustable swivel pipe roll hangers, Grinnell, Figure 174; Fee and Mason, Figure 2729; or equal.
9. Short runs of uninsulated pipe subject to expansion in sizes up to and including 3 ½ inches as well as pipe of those sizes **not** subject to expansion shall be hung by means of adjustable swivel, split pipe ring, Grinnell, Figure 104; Fee and Mason, Figure 199; or equal.
10. Insulated piping and tubing, short lengths of 4 inches and larger pipe subject to expansion, and pipe 4 inches and larger **not** subject to expansion shall be hung by means of adjustable steel clevis hangers, Grinnell, Figure 260; Fee and Manson, Figure 239; or equal.
11. Pipe 2 inches and less in diameter and not subject to expansion may, when paralleling walls, be supported by single hook clamp hangers, Grinnell, Figure 168; Fee and Mason, Figure 327B, or equal.
12. Flat straphangers will not be permitted. Hangers relying on mastics or adhesives shall not be used.
13. Pipe supported from underneath and subject to expansion shall have adjustable pipe roll stand supports, Grinnell, Figure 274; Fee and Mason, Figure 161; or equal. The pipe roll stand shall be supported by concrete piers, structural steel, or steel brackets as required.
14. Pipe supported from underneath and not subject to expansion shall have adjustable pipe supports as shown on the Drawings. Supports shall be properly sized and ample properly grouted floor flanges. Adjustable pipe supports shall be Standon Model S89 Flange Support or Engineered approved equal.
15. Hangers suspended from structural steel shall be anchored on U.F.S. beam clamp, Grinnell, Figure 228L or 2921; Fee and Mason, Figure 252L or 253L; or equal with links as required.
16. Hangers from concrete work shall be secured by universal, galvanized metal inserts, Grinnell, Figure 282; Fee and Mason, Figure 2570; or equal, placed in the concrete at the time of pouring. Wooden plugs or other improvised means shall not be used for any form of hanger fastening.
17. Steel or concrete pipe supports for all piping between undisturbed earth and face of structures shall be in accordance with details shown on the Drawings.
18. All interior and exterior concrete piers shall be Class A concrete meeting the requirements of these Specifications.
19. Rods for supporting suction bells or foot valves of pump intakes shall be stainless steel of the size shown on the Drawings. The rods shall be furnished complete

with stainless steel turnbuckles and eyes or other approved means for connection to the suction bell and stainless eyebolt anchored in the concrete. Supports for other pump suction pipelines shall be as shown on the Drawings.

20. Uninsulated copper tubing shall be hung by means of copper-plated, split ring hangers with copper-plated sockets, Grinnell Figure CT-109, Fee and Mason Figure 360, or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Contact between ferrous supports and non-ferrous piping materials shall not be permitted. Supports and clamps shall be rubber coated or copper plated as necessary to prevent this condition.
- B. Adequate supports shall be provided so that there is no movement or visible sagging between supports.
- C. Hangers shall permit a minimum of 1 ½ inch vertical adjustment after installation.
- D. Hanger rods shall be carbon steel conforming to the following sizes:

Rod Diameter, Inches	Pipe Size, Inches
½ and under	¼ – 2
5/8	2 ½ - 4
¾	5-8
7/8	10 and up

- E. Carbon steel, alloy steel, stainless steel, and hard-drawn copper pipe shall be supported on maximum intervals as follows:

Pipe Size, In	Maximum Interval for Steel, Feet Liquid	Maximum Interval for Steel, Feet Gas	Maximum Interval for Copper, Feet
½	5	6	4
¾	6	7	5
1	7	9	6
1 ½	9	11	8
2	10	13	9
2 ½	11	14	10
3	12	15	11
4	13	17	-
6	17	21	-

8	19	24	-
10	22	27	-
12	23	29	-
14	25	32	-
16	27	35	-
18	28	37	-
20	30	39	-
24	32	42	-

- F. Annealed copper tubing, polyethylene tubing, and PVC piping shall be supported on maximum intervals as follows:

Tube Size, In.	Maximum Interval, Ft.
and smaller	2
$\frac{1}{2}$ -	3
$\frac{3}{4}$ - 1	4
1 $\frac{1}{4}$ - 2	5
2 $\frac{1}{2}$ - 3 $\frac{1}{2}$	6
4	7
6	8

- G. Where indicated or directed by the Engineer, exposed piping and tubing carrying liquid shall be sloped as necessary to permit complete draining. Pipe deflection between supports shall be considered when determining the slope required to permit complete drainage. All underground piping shall be sloped uniformly for complete drainage.
- H. Cast iron or ductile iron piping shall be supported as recommended by the manufacturer, and at all valves and fittings larger than 4 inches in size as shown on the Drawings. At least one support shall be provided per pipe section or at every other joint, whichever is closer. Supports shall be located next to hubs or bells.
- I. Pipe ends of pipe columns used for support shall be completely covered with a $\frac{1}{4}$ - inch-thick plate or angle leg welded in place.
- J. All threaded connections installed loose, such as hanger rods and U-bolts, shall have a double nut installation.
- K. Vertical piping shall be supported as shown or required to prevent buckling or swaying utilizing special brackets. Unless otherwise shown, vertical piping shall be supported at the bottom and at each floor. Vertical copper tubing 1 inch and smaller in size shall be supported at 5-foot intervals.

- L. Provide a support within 18 inches of each elbow and within 24 inches of each equipment connection.
- M. Pipes passing through non-load bearing walls and partitions shall not bear on building construction. Pipes shall not be supported from roof decking, bar joists, or ceiling suspension systems unless approved by the Engineer.
- N. Insulation on hot piping (carrying fluids above 70° F) shall be protected at supports and hangers with 12-inch long galvanized steel protection saddle with welded center support. Protection saddle shall be Grinnell Figure 160 or 161, Fee and Mason Figure 171 or 1710, or equal.
- O. Insulation on cold piping (carrying fluids at 70° F or below) shall be protected at supports and hangers by galvanized steel insulation shields with 180° contour. Insulation shields shall be Grinnell Figure 167, Fee and Mason Figure 81, or equal.
- P. On insulation finished with an aluminum jacket, a 1/32-inch thick sheet of neoprene shall be provided between the jacket and the shield.
- Q. Hangers shall be selected to fit around insulation.
- R. Following installation all pipe supports shall be field primed and painted with the specified painting system for the application in accordance with requirements of the section entitled "Painting" of these Specifications.
- S. Unless otherwise shown, piping shall not be fastened to a support in such a manner that would prevent axial movement due to thermal expansion and contraction.
- T. No pipe supports shall be anchored to or supported from floor grating.
- U. Unless otherwise noted, piping dimensions shown on the Drawings are for reference only and shall be verified in the field by the Contractor. The Contractor shall size supports and hangers using actual field dimensions.

****END OF SECTION****

SECTION 15100

VALVES

PART 1 - GENERAL

1.01 DESCRIPTION

The work covered by this section includes furnishing all labor, equipment, and materials required to install all valves, including operators, boxes, and accessories, as specified herein, shown on the Drawings, or required for proper completion of the work of this Section. .

1.02 QUALITY ASSURANCE

- A. American Society of Testing Materials (ASTM)
- B. American National Standards Institute (ANSI)
- C. American Water Works Association (AWWA)
- D. American Standards Association (ASA)
- E. Commercial Standard (CS)

1.03 SUBMITTALS

Product Data

- A. Submit shop drawings on all valves. Shop drawings shall include location of actuators and associated hand wheels, levers or devices for Engineer approval.
- B. Submit complete operation and maintenance data on 8" and larger valves in accordance with the requirements of the Operation and Maintenance Data of these Specifications.
- C. Provide a guarantee against defective equipment and workmanship in accordance with the requirements of the Warranties and Bonds.

1.04 PRODUCT HANDLING

A. PROTECTION:

Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

B. STORAGE:

Provide a covered storage area for stockpiled products.

C. REPLACEMENT:

In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 GENERAL

Unless otherwise specified or indicated, valves shall be suitable for 175 pound working pressure.

All castings, regardless of material, shall be free from surface defects, swells, lumps, blisters, sandholes, to other imperfections.

All valves shall have the name of the manufacturer, rated working pressure, and size of the valve cast upon the body or bonnet in raised letters. Alternately, the name of the valve manufacturer, rated working pressure, and size may be stamped on a stainless steel identification plate permanently attached to the valve body or bonnet. Valves specified to conform with AWWA requirements shall have the letters "AWWA" cast upon the valve body or bonnet in raised letters.

Unless otherwise specified, the direction of rotation of the operator to open the valve shall be to the left (counter-clockwise). Each valve body or operator shall have cast thereon the word OPEN and an arrow indicating the direction to open.

Where required for satisfactory operation of valves, provide extension stems, stem guides, cast iron valve boxes, floor boxes, handwheels, floor stands and other valve appurtenances. Extension stems shall be complete with guide bearings, wrench nut and tee-handle wrench. All valve items and machinery stuffing boxes shall be packed with materials selected for the service intended. All packing shall be maintained until final acceptance by the Owner.

Buried valves shall be installed where shown. They shall be cleaned and manually operated before installation. Valves shall be set vertically and in a closed position and shall be kept closed until otherwise directed by the Engineer. An approved valve box constructed of cast iron with a round base shall be provided on each valve. The valve box shall be of the sliding type with a 5 inch shaft and the cover shall be slotted for easy removal. The valve box shall be set carefully, truly vertical, and accurately centered over the valve with top at finished graded elevation and shall have a protective concrete pad as shown on the Drawings. It shall be set so as not to transmit traffic loads to the valve.

2.02 SHOP PAINTING

All interior ferrous metal surfaces of valves except for seating surfaces shall receive two (2) coats of epoxy paint.

All exterior ferrous metal surfaces of valves that will not be buried shall receive at least one (1) coat of epoxy paint.

All exterior ferrous metal surfaces of valves that will be installed in buried locations shall receive a heavy bituminous coating or two (2) coats of epoxy paint.

2.03 AIR-CUSHIONED CHECK VALVES

A. CONSTRUCTION

1. The valve shall have a heavy duty body shall be constructed of high-strength cast iron conforming to ASTM A126 Class B with integral flanges, faced and drilled per ANSI B16.1 Class 125 and be suitable for horizontal or vertical installation.

2. The valve body shall be the full waterway type, designed to provide a net flow area not less the nominal inlet pipe size when swung open no more than 25 degrees. The valve shall have a replaceable bronze body seat.
3. Valve disc shall be cast iron and faced with a renewable resilient seat ring of rubber or other suitable material approved by the Engineer, held in place by a follower ring and stainless steel screws.
4. The disc arm shall be ductile iron or steel, suspended from and keyed to an austenitic stainless steel shaft which is completely above the waterway and supported at each end by heavy bronze bushings. The shaft shall rotate freely without the need for external lubrication. The shaft shall be sealed where it passes through the body by means of a stuffing box and adjustable packing. Simple O-ring shaft seal are NOT acceptable.
5. The valve shall be supplied with an outside lever and adjustable counterweight to initiate valve closure. Final closure shall be damped by means of single, side-mounted bronze air-cushion assembly directly mounted to the valve body on machined pads. The amount of cushioning shall be easily adjustable without the need for pre-charged air chambers. Commercial air cylinders which pivot and/or are attached with fabricated brackets are NOT acceptable.

B. FUNCTION

1. The valve shall swing open smoothly at pump start and close quickly and quietly upon pump shutdown to prevent flow reversal. When closed, the valve shall seat drop tight.

C. MANUFACTURER

1. The valve shall be GA Industries, Inc. Figure 250-D or Engineer approved alternate.

2.04 ECCENTRIC PLUG VALVES

- A. Plug valves shall be of the 90 degree turn, non-lubricated, serviceable (able to be repacked) under full line pressure and capable of sealing in both directions at the rated pressure. The disc shall be completely out of the flow path when open. Plug valves specified herein shall be by DeZurik, Val-Matic, M & H Valve Company or Engineer approved alternate.
- B. Valves 24-inch and smaller shall have a minimum 80 percent open port area. Valves larger than 24-in shall have a minimum 80 percent port area as measured by the percent cross-sectional area of equivalent size (nominal same diameter) pipe
- C. Manufacturer shall submit tables showing Cv values versus percent open for ENGINEER's review.
- D. Valves shall be rated at minimum 175 psi W.O.G. (Water, Oil and Gas) working pressure for sizes 4-inch to 12-inch inclusive and at minimum 150 psi W.O.G. working pressure for sizes 14-inch and larger.

1. All plug valves under this paragraph shall be performance, leakage and hydrostatically tested in accordance with AWWA C504, except as herein modified.
 2. At the above rated minimum working pressures, the valves shall be certified by the manufacturer as permitting zero leakage for a period of at least one-half hour with pressure applied to the seating face.
 3. At the direction of the Engineer, the valve manufacturer may be requested to perform a valve seat leakage test, witnessed by the Engineer to prove compliance with these Specifications.
- E. Valve bodies shall be of cast iron, 30,000 psi tensile strength, ASTM A126, Grade B, and of the top entry, bolted bonnet design, cast with integral flanges conforming to the connecting piping. All exposed bolts, nuts and washers shall be zinc or cadmium-plated, except for buried or submerged valves, which shall have Type 316 stainless steel hardware.
- F. Plugs shall be ASTM A126 Class B cast iron. Plugs shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. With the plug in the closed position, the interference between the plug face and the body seat shall be externally adjustable in the field with the valve in line under pressure. The plug shall be completely coated with a hycar compound suitable for use with sewage. Plugs on valves in chemical sludge piping (any sludge piping exposed to alum, ferric chloride, etc.) shall be coated with a pure synthetic viton compound of a minimum of 70 durometer hardness bonded to the plug. The hycar and viton shall be applied at the factory to ensure that the plug is completely coated and then heat-treated to ensure a positive bond. Following this process, bare cast iron shall not be visible nor exposed in the flow area to ensure that the plug is abrasion resistant and suitable for service in raw wastewater, sludge, and chemically treated wastewater and sludge applications.
- G. Valves shall have sleeve type metal bearings and shall be of sintered, oil impregnated permanently lubricated Type 316 ASTM A743 Grade CF-8M in 1/2-in to 36-in valve sizes. For valves larger than 36-in, the upper and lower plug journals shall be fitted with ASTM A-240 Type 316 stainless steel sleeves with bearings of ASTM B30 Alloy C95400 aluminum bronze. Non-metallic bearings shall not be acceptable.
- H. True eccentric action shall be required. Design of the valve shall provide for a rectangular port that allows contact between the welded nickel seat and the plug to occur only in the final 3 degrees of plug movement. Round ported valves as well as other non-eccentric action valves shall not be acceptable. ENGINEER reserves the right to visit the manufacturing facility to witness the eccentric action of partially assembled valves and to verify size and shape of the port area as well as the welded nickel seat.
- I. The methods of mounting the actuator to the valve shall provide an air gap between the two. Actuator shall clearly indicate valve position and an adjustable stop shall be provided. Construction of actuator housing shall be semi-steel. Hardware on actuators shall be of the same materials as the valves.
- J. Valve actuators for manual valves shall have lever or gear actuators and tee wrenches, extension stems, floorstands, extended bonnets, etc., as shown on the Drawings. Extended bonnets shall have the gear located at the operator. Stem

extensions with handwheel operators shall not be acceptable. Valves 4-in and larger shall be equipped with gear actuators. Gearing shall be enclosed in a semi-steel housing and shall 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 and to provide seat adjustment to compensate for changes in pressure differential or flow direction. Exposed nuts, bolts and washers shall be zinc plated.

- K. Valve and gear actuators for buried or submerged service shall have seals on the shafts and gaskets on the valve and actuator covers to prevent entry of liquid. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. Exposed nuts, bolts, and washers shall be stainless steel.
- L. Valves and actuators shall be fully manufactured in the USA. Foreign and/or imported components, castings, and assembly shall not be acceptable. Documentation of this requirement shall be furnished upon request.
- M. Plug valves shall be installed so that the plug rotates around a horizontal axis. The plug shall be stored in the top when the valve is in the open position and shall seat in the direction opposite the high-pressure side.

2.05 SEWAGE SURGE RELIEF VALVES

- A. Main valve body shall be elbow pattern of cast iron conforming to ASTM A126 Class B, with integral flanges, faced and drilled per ANSI B16.1 Class 125. The valve body shall be inherently self-cleaning and have a net flow area through the valve no less than the area of its nominal pipe size. The body shall have a removable bronze seat.
- B. The valve disc shall be cast iron or steel with a renewable, resilient seat ring of rubber or other suitable material and retained by a bronze or stainless steel follower ring and stainless steel screws. The valve stem shall be stainless steel bushing retained in the valve cover. The valve stem shall be sealed where it passes through the body by dual seals separated by a lantern ring with external leak detection port.
- C. Sizes through 8" shall have dual compression springs; larger valves shall have a single compression spring. Springs shall be encased in steel cylinders; exposed springs or tension springs are NOT acceptable. An integral hydraulic system shall permit opening and adjustable, slow closing without the need of pre-charged cylinders. The valve shall be fully capable of operating in any position
- D. The valve shall be factory tested and set to open at a pre-determined pressure. Springs shall permit field adjustment from zero to 10 percent above factory setting.
- E. The surge relief valve shall open quickly when the system pressure exceeds its setting, remain open as long as the pressure exceeds this setting, and slowly close drop tight when the pressure subsides below the spring setting.
- F. The valve shall be GA Industries, Inc. Figure 625-D or engineered approved equal.

2.06 AIR/VACUUM RELEASE VALVES

- A. The Sewerage Air Release and Vacuum Break Valve shall consist of a compact tubular all stainless steel fabricated body, hollow direct acting float and solid large orifice float in HDPE – stainless steel nozzle and woven dirt inhibitor screen, nitrile rubber seals and natural rubber seat.
 - B. The intake orifice area shall be equal to the nominal size of the valve i.e., a 6” valve shall have a 6” intake orifice. Large orifice sealing shall be affected by the fact the flat face of the control float seating against a nitrile rubber “O” ring housed in a dovetail groove circumferentially surrounding the orifice.
 - C. The valve shall have an integral “Anti-Surge” Orifice mechanism which shall operate automatically to limit surge pressures or shock induced by liquid oscillation and/or rapid air/gas discharge to less than 1.5 x valve rated working pressure.
 - D. Discharge of pressurized air shall be controlled by the seating and unseating of a small orifice nozzle on a natural rubber seal affixed into the control float. The nozzle shall have a flat seating land surrounding the orifice so that damage to the rubber seal is prevented.
 - E. The valve construction shall be proportioned with regard to material strength characteristics, so that deformation. Leaking or damage of any kind does not occur by submission to twice the designed working pressure.
 - F. Connection to the valve inlet shall be facilitated by flanged ends conforming to PN10,16 or 25 ratings of BS 4504 or SABS 1123 Standards or, ANSI B16.1 Class 125 and Class 250 and ANSI B 16.5 Class150 and Class 300 Standards.
 - G. Flanged ends shall be supplied with the requisite number of stainless steel screwed studs inserted for alignment to the specified standard. **Nuts, washers or jointing gaskets shall be excluded.**
 - H. Prior to the ingress of liquid into the valve chamber, as when the pipeline is being filled, valves shall vent through the “Anti-Surge” orifice when sewage approaches velocities are relative to a transient pressure rise, on valve closure, of <1.5 x valve rated pressure.
 - I. Valves shall not respond to the presence of air/gas by discharging it through the small orifice at any pressures within a specified design range, i.e., 0.5 bar to 10 bar and shall remain leak tight in the absence of air.
 - J. Valves shall not exhibit leaks or weeping of liquid past the large orifice seal at operating pressures of 0.5 bar to 1.5 x rated working pressure.
 - K. Valves shall react immediately to pipeline drainage or water column separation by the full opening of the large orifice so as to allow unobstructed air intake at the lowest possible negative internal pipeline pressure.
- The valve shall be 2” Vent-O-Mat Series RGXb-DN50, or Engineered approved alternate.

2.07 AIR RELEASE VALVES

A. The Sewage Air Release Valve shall be float operated and shall employ a compound lever mechanism to enable the valve to automatically release accumulated air and gasses from a sewage pipeline while the system is pressurized and operating. Valve shall be rated for a working system pressure of 150 psi minimum.

B. The Air Release Valve shall closed drop tight, incorporating an adjustable Buna-N orifice button. All internal metal parts shall be of stainless steel. The linkage/lever mechanism shall be able to be removed from the valve without disassembly of the mechanism. The float shall be stainless steel and be capable of withstanding a 1000 PSIG test pressure.

C. The body and cover shall be of cast iron conforming to ASTM A 126 Class B. Inlet connection shall be 2" NPT and outlet connection shall be ½" NPT. Contractor shall extend outlet connect to the drain system with 1" PVC piping. Valve shall be fitted for flushing attachment for backwashing.

The Sewage Air Release Valve shall be as manufactured by Crispin or Engineer approved alternate.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All valves shall be installed in accordance with the Drawings, approved shop drawing and manufacturer's instructions.

3.02 FIELD TESTING

A. Following installation, all valves shall be tested by the Contractor under the anticipated operating conditions. The ability of the valves to operate properly without leakage, binding, sticking, fluttering, or excessive operating torque shall be demonstrated to the satisfaction of the Engineer. The Contractor shall at his own expense adjust or replace any valve as necessary to assure satisfactory operation.

****END OF SECTION****



SECTION 16000
ELECTRICAL POWER AND SYSTEMS

PART 1- GENERAL

1.01 SCOPE OF WORK

- A. The electrical work commences with the point of electrical service where shown on the Drawings and includes furnishing all material and labor for a complete electrical installation.
- B. The requirements of Division I apply to all work hereunder. The General and Special Conditions are a part of this Division of the Specifications and all provisions contained therein which affect this work are as binding as though incorporated herein.

1.02 DEFINITIONS

- A. Provide: Furnish, install, and connect.
- B. Product Data: Catalog cuts and descriptive literature.
- C. Shop Drawings: Factory prepared specific to the installation.
- D. Indicated: Shown on the Drawings.
- E. Noted: Indicated or specified elsewhere.

1.03 SUBMITTALS

- A. Within thirty (30) days after the contract award, or as otherwise directed, forward to the Engineer a complete list of all materials and equipment proposed for installation. Materials list shall include but not limited to conduit, conduit fittings and bodies, wire and cables, disconnect switches, motor starters, panelboards and breakers, ground rods, lamps, switches, receptacles, and TVSS devices. The contractor shall provide a minimum of five sets of shop drawings for the owner in accordance with Section 01340 "Shop Drawings, Product Data and Samples" section of these specifications. Review drawings consist of shop drawings, product data and other information as noted in the individual equipment sections. Except as noted, submittal information is for review and equipment may not be installed until submittals have been returned stamped "No Exceptions Noted" or "Make Corrections Noted".
- B. The intent to use the exact make specified does not eliminate the responsibility of submitting such a list. List shall include sufficient information to permit ready and complete identification.
- C. Information required "for reference" such as product samples, similar unit test reports and time current curves is for the purpose of determining the suitability of a product, selecting breaker settings, etc. This information is to be submitted at the same time as review data; however, this information will not be returned and stamp is not required prior to installation.
- D. Except as noted, installation instructions are not required to be submitted. However, it is the Contractor's responsibility to obtain installation information from the manufacturer for all equipment prior to installing the equipment.

1.04 QUALITY ASSURANCE AND CODE COMPLIANCE

- A. Provide the complete electrical installation in accordance with the National Electrical Code (NFPA 70), Life Safety Code (NFPA 101), and in accordance with applicable local codes. Obtain all necessary permits required by the local authorities, and have all work inspected by appropriate authorities, and after completion of the work, furnish to the Engineer for the Owner, a certificate of final inspection and approval from the inspection bureau having jurisdiction. Pay all fees and installation charges as may be required by City or County to furnish the system indicated on the drawings.

- B. All material, apparatus, and equipment shall be new and shall be designed, manufactured, and tested in accordance with industry standards. Where applicable, the date for industry standards is that which is in effect on the date of Advertisement of the Project.
 - 1. American National Standards Institute (ANSI)
 - 2. American Society for Testing and Materials (ASTM)
 - 3. Federal Specifications (FS)
 - 4. Institute of Electrical and Electronics Engineers (IEEE)
 - 5. Insulated Cable Engineers Association (ICEA)
 - 6. National Electrical Manufacturers Association (NEMA)
 - 7. National Fire Protection Association (NFPA)
 - 8. Underwriters Laboratories, Inc. (UL)

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Ship products to the job site in their original packaging. Receive and store Products in a suitable manner to prevent damage or deterioration. Keep equipment upright at all times.

- B. Investigate the spaces through which equipment must pass to reach its final destination. Coordinate with the manufacturer to arrange delivery at the proper stage of construction and to provide shipping splits where necessary.

1.06 PROJECT/SITE CONDITIONS

- A. Power will be supplied by the utility company distribution system utilizing underground distribution. Verify and comply with all power company requirements. Make necessary arrangements with the power company for temporary service requirements.

PART 2- PRODUCTS

2.01 MATERIALS (NOT FURNISHED)

- A. Unless otherwise noted, the following are furnished and installed under other Divisions:
 - 1. Motors
 - 2. Individual Motor starters when provided by the Equipment Vendor
 - 3. Electric heating and air conditioning equipment
 - 4. Building energy management systems
 - 5. Electrical heat tracing
 - 6. Pilot and control devices for the above equipment

- B. Power wiring and equipment connections for the above items are included in this Division. Also included in this Division is control wiring to the extent shown on the Electrical Drawings: other control wiring is furnished under the applicable Mechanical Division.

2.02 MANUFACTURED UNITS

- A. Provide only new products of the manufacturer's latest design.

2.03 EQUIPMENT

- A. Where the words "equal to" follow or precede the listed acceptable manufacturers, equal products of other manufacturers are acceptable and request for substitution may be made during submittal stage.
- B. Where the words "or equal" follow the listed acceptable manufacturers, products of other manufacturers must be submitted and approved prior to the Bid, in accordance with the Instructions to Bidders of the Contract Documents.

2.04 SOURCE QUALITY CONTROL

- A. Furnish record drawings in accordance with the requirements of Division I. Record drawings consist of submittal data as listed above, operation and maintenance data, and as-built drawings. Record drawings are to reflect the final installation, including any changes during review, manufacturing tests, and installation.
- B. The contractor shall provide five sets of Operations and Maintenance (O&M) Manuals for the owner in accordance with section 01710 of these specifications. The manuals shall be provided for all items of electrical equipment including but not limited to motor control centers, distribution switchboards, motor starters, enclosed circuit breakers, panelboards, generators, and transfer switches. The manuals shall be bound in hardback three ring binders and shall have a minimum of the following:
 - 1. Title page with project name; installing contractor's name, address and telephone number.
 - 2. Index sheet.
 - 3. Complete manufacturer's operation and maintenance data (start-up, routine maintenance and trouble shooting information) with tabs (corresponding to the index) separating each item or system. Include the name, address, and phone number of the nearest sales and service organization for each item.
 - 4. Copies of all electrical test reports and coordination studies.
 - 5. Warranty information and start date.
 - 6. Spare parts list.
 - 7. Repair parts and service information
- C. As-Built Drawings: Furnish one set of prints maintained at the job site at all times with all changes during construction marked thereon. Include on the as-built drawings sufficient dimensions to permit location of underground conduits.
- D. Submit the results of any tests required in the individual equipment sections.

2.05 GUARANTEE

- A. Unless otherwise noted in these specifications workmanship, equipment and material shall be guaranteed for a period of one year from the final acceptance of the work by the Owner, as described in the General Conditions.

PART 3-EXECUTION

3.01 INSTALLATION

- A. The complete installation is to be accomplished by skilled electrical tradesmen, with certified or suitably qualified individuals performing all special systems installation and testing. All workmanship shall be of the highest quality, sub-standard work will be rejected.
- B. Schedule the work and cooperate with all trades to avoid delays, interferences, and unnecessary work. If any conflicts occur necessitating departures from the Drawings and Specifications, details of departures and reasons therefore shall be submitted immediately for the Engineer's consideration.
- C. Prior to final inspection, clean all dirt, mud and construction debris from all boxes, cabinets, manholes and equipment enclosures.
- D. The actual final locations of wiring and devices are subject to building and structural conditions. Consult and coordinate with other trades engaged on the project. Minor changes in outlet locations may be made by the Engineer at any time prior to roughing-in of the electrical work without additional cost.
- E. The Contractor shall apply to the local power company for electrical service and shall pay all fees associated with obtaining such service. All power company requirements for electrical service entrance and metering equipment shall be complied with; the Contractor shall coordinate his and his subcontractor's activities with those of the power company to facilitate the electrical service installation.

3.02 FIELD QUALITY CONTROL

- A. Description: Submit a coordination study with recommended settings for all fault protective devices within the scope of the study. The study shall be prepared by a registered professional engineer, who is not an employee of the Contractor, equipment supplier, or other party having a financial interest in the results of the study. The preparer shall certify that the protective device settings recommended represent a reasonable engineering compromise between equipment protection and selective coordination. The study shall include the calculation of Arc-Flash hazards in accordance with IEEE 1584.
- B. Documentation: Provide tabulations of recommended settings and time current curves showing the degree of coordination obtained with the recommended settings. Also show equipment inrush characteristics and applicable protection limits such as motor stall times, transformer ANSI damage limits, cable heating limits and NEC overcurrent protection requirements. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Terminate device characteristic curves at a point reflecting the maximum symmetrical or asymmetrical fault current seen by the device. Provide Arc Flash Warning Labels for all equipment as required by NEC article 110.16 and in accordance with NFPA 70E-2009 and ANSI Z535.4-1998 for Product Safety Signs and Labels.
- C. Scope: The study extends from the service entrance equipment down to, and including, the low voltage motor control centers. Panelboards and other equipment downstream from the low voltage motor control centers need not be included, except as required to obtain settings for equipment within the study scope.
- D. Study Data: The Contractor is responsible for providing field data (conductor materials, existing device types, nameplate information, etc.) to the study preparer. The Contractor is also responsible

for providing to the study preparer shop drawing data on new equipment. The study preparer is responsible for obtaining all other needed data (equipment data, time current curves, etc.).

- E. Submittal Requirements: Submit the coordination study prior to, or concurrent with, distribution equipment within the study scope. This is to allow suggested improvements (relay ranges, CT ratios, etc.) that may arise in performing the study to be incorporated prior to equipment fabrication. Review procedures are as specified in Article 1.06 above.

3.03 DEMONSTRATION

- A. Prior to request for final review, test all systems and repair or replace all defective work. Submit, with request for final review, written certification that all electrical systems are complete and operational.
- B. Unless otherwise specified, a 1,000 Volt megohmmeter shall be used for resistance measurements.
- C. At the time of final review of electrical work, demonstrate the operation of electrical systems. Furnish labor, apparatus and equipment for systems' demonstration.
- D. After final review and acceptance, turn over to the Owner all keys for electrical equipment locks. Present to the Owner or the Owner's designated representative, demonstrations and oral instructions for proper operation and maintenance of the electrical equipment and systems.

****END OF SECTION****

SECTION 16110

RACEWAYS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This section covers furnishing and field installation of a complete raceway system in accordance with these specifications and the drawings.
- B. Raceways shall be furnished in quantities sufficient for a complete installation as indicated on the drawings and in these specifications.
- C. The raceway system is defined to include tray, conduit, underground duct, wireway, and all materials, devices, and work required to install, support, secure and provide a complete system for support and protection of electrical conductors.

1.02 SECTION INCLUDES

- A. Rigid metal conduit and fittings.
- B. Flexible metal conduit and fittings.
- C. Liquidtight flexible metal conduit and fittings.
- D. Non-metallic conduit and fittings.
- E. Conduit and equipment supports.
- F. Fastening hardware.

1.03 RELATED SECTIONS

- A. Section 02200 "Earthwork".
- B. Section 03310 "Cast-in-Place Concrete".

1.04 SUBMITTALS

- A. Submit product data.

1.05 REFERENCE STANDARDS

- A. Design, manufacturing and assembly of elements of raceway system materials and devices herein specified shall be in accordance with the standards of the below listed organizations.

- 1. American National Standards Institute (ANSI)

2. National Electrical Manufacturers Association (NEMA)
 3. National Fire Protection Association (NFPA)
 4. National Electrical Code, NFPA-70 (NEC)
 5. Underwriters Laboratories, Inc. (UL)
- B. Raceway system components shall be installed in accordance with applicable requirements of the NEC.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Conduit: Allied, Republic, Triangle or Wheatland.
- B. PVC Conduit: Amoco, Carlon or Certainteed.
- C. Flexible Conduit: Anaconda, Thomas & Betts, Electric Flex or Triangle.
- D. Fittings: Appleton, Crouse-Hinds, Oz or Thomas & Betts.
- E. Support System: Prefabricated structural systems shall be equal to B-Line Systems, Kindorf, Powerstrut or Unistrut.
- F. Substitutions: Products equal to those listed.

2.02 MATERIALS

- A. Rigid Metal Conduit and Fittings
 1. Rigid Steel Conduit (GRS): Steel conduit, couplings, and elbows shall be hot-dip galvanized rigid mild steel in accordance with ANSI C80.1 and UL 6. The conduit interior and exterior surfaces shall have a continuous zinc coating with a transparent overcoat of enamel, lacquer, or zinc chromate. Rigid steel conduit shall be provided in standard lengths complete with one coupling per ten (10) foot length, minimum size 3/4-inch.
 2. Metal Conduit Fittings. All metal conduit fittings shall conform to the requirements of ANSI C80.4 and UL 514 where these standards apply. Galvanized iron or galvanized steel fittings shall be used with steel conduit.
 - a. Bushings. Bushings shall be provided for the termination of all conduit not terminated in hubs and couplings. Grounding type insulated bushings with insulating inserts in metal housings shall be provided for conduit 1-1/4 inches and larger. Standard bushings shall be galvanized.
 - b. Locknuts. One interior and one exterior locknut shall be provided for all conduit terminations not provided with threaded hubs and couplings. Locknuts shall be designed to securely bond the conduit to the box when tightened.
 - c. Unions. Conduit unions and their location shall be approved by the Engineer prior to their installation. Watertight conduit unions shall be

Crouse-Hinds Type UNF or Engineer approved alternate.

- B. Flexible Metal Conduit and Fittings
 1. Flexible Metal Conduit (FMC): Flexible metal conduit shall be hot dip galvanized steel in accordance with UL 1; FS WW-C-566; single steel continuous strip with galvanized coating; minimum size 3/8-inch. The use of flexible metallic tubing in place of flexible metal conduit is not acceptable.
 2. Fittings and Conduit Bodies: NENIA FB-1; malleable iron squeeze type.
- C. Liquidtight Flexible Metal Conduit and Fittings
 1. Liquidtight Flexible Metal Conduit (LMC): Liquidtight flexible metal conduit shall be hot dip galvanized steel with an overall liquidtight sunlight resistant jacket consisting of extruded thermoplastic, UL listed. Minimum size 3/4-inch. Exception: Where connected to devices with manufacturer supplied 1/2 inch hubs, match conduit size to hub size.
 2. Fittings and Conduit Bodies: NEMA FB-1; compression type with O-ring.
- D. Rigid Nonmetallic Conduit and Fittings
 1. Plastic Conduit: Plastic conduit shall be schedule 40 (or 80 where noted), polyvinyl chloride. NEMA TC-2; Schedule 40 and 80 PVC.
 2. Fittings and Conduit Bodies: NEMA TC-3.
- E. Conduit Clamps: Supports for conduits in single runs or groups of two shall be one-hole cast metal straps and clamp-backs unless other types are acceptable to the Engineer. They shall be galvanized malleable iron or Engineer approved alternate.
- F. Support Channel: Stainless steel.
- G. Hardware: stainless steel.
- H. Threaded Rods: 3/8-inch diameter, stainless steel.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Coordination of Box Locations
 1. Provide boxes as shown on Drawings, and as required for splices, taps, wire pulling and equipment connections.
 2. Box locations shown on the Drawings are approximate unless dimensioned. Verify box locations prior to rough-in. Coordinate mounting heights and locations of outlet mounted above counters, benches, backsplashes, and other furnishings. Any outlet may be relocated by up to 10 feet before it is permanently installed without incurring additional cost.

3.02 INSTALLATION

A. General Installation Requirements

1. The installation specifications included in this article apply to all raceway system components.
2. Minimum Size: The minimum size conduit to be used on this project shall be ¾" diameter.
3. Anchors: Where supports for raceways, boxes, and cabinets are mounted on concrete surfaces, they shall be fastened with self-drilling tubular expansion shells, single cone expanders, and annular break off grooved chucking cones. Anchors shall be Phillips "Redhead" or Engineer approved alternate.
4. Sleeves and Openings: The Contractor shall be responsible for all required openings. Required openings not provided during structure fabrication shall be provided by the Contractor using a hacksaw, a hole saw, or a core drill subject to acceptance by the Engineer.

B. Metallic Conduit Installation

1. The Contractor shall field route conduit according to the general routing indicated on the drawings, coordinate conduit locations with other equipment and structures, and as described in these specifications.
2. Cut conduit square using a saw or pipe cutter and de-burr cut ends.
3. Threading Conduit. The plane of all conduit ends shall be square with the center line. Where threads are required, they shall be cut and cleaned prior to conduit reaming. The ends of all conduit shall be reamed to remove all rough edges and burrs. A cutting oil shall be used in threading operations; the dies shall be kept sharp, and provisions shall be made for chip clearance. All steel conduit, after threading, shall be regalvanized with "Zinc Rich" coating as manufactured by ZRC Chemical Products Company or Engineer approved alternate. Bring conduit to the shoulder of fittings and couplings and fasten securely. All connections are to be wrench tightened and electrically continuous. No running threads are permitted.
4. Metal conduit shall be joined by threaded conduit couplings with the conduit ends butted. The use of running threads will not be permitted. Where metal conduit cannot be joined by standard threaded couplings, conduit unions or split couplings may be used if both material and location are acceptable to the Engineer.
5. Conduit shall be securely fastened to all boxes and cabinets. Threads on metallic conduit shall project through the wall of the box to allow the bushing to butt against the end of the conduit. The locknuts both inside and outside shall then be tightened sufficiently to bond the conduit securely to the box.
6. Use conduit hubs for fastening conduit to cast boxes. Conduit entering enclosures outdoors or in wet areas shall enter through Efcor "Water-Tite" hubs, or Engineer approved alternate, or threaded openings. Use conduit bodies to make sharp changes in direction. For sizes 2-inches and larger, use "LD" or similar fittings to permit a straight pull from either direction.
7. The maximum length between pull points is 400 feet. This length shall be reduced by one foot for each degree of bend.
8. A run of conduit shall not contain more than the equivalent of four quarter bends, including those immediately at outlets or fittings. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2-inch size. Bends in

conduit shall be made without reducing the internal diameter of the conduit. The use of a pipe tee or vise for bending conduit will not be permitted. The inside radius of conduit bends shall be not less than six times the inside diameter of the conduit. Conduits deformed or crushed in any way shall be removed from the jobsite.

9. Type LB, LR, LL, T, LRL or similar fittings shall not be used with conduit containing any of the following:
 - (a) Single conductor power cable larger than No. 6 AWG.
 - (b) Multiconductor 600 volt cable having more than 2 conductors.
 - (c) Any cable rated above 600 volts.
10. Moisture pockets shall be eliminated from conduits. If water cannot drain to the natural opening in the conduit system, a hole shall be drilled in the bottom of a pull box or a "C-type" conduit fitting provided in the low point of the conduit run.
11. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture. Install threaded PVC end caps on conduits stubbed up for future use.
12. Provide a 200 pound tensile strength polyolefin line pulled through and tied off at each end of all empty conduits.
13. Install expansion joints where conduit crosses building expansion joints and for straight runs in excess of 100 feet.
14. Where conduit penetrates fire-rated walls and floors, provide mechanical fire-stop fittings with UL listed fire rating equal to wall or floor rating.
15. Provide watertight seals, equal to OZ type WSK or FSK, where conduit penetrates exterior walls and where conduit passes between spaces normally at different temperatures. Seal duct bank and underground conduit entry with GE or Dow silicone sealant.
16. In locations where the conduit cannot be turned, provide three piece threaded rigid couplings. Provide clamp backs for conduits on exterior or damp surfaces to prevent the raceway from bearing directly on the damp surface.
17. Route conduits in slabs above the bottom reinforcing and below the top reinforcing. Maximum size for conduits in slabs above grade is 1-inch. Route so conduits in slabs above grade do not cross.
18. Protect conduit threads from rust and damage during construction.
19. All additional conduit couplings, factory bends, plastic-to-steel conduit adapters, solvent cement, and special fittings for the complete conduit system shall be included. All conduit, not concrete encased, run under drives or roadways shall be a minimum of 36" deep.
20. Conductor Protection: Provide bushings on metallic and bell ends on PVC conduits unless conduit terminates in a hub or similar fitting.
21. Precautions shall be taken to prevent the accumulation of water, dirt, or concrete in the conduit. Conduit in which water or other foreign materials have been permitted to accumulate shall be thoroughly cleaned or, where such accumulation cannot be removed by methods acceptable to the Engineer, the conduit shall be replaced.

C. Conduit Arrangement and Support

1. Arrange conduit to maintain headroom and present a neat appearance. Group conduit in parallel runs where practical and provide rack space for 25 percent additional conduits. Use concentric bends for parallel runs.

2. Except as otherwise specified or indicated on the drawings, all conduit shall be installed in exposed runs parallel or perpendicular to dominant surfaces with right angle turns made out of symmetrical bends or fittings.
3. Conduit shall not be installed on the outside face of exposed steel columns, but shall be routed on the web or on the inside of a flange of the column. Except where prevented by the location of other work, a single conduit or a conduit group shall be centered on structural members.
4. All conduit field routing shall be coordinated with all other trades to insure accessibility to junction boxes and condulets and shall be acceptable to the Engineer. Routing not acceptable shall be rerouted and replaced without expense to the Owner.
5. All conduit runs in the slab or below grade shall be inspected and approved by the engineer prior to covering with concrete or backfill
6. Avoid sources of heat when possible. Where unavoidable, maintain 3-inch clearance when crossing hot pipes and 12-inch clearance between parallel hot pipes, flues, heating appliances and other heat sources.
7. Support conduits to prevent distortion of alignment by wire pulling operations. Fasten single conduits with one hole malleable iron straps. For multiple runs use channel and clamps. Wire, perforated pipe straps and the like are not acceptable support means.
8. Except where buried in concrete, all conduit runs shall be rigidly supported. Each conduit shall be supported within one foot of junction boxes and fittings. Hang trapeze assemblies with threaded rods not less than 3/8-inch diameter. Remove all temporary supports prior to pulling conductors. Support spacing along conduit runs shall be as follows:

<u>Conduit Size</u>	<u>Max. Distance Between Supports</u>
3/4 inch through 1-1/4 inch	7 feet in horizontal runs or 10 feet in vertical runs
1-1/2 inch and larger	10 feet within one foot of each box, cabinet, or fitting.

D. Plastic Conduit Installation

1. Except as specified in the following paragraphs, polyvinyl chloride conduit shall be installed in accordance with the installation requirements previously specified for metallic conduit.
2. Plastic conduit shall not be run exposed or concealed in walls unless specifically noted.
3. Expansion joints for exposed conduit or buried conduit that will be exposed to temperature variations during installation shall be provided as recommended by the manufacturer.
4. Joints shall be unthreaded solvent cement type as recommended by the conduit manufacturer. The contact surfaces of the conduit and fitting socket shall be cleaned with Stoddard solvent, methyl ethyl ketone, or acetone, liberally coated with solvent cement, promptly and fully engaged, and either conduit or fitting rotated approximately 1/4 turn to dispel air and evenly distribute solvent cement over contact surfaces. For proper connection, total elapsed time between the start

of the cement application to the surfaces being joined and final assembly of the joint should not exceed 60 seconds. The initial strength of the joint will permit continuous conduit installation; however, additional stress at the joint shall be avoided for at least 24 hours after joining.

5. The conduit length for field bending shall be heated to approximately 275° F by radiant heat, hot air, or hot liquid immersion. Open flame heating will not be permitted. Special mandrels or forms shall be used to provide a smooth bend without reduction of the conduit diameter. Conduit discolored by prolonged heating will not be acceptable.
6. Where plastic conduit is required to be buried directly in the earth as indicated on the drawings, the conduit shall be bedded in a graded 3 inch deep soft bedding of sand or finely divided job excavated material free from debris, organic, material, and stones. Backfill, to approximately 6 inches above the conduit, shall be the same as bedding material.
7. Any location plastic conduit is run exposed or under drives or roadways without concrete encasement the conduit shall be schedule 80, polyvinyl chloride.
8. Rigid galvanized steel elbows shall be used at all locations where a transition is made from below grade PVC conduit to above grade. GRS conduit shall extend from the elbow to above grade.

E. Below Grade Conduit Installation

1. Steel conduit shall not be direct buried in the earth unless specifically noted otherwise on the plans.
2. Below grade steel conduit shall be encased with not less than 3 inches of concrete. Concrete used for conduit encasement shall contain not less than 5-1/2 sacks of cement per cubic yard. It shall contain clean and well graded aggregates and low water content. The slump shall be such that the mixture is stiff and will stand erect when placed. The concrete shall be vibrated to consolidate it around the steel and shall be slow cured for several days to provide strength and prevent shrinkage.
3. Conduit shall be supported for encasement by steel wire hangers attached to temporary supports laid across the conduit trench. After the concrete encasement has hardened, the supports and those parts of the wire hangers not encased in concrete shall be removed.
4. Where steel conduit is installed in direct contact with the earth the conduit shall be painted with two (2) coats of black asphaltum paint. The entire length of the conduit that will be in contact with the earth to a point 6 inches above final grade shall be coated.
5. A minimum separation of 3 inches shall be maintained between multiple conduits enclosed in the same concrete encasement but not assembled as a duct bank.
6. Concrete used for encasing steel conduit shall contain no additives that contain chlorides. The concrete shall be mixed with pure, clean, potable water.
7. The Contractor shall field route conduit according to the general routing indicated on the drawings and shall coordinate conduit locations with other work. Conduit shall be accurately positioned and securely anchored before the concrete is poured to encase it. The Contractor shall note any deviations from the plans in the routing on the redline mark-ups provide to the engineer.
8. Conduit that will be visible above the finished floor shall be straight and plumb.

9. Conduit that is stubbed up shall be plugged prior to pouring of concrete and shall remain plugged until the conduit is extended later.
10. Rigid galvanized steel elbows shall be used at all locations where a transition is made between above and below grade conduit. GRS conduit shall extend from the elbow to above grade.

F. Underground Duct Bank Installation

1. Concrete encased duct banks of individually assembled plastic ducts, arranged as indicated on the drawings, shall be furnished and installed in accordance with the following specification.
2. All excavation work shall conform to Division 2 of these specifications.
3. All concrete work shall conform to Division 3 of these specifications.
4. Install ducts with minimum grade of 4-inches per 100 feet.
5. Each duct bank shall be laid to exact grade in the trench and the ends shall enter manholes or buildings as indicated on the drawings. No dips or low points that retain water in any duct will be permitted in ducts between manholes or between buildings and manholes.
6. End bells shall be used in individual ducts at the end of duct banks entering manholes or buildings except where another type of termination is specified or detailed on the drawings.
7. All sweeps shall be fabricated with straight sections of duct, bent to provide the radius indicated on the drawings.
8. The ends of the individual ducts shall be cleaned and swabbed with joint sealing compound, and the duct shall then be forced tightly into the coupling to make a watertight connection.
9. The individual ducts shall be laid in place, held by standard spacers placed at 5 foot intervals, and bound with hemp or sisal twine.
10. The ends of the ducts in each of the upper layers shall be stepped back approximately 2 feet from the end of the layer immediately below it.
11. Defective ducts shall not be installed and shall be removed immediately from the site of the work. Particular care shall be taken to keep concrete or other substances from the inside of the individual ducts during construction.
12. All reinforcing materials and other magnetic materials installed in a duct bank shall be parallel to the lengths of the individual ducts, except for ties enclosing all ducts of the duct bank.
13. Install top of duct bank minimum 18-inches below finished grade with plastic warning tape 12-inches below finished grade.
14. Where duct bank passes beneath footings or slabs resting on grade excavate to provide a minimum of 6-inch clearance between the conduits and the structure. Backfill to the base of the structure with concrete.
15. After completion of the duct bank or before cable is pulled into existing duct banks, each duct shall be tested and cleaned, and ducts that will not be used immediately shall be plugged at each end. As a clearance test, each duct shall pass a mandrel with a diameter 1/4 inch less than the inside diameter of the duct. All foreign material, earth, sand, and gravel shall be removed from the ducts with circular stiff bristled brushes. A 1/4 inch nylon rope shall be installed in all unused ducts.

G. Supporting Device Installation

1. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors or beam clamps.
2. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
3. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
4. Do not use powder-actuated anchors.
5. Do not use perforated straps or wire.
6. Make all supports from the structure, not the work of other trades. Do not drill structural steel members. Install supports so as not to weaken the structure.
7. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
8. Install free-standing electrical equipment on 4" high concrete maintenance pads.

3.03 PROTECTION SCHEDULES

A. Conduit Schedule

1. Except as noted, use only rigid steel conduits.
2. Use liquidtight flexible steel conduit for connections to motors, transformers and other vibrating equipment.
3. Rigid nonmetallic conduit may be used for underground, concrete encased duct banks and in or below slab on grade. Exception: Use rigid steel conduit for analog signal circuits; 4 to 20 mA and AC or DC signals less than 25 volts.
6. Where PVC conduit is indicated, make a transition to rigid steel below grade or slab and continue above with rigid steel conduit. Exception: PVC may enter switchboards, motor control centers or other floor standing electrical equipment enclosures. Provide bell ends or socket end bell at enclosure entry.

****END OF SECTION****

SECTION 16120

WIRES AND CABLES

PART 1 - GENERAL

1.01 SCOPE

- A. Insulated cable, conductors, and conductor accessories shall be furnished and installed in accordance with the requirements of this section of these specifications. Insulated cable, conductors, and conductor accessories shall be furnished in quantities sufficient for a complete installation as indicated on the drawings and in these specifications.
- B. Installation shall be defined to include placement, splicing, terminating conductors, coiling and taping of spare conductors, identification, testing, and verification of each circuit, cable and conductor.
- C. Terminating a conductor shall include attaching each conductor in its designated location using the specified materials and insulating the entire connection where specified or required by the application

1.02 SECTION INCLUDES

- A. Building wire.
- B. Cable.
- C. Wiring connections and terminations.
 - 1. Terminating a conductor shall include attaching each conductor in its designated location using the specified materials and insulating the entire connection where specified or required by the application.

1.03 SUBMITTALS

- A. Submit product data.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Conductors: Aetna, Cablec, Continental, Okonite, Rockbestos, American Insulated Wire, Kerite, Southwire, Pirelli, Triangle, or engineer approved alternate.
- B. Instrumentation Cables: Equal to Belden, Continental, Dekoron or West Penn.

- C. Signal Circuit Cables: Equal to Belden, Continental, Dekoron or West Penn.
- D. Connectors: Equal to Thomas & Betts, Ideal or OZ.
- E. Pulling Compounds: Water soluble, equal to Polywater J.
- F. Wire and Cable Markers: Plastic, split sleeve or tubing type, equal to Brady Type XC or T & B Type SM.

2.02 EQUIPMENT

A. Building Wire

- 1. Power Cable:
 - a. Power cable shall consist of a single 98% conductivity copper conductor insulated by 600 volt rated cross linked polyethylene suitable for wet or dry locations. The insulation material shall be rated 90° C dry, 75° C wet, and shall be U.L. Type XHHW.
 - b. The conductor size shall be as shown on the drawings with a minimum size of #12 AWG.
- 3. Lighting Cable:
 - a. Lighting cable shall consist of 98% conductivity copper conductor insulated for 600 volts and suitable for dry locations. The insulating material shall be rated 90° C and shall be U.L. Type XHHW or THHN.
 - b. The conductor size shall be as shown on the drawings with a minimum size of #12 AWG.
 - c. All lighting cables shall be single conductor and shall be color coded.
- 4. Control Cable:
 - a. Control cable shall consist of a single 98% conductivity copper conductor with Class B stranding insulated for 600 volts and suitable for wet or dry locations. The insulating material shall be polyvinyl-chloride rated for 75° C. A nylon jacket shall be applied over the insulation meeting the requirements of U.L. 83 for a THHN or THWN cable.
 - b. The conductor size shall be as shown on the drawings with a minimum size of #14 AWG.

B. Remote Control And Signal Cable

- 1. Instrumentation Cable:
 - a. Instrumentation cable shall consist of Class B stranded copper conductor insulated with 300 volt rated PVC insulation. Cable pairs shall be twisted and an overall aluminum or copper shield, with drain wire, shall be applied. A PVC jacket shall be applied over the entire assembly.
 - b. Instrumentation cable shall be suitable for installation in tray or conduit, and shall be suitable for Class 3 circuits in accordance with Article 725 of the National Electrical Code.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General Wiring Methods

1. Cable Placement:

- a. Power, control, and instrumentation cable shall be routed as indicated on the drawings. All instrumentation cable shall be routed a minimum of six (6) inches from power and/or control conductors when run parallel and shall be in separate raceways.
 - b. If at any time during the progress of the work the Contractor finds raceways which appear inadequate to accommodate the assigned cable, he shall notify the Engineer at once and shall discontinue any further work on the questionable raceway until advised by the Engineer as to how he shall proceed.
 - c. Immediately prior to the placement of each cable or cable group, the raceway route to be followed shall be inspected and ascertained to be complete in installation and free of all materials detrimental to the cable or its placement. All cable assigned to a particular duct or conduit shall be grouped and pulled in simultaneously, using cable grips and acceptable lubricants.
 - d. All cable shall be carefully checked both as to size and length before being pulled into conduits or ducts. Cable pulled into the wrong conduit or duct or cut too short to rack, train, and splice as specified herein, shall be removed and replaced by and at the expense of the Contractor. Cable removed from one conduit or duct shall not be pulled into another conduit or duct.
2. Use only stranded conductors. Exception: Solid conductors size #12 and #10 AWG may be used for receptacle branch circuit wiring.
 3. Do not install more than three (3) current carrying conductors in a single raceway unless conductors are properly derated per the NEC 310.15(B)(2).
 4. Identification: The Contractor shall identify the ends of all power, control, and instrument circuits. At terminations, the Contractor shall identify each conductor of power circuits, each multiconductor cable, and each conductor of circuits consisting of multiple single conductors where the conductors are not otherwise identified. All conductors shall be identified throughout the electrical system.
 - a. Each cable marker shall bear the number of the corresponding circuit according to the drawings.
 - b. Markers shall be attached where the first individual conductor is routed away from the assembly.
 - c. Each phase of multiphase power circuits shall be individually identified.
 - d. One end of each marker board shall remain free of the fastening tail, and the entire marker shall be so attached that it is readily visible for circuit identification.
 - e. For control and signal conductors use wire markers at all terminals and connections. Color code power circuit conductors as follows:

	120/208 Volt System	277/480 Volt System
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow

	120/208 Volt System	277/480 Volt System
Neutral	White	Grey
Ground	Green	Green

5. For conductors #8 AWG and larger color coding may be accomplished with 1-inch wide colored tape applied at each end of the conductor or at points where conductor is accessible so as to be visible inside the enclosure.
6. Neatly train and lace wiring inside boxes, equipment and panelboards. Provide adequate support to prevent conductor movement under fault conditions.
 - a. Nylon ties shall be used to neatly lace together conductors entering switchboards and similar locations after the conductors have emerged from their supporting raceway and before they are attached to terminals.
7. Spare Conductors:
 - a. All spare conductors of a multiconductor cable shall be left at their maximum lengths for possible replacement of any other conductors in the cable.
 - b. Each spare conductor shall be neatly coiled and then taped to the conductors being used.
8. All cable supports and securing devices shall have bearing surfaces located parallel to the surfaces of the cable sheath and shall be installed to provide adequate support without deformation of the cable jackets or insulation.
9. All cable shall be routed as shown on the drawings. All cable assigned to a particular conduit shall be grouped and pulled in simultaneously, using cable grips and acceptable lubricants. Fishing and pulling shall be done with a flexible round metal tape, CO₂ propelled polyethylene cord, nylon rope, or manila rope.
10. Cable pulling:
 - a. Woven wire cable grips shall be used to pull all single conductor cable larger than 1/0 AWG, and all multiconductor cable. Pulling loops shall be used for single conductor cable 1/0 AWG and smaller. When a cable grip is used, the area of the cable covered by the grip plus 6 inches shall be cut off and discarded when the pull is completed. When pulling loops are used, the entire loop shall be cut off and discarded when the pull is completed. A swivel or swivel connection shall be inserted between the pulling rope and the cable grip or loop.
 - b. Cable pulling lubricant shall be suitable for use with the cable being lubricated. All pulling lubricant shall be approved by the Engineer prior to its use. Cable pulled into conduit using a lubricant unacceptable to the Engineer shall be removed and discarded, the conduit thoroughly cleaned, and new cable pulled in. The pulling tension on any cable shall not exceed the maximum tension recommended by the cable manufacturer. If any

excessive strain develops while pulling, the pulling operation shall be stopped at once and the difficulty determined and corrected. To avoid insulation damage from excessive sidewall pressure at bends in duct and conduit runs, the pulling tension in pounds at a bend shall not exceed 100 times the radius of the bend in feet.

- c. Extreme care shall be exercised during the placement of all cable to prevent tension and bending conditions in excess of the manufacturer's recommendations. The permanent radius of a bend after cable installation shall be in accordance with the cable manufacturer's recommendations.
12. Feeding Tubes: A 4 inch or larger flexible feeding tube, with a removable nozzle sized to fit the ducts, shall be used in pulling all underground cable. The feeding tube shall be long enough to extend from the duct entrance to the outside of the manhole and shall be so arranged that it will be impossible for the cable to drag across the edge of the manhole ring or any other damaging surface.
13. Splices: No splices shall be made in conductors for instrument circuits or control circuits without specific acceptance by the Engineer except where required at connections to accessory devices equipped with factory installed pigtailed or where high temperature wire is necessary locally to connect to a particular device.

C. Wiring Installation In Raceways

1. Unless otherwise indicated, install all conductors in conduit.
2. Pull all conductors into a raceway at the same time. Thoroughly swab raceway system before installing conductors. Use wire pulling lubricant for all pulls. Do not exceed the manufacturer's pulling tension.
3. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

D. Wiring Connections And Terminations

1. Splices in power conductors shall be with compression type connectors.
2. Splices in control conductors shall be with compression type locking spade terminal connectors.
3. The terminal connectors shall be connected using bolts, tooth lock washers and hex nuts of copper or copper bearing metal.
4. Splices in lighting conductors smaller than 8 AWG shall be with "Scotch-Lok" twist type insulated spring connectors or Engineer approved alternate.
5. Splices in lighting conductors 8 AWG and larger shall be with compression type connectors.
6. No splices shall be made in conductors for instrument circuits or control circuits without specific acceptance by the Engineer except where required at connections to accessory devices equipped with factory installed pigtailed or where high temperature wire is necessary locally to connect to a particular device.
7. Shields may be spliced where necessary to permit connection to the station ground.
8. Power cable circuits may be spliced only by methods and at locations acceptable to

the Engineer.

9. Splices shall not be made to utilize short lengths of cable nor shall they be made to provide correct lengths on cable initially cut too short for a particular circuit.
10. Splices, joints, and connections in cable shall be made only in pull boxes, junction boxes, or manholes unless otherwise indicated on the drawings, and shall be made in accordance with the instructions of the cable manufacturer.
11. Make connections to circuit breakers, disconnect switches, panel mains, etc. with solderless lugs.
12. Thoroughly clean wires before installing lugs and connectors.

3.02 FIELD QUALITY CONTROL

- A. All insulated conductors shall be tested for continuity and conductor identification. In addition, all insulated conductors of multiconductor cable shall be tested for short circuits. The Contractor shall furnish portable, battery powered, ring testers and other test equipment as required to conduct these tests. The contractor shall submit copies of all cable tests to the engineer for review and place a copy of all cable tests in the O & M Manual at the conclusion of the project.
 1. Continuity tests shall include all tests necessary to confirm that the conductor is continuous throughout its entire length. Ring all conductors for continuity and replace any open conductors.
 2. Identification tests shall include all tests necessary to confirm that the conductor being investigated originates and terminates at the locations indicated on the drawings.
 3. Short circuit tests shall include all tests necessary to confirm that no conductor of a multiconductor cable is short circuited to another conductor in that cable.
 4. All insulated conductors, except supervisory and communication cable, rated less than 5000 volts shall be tested with a 1000 volt megger or an equivalent testing device. Insulation resistance measurements shall be made between each conductor and ground and between each conductor and all other conductors of the same circuit. Acceptable resistance values shall be approximately infinite.
- B. Ground Fault Tests: Megger all feeder circuits for grounds. Compile and submit a list of megger readings. Replace all conductors measuring less than 2 megohms to ground.
- C. Torque test conductor connections and terminations to manufacturer's recommended values.
- D. Inspect wire and cable for physical damage and proper connection.

****END OF SECTION****

SECTION 16130

BOXES

PART 1 - GENERAL

1.01 SCOPE

- A. All boxes required throughout the electrical raceway system shall be furnished and installed in accordance with the requirements which follow.

1.02 SECTION INCLUDES

- A. Outlet boxes.
- B. Pull and junction boxes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Boxes shall be equal to Appleton, Crouse Hinds, Racor, or Steel City.

2.02 MATERIALS

- A. Outlet Boxes
 1. Sheet Metal Outlet Boxes: NEMA OS-1, UL 514; galvanized steel, with ½ inch male fixture studs where required.
 2. Cast Boxes: Cast ferrous alloy with galvanized or cadmium finish, deep type, gasketed cover, threaded hubs for use with steel conduit, UL 514.
 3. Floor Boxes: Full adjustable, steel, water and concrete tight equal to T&B model number 68 D.
 4. Except as indicated otherwise on the drawings or in these specifications, all junction boxes or pull boxes 4 inch trade size or smaller in any dimension shall be galvanized malleable iron or acceptable equal cast ferrous metal for use with steel conduit.
- B. Pull and Junction Boxes
 1. Junction boxes and pull boxes shall be as indicated on the drawings and as specified in these specifications. Where no type or size is indicated elsewhere for junction boxes or pull boxes, they shall be in accordance with the requirements of the NEC, Article 314, Paragraphs 28, 29, 40 and 41 for use on systems with a nominal rating of 600 volts and less, and Section IV for use on systems with a nominal rating of over 600 volts.

- a. Sheet Metal Boxes: NEMA OS-1; galvanized steel. Boxes larger than 12-inches in any dimension shall be hinged enclosure. Equal to Hoffman Bulletin A-51.
 - b. Cast Metal Boxes: NEMA 250; Type 4, galvanized cast iron box and cover, neoprene gasket, stainless steel cover screws, UL listed as raintight. Provide flat-flanged type for surface mounting and outside flange recessed cover type for underground use. Boxes for sidewalk or other traffic areas to have appropriate duty cover with non-skid finish.
 - c. Corrosion Resistant Boxes: UL 508 Type 4X, gasketed screw cover. For boxes larger than 12-inches in any dimension provide hinge on one side and stainless steel toggle latches (equal to Hoffman A-FC412SS) on the other three sides. Equal to Type 304 stainless steel equal to Hoffman Bulletin A-51S.
2. Electrical enclosures, except junction boxes and pull boxes 4 inch trade size and smaller and other enclosures of cast metal, shall be constructed from steel plate reinforced as required to provide true surfaces and adequate support for devices mounted thereon.
 3. Except as indicated otherwise in these specifications or on the drawings, all junction boxes and pull boxes larger than 4 inch trade size for use in indoor locations shall be sheet steel hot-dip galvanized after fabrication and those for use in outdoor locations shall be 316 stainless steel.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Coordination Of Box Locations
 1. Provide boxes as shown on Drawings, and as required for splices, taps, wire pulling and equipment connections.
 2. Box locations shown on the Drawings are approximate unless dimensioned. Verify box locations prior to rough-in. Coordinate mounting heights and locations of outlet mounted above counters, benches, backsplashes, and other furnishings. Any outlet may be relocated by up to 10 feet before it is permanently installed without incurring additional cost.

3.02 INSTALLATION

- A. Box Installation
 1. Do not install boxes back-to-back in walls. Provide minimum 6-inch separation, except provide minimum 24-inch separation in acoustic-rated walls.
 2. Support boxes independently of conduit openings.
 3. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
 4. Unless otherwise noted, use only cast outlet boxes.

5. Conduit openings in pull boxes shall be made with a hole saw or shall be punched. Field locate holes in junction and pull boxes so as to afford the maximum bending radius for the conductors.
9. Boxes mounted on concrete shall be secured by self-drilling anchors. Mounting on steel shall be by drilled and tapped screw holes, or by special support channels welded to the steel, or by both. Boxes larger than 4 inch trade size shall be leveled and fastened to the mounting surface with not less than 1/4 inch air space between the enclosure and mounting surface. All mounting holes in the enclosure shall be used.
10. Except as prevented by the location of other work, all junction boxes and outlet boxes shall be centered on structures.
11. Label cover of junction boxes with circuit numbers of conductors in the box.
12. Unless indicated otherwise on the drawings or in these specifications, electrical enclosures, except junction boxes and pull boxes 4 inch trade size and smaller, shall be as follows:

<u>Location</u>	<u>Enclosure Type</u>
Outdoor (Nonhazardous)	NEMA 4X

END OF SECTION

SECTION 16155
MOTOR STARTERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Separately mounted motor starters.
 - 1. Manual
 - 2. Full voltage magnetic
 - 3. Reduced voltage magnetic

1.02 RELATED SECTIONS

- A. Motors are owner furnished.
- B. Solid state reduced voltage starters are specified in Section 16156.

1.03 SUBMITTALS

- A. Submit shop drawings showing certified dimensions and data on all accessories in accordance with NEMA classification as noted above and additional information as noted in the following paragraphs.
- B. Elementary Diagrams: Provide a separate elementary diagram for each starter unit following the format shown on the Drawings and showing numbered terminal points and interconnections to the first level of remote devices.
- C. Reference Data: Submit one set of full size (11 x 14-inch) time current curves on log-log transparency paper for all overcurrent protective devices. Exception: A tabulation of heater sizes or elements versus motor current rating may be submitted in lieu of time current curves for overload relays

1.04 QUALITY ASSURANCE

- A. All motor starters specified in this section shall be NEMA rated devices.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Motor starters shall be manufactured by Square D, Cutler-Hammer, Allen-Bradley, Furnas, or Engineer approved equal.

2.02 EQUIPMENT

A. Contactors:

1. The rated continuous current carrying capacity of each starter contactor shall be as listed in NEMA ICS 2, Table 2-210-1 for that size contactor. The interrupting capacity of each starter contactor shall be not less than 10 times the rated continuous current carrying capacity.
2. The electrical life, without maintenance, of each starter contactor shall be not less than 500,000 operations with each opening or closing of the load contacts to constitute one complete operation. The mechanical life of each starter contactor shall be not less than 5,000,000 operations.

B. Circuit Breakers:

1. Each combination starter unit shall include one three-pole single throw, 600 volt, molded case circuit breaker with not less than 14,000 amperes symmetrical interrupting rating at 480 volts. All breakers shall be manually operated with quick-make, quick-break, trip-free mechanism of the toggle type. All circuit breakers shall be of the same manufacture.
2. Manual operating handles shall be furnished on the doors to operate the circuit breakers. Provisions shall be made for padlocking each handle in the open position.
3. The access doors shall be interlocked with the operating handles to prevent opening the doors normally when the circuit breakers are in the closed position.
4. Circuit breakers shall be the magnetic instantaneous trip only type sized according to the following table.

NEMA Starter Size	Frame Size (Amps)	Rating of Breaker in Amperes	
		Minimum Continuous	Approx Instantaneous Trip Range Adjustment
1	100	25	Adjustable from 66 to 165
2	100	50	Adjustable from 160 to 360

C. Enclosures:

1. Enclosures for motor starters shall be as listed on the drawings. All enclosure number designations shall correspond to those listed in NEMA Standard No. ICS-6.
2. NEMA 4 enclosures for use with manual starters in outdoor locations shall be die cast zinc with a screw cover and rubber gasket. NEMA 4X enclosures shall be 16 or 14 gauge type 304 stainless steel with clamps on three sides and a neoprene rubber or urethane elastomer gasket.

D. Overload Relays:

1. Overload relays shall be either melting alloy or bimetallic. Single phase starters shall contain one thermal unit; three phase starters shall contain three thermal units. Thermal units shall be selected to cause the relay to trip at an ampere level no greater than 125% of the motor full load amps, for 1.15 service factor motors, or 115% for 1.0 service factor motors.
2. Overload relay contacts shall have a NEMA B600 current rating. Where indicated on the wiring diagrams, a form C alarm contact with a NEMA B600 current rating shall be furnished.
 - a. Melting Alloy Overload Relays: Melting alloy overload relays shall use a eutectic alloy solder to sense motor current and trip the relay upon detecting an overload. Melting alloy overload relays shall remain tripped until it has cooled and reset manually. A pushbutton shall be provided on the enclosure door for this purpose. All melting alloy overload relays shall contain a trip-free mechanism to allow the relay to trip even when the reset pushbutton is held in the reset position.
 - b. Melting alloy overload relays shall be provided with standard trip, slow trip, or quick trip thermal units, as indicated on the motor starter list.
 - 1) Standard Trip. Standard trip thermal units shall provide trip characteristics for normal motor acceleration up to approximately 7 seconds on a full voltage start.
 - 2) Slow Trip. Slow trip thermal units shall provide trip characteristics for motor acceleration up to approximately 12 seconds on a full voltage start.
 - 3) Quick Trip. Quick trip thermal units shall be provided for submersible pump applications and shall be sized to match the pump motor characteristics.
 - c. Bimetallic Overload Relays. Bimetallic overload relays shall use a bimetal to sense motor current and trip the relay upon detecting an overload. The trip current shall be adjustable from 85 to 115% of the trip current rating. The relays shall be shipped as manual reset type but shall be field convertible to automatic reset.

E. Manual Starters:

1. Manual starters shall consist of a manually operated contactor and melting alloy overload relays in an enclosure. The number of poles, starter size, voltage, and phase and enclosure type shall be as indicated on the drawings. Control shall be by means of interlocked start-and-stop pushbuttons on the starter door. When indicated on the drawings, provide a low voltage coil to open the starter contacts if power is lost, requiring a manual reset to close the contacts. Likewise, overload relay operation shall require a manual reset.
2. Three phase manual starters shall include one normally open auxiliary contact as specified in 2.03.A.1.

F. Magnetic Starters: Magnetic starters shall be full voltage, non-reversing (FVNR).

1. Full Voltage Non-Reversing: Magnetic FVNR starters shall consist of an electrically operated contactor and an overload relay in an enclosure. The number of poles, starter size, voltage, coil voltage, phase, enclosure type, and overload relay type shall be as indicated on the starter list. The control wiring shall be as shown on the drawings. The number and type of auxiliary contacts, pushbuttons, and indicating lights shall be as shown on the drawings. Control power transformers, as specified in 2.03.C, shall be provided when indicated on the starter list and shown on the drawings.
2. Reduced Voltage Non-Reversing: RVNR starters shall consist of an autotransformer starter and overload relay in an enclosure. The autotransformer shall have taps at 80%, 65%, and 50% of line voltage for starting voltage. Starting and running contactors shall be provided and wired for closed transition starting. Other details shall be as specified in 2.02.F.1 for FVNR starters.

G. Combination Starters:

1. Combination starters shall consist of a magnetic starter, molded case circuit breaker, and overload relay in an enclosure. Magnetic starters are specified in 2.02.F. Molded case circuit breakers are specified in 2.02.B. Overload relays are specified in 2.02.D.
2. Combination starters shall be supplied when indicated on the motor list. Circuit breaker continuous ratings shall be as shown on the drawings.

2.03 ACCESSORIES

A. Auxiliary contacts: All starters shall be furnished with mechanically operated auxiliary contacts in the quantities specified herein. Electrically operated auxiliary contacts shall be supplied when indicated on the motor starter list.

1. Mechanically Operated. Mechanically operated auxiliary contacts shall be mounted on the main contactor. Contacts shall be rated for 10 amperes continuous, 60 amperes make, and 6 amperes break at 35% power factor, 120 volts AC. Contacts shall be furnished in the following quantities:

<u>Type</u>	<u>Starter</u>		<u>Contact Quantity</u>	
	<u>Phase</u>		<u>Size</u>	<u>N.O. N.C.</u>
FVNR	3		0,1,2	1 1

2. Electrically Operated. Electrically operated auxiliary contacts shall be provided by means of a relay operated by a mechanically operated auxiliary contact in a 120 volt AC control circuit. The relay shall have the contact ratings specified previously for mechanical contacts. Relays shall be socket mounted with a hold-down clip to prevent relay misoperation due to vibration. Electrically operated auxiliary contacts shall be wired to terminal blocks within the enclosure.

- B. **Indicating Lights:** Indicating lights shall be provided on the starter door when shown on the motor starter list and the drawings. Indicating lights shall be round with a round bezel and shall be watertight and oil tight. The lamp for the cap shall be red for "on" and green for "off." Other lamps and colors shall be as shown on the wiring diagram. Indicating lights shall include legend plates.
- C. **Control Power Transformers:**
 - 1. Control power transformers used to convert 480 volts, single phase, to 120 volts for the control circuits shall be provided when shown on the motor starter list and the drawings. The transformer volt-ampere power rating shall be at least equal to the power required by the starter coil, indicating lights, and auxiliary relays in the control circuit, plus 50 VA.
 - 2. Control power transformers shall include two primary fuses and one secondary fuse, sized according to the National Electrical Code for the transformer VA rating.
- D. **Pushbuttons:** Pushbuttons shall be provided for all manual starters and for magnetic starters when shown on the drawings. Pushbuttons for magnetic starters shall be round with a round bezel and shall be watertight and oil tight. The function and quantity of pushbuttons shall be as shown on the drawings. All pushbuttons shall include legend plates.
- E. **Nameplates:** Engraved nameplates shall be provided for all individually mounted starters to identify the load served. Nameplates shall be engraved with black letters of 3/16 inch minimum height on a white background, fastened to the front of the enclosure with stainless steel screws.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with the manufacturer's instructions.
- B. Verify motor alignment prior to operation.

3.02 FIELD QUALITY CONTROL

- A. Install overload relay thermal elements based on motor nameplate rating. If capacitors are installed between the relay and motor, select thermal elements based on the measured motor current. Adjust other -overcurrent protective devices to settings per the coordination study.
- B. Megger each bus, phase-to-phase and phase-to-ground.

****END OF SECTION****

SECTION 16156

SOLID STATE REDUCED VOLTAGE MOTOR STARTERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

1. Solid State Reduced Voltage motor Starters.

1.02 RELATED SECTIONS

- A. Motors are specified in Section 16150.
- B. Motor starters are specified in Section 16155.

1.03 SUBMITTALS

- A. Submit shop drawings showing certified dimensions and data on all accessories.

1.04 QUALITY ASSURANCE

- A. All motor starters specified in this section shall be NEMA rated devices.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Solid state reduced voltage starters shall be Square-D, Altistart 46 Soft Start, Class 8636; Cutler-Hammer, Easy Start EA; Allen-Bradley, SMC-Flex Non-Combination Enclosed starters or engineer approved alternate.

2.02 EQUIPMENT

- A. Environmental: The unit shall be rated for a maximum ambient temperature of 40°C, an altitude of 3,300 feet, and a humidity range of 0 to 95% non-condensing.
- B. Power Section: The power section shall be three phase, 60 hertz, and rated for 10 horsepower and 480 volts. It shall consist of three sets of back-to-back phase controlled SCR's. The SCR's shall be rated to withstand a peak inverse voltage of at least 2.5 times SCR rated line-to-line voltage. The starter shall have a short circuit withstand rating of not less than 30,000 symmetrical amperes.
 1. Design Features: The starting current and the current limit shall be adjustable from 150 to 500 percent of motor full load current. The acceleration time shall be adjustable from 2 to 30 seconds. The power section shall have metal oxide

varistor (MOV) type surge suppressors across the SCR's rated 10% above the SCR rated voltage. Suitably rated snubbers for voltage suppression shall be included. The SCR's shall be equipped with automatic reset over-temperature switches wired in series with the overload relay contact. The continuous current rating of the unit shall not be less than 115 percent of the motor full load ampere rating.

2. By-Pass Contactor: A contactor shall be provided to automatically bypass the SCR devices after the motor has reached running speed. The contactor shall be NEMA size 2 rated for 10 horsepower, 3 phase, 60 hertz, 460 volts.
3. Disconnect Switch: A molded case switch rated for not less than 20 amperes shall be provided for the incoming line. The switch shall have a minimum short circuit withstand rating of 30,000 amperes at 600 volts ac. A shunt trip shall be included to trip the switch if a malfunction is sensed by the starter circuitry.
4. Grounding: Two ground lugs shall be furnished, one for incoming and one for outgoing ground connections.
5. Terminations: Power terminations for the load and line side conductors shall consist of bolted type terminals suitable for use with the proper number of copper conductors per phase as shown on the drawings.

C. Control Section:

1. Controls shall be provided to allow the motor starting current to be ramped up to the current limit setting.
2. The control logic shall include as a minimum:
 - a) Single-phase protection.
 - b) Undervoltage protection.
 - c) Short circuit electronic trip overcurrent protection. Time not to exceed 1/2 cycle.
 - d) Inverse time running overcurrent protection.
 - e) Auxiliary trip circuitry.
 - f) Gate firing circuit lockout protection on trip.
 - g) 50% - 130% full load running current trip adjustment.
 - h) 150% - 400% current limit adjustment.
 - i) Individual light emitting diodes (LEDS) for run, trip, phase loss, and shorted SCR.
 - j) Minimum and maximum voltage adjustments.
3. A control circuit transformer shall be provided adequately sized for the starter control circuits, the line switch shunt trip, and the door mounted indicating lights. The transformer shall have two primary and one secondary fuses.
4. The solid state logic shall be phase insensitive. Current from all three phases shall be monitored and used for control.

D. Operator Interface

1. The following devices shall be mounted on the enclosure door:
 - a. Start-stop pushbutton
 - b. Red and green indicating lights
 - c. Overload reset pushbutton

- d. Ammeter
 - e. Voltmeter
 - 2. One potential transformer and one current transformer shall be connected to the load side of the unit to operate the meters.
 - 3. Snubbers: Resistor/Capacitor snubber networks shall be used to prevent false firing of SCR's due to dv/dt characteristics of the electrical system.
- E. Terminal Blocks: Terminal blocks shall be provided to interface with external control wiring. Terminal blocks shall be rated for 600 volts and 30 amperes, suitable for class C applications, and shall be double row construction with binder head screws. Marking strips shall be included.
- F. Enclosure:
- 1. The starter enclosure shall be NEMA Type 12, unless otherwise noted on the plans or in these specifications, constructed from not less than 16 gauge steel.
 - 2. The structure, when floor-mounted, shall be provided with adequate lifting means and shall be capable of being rolled or lifted into installation position and bolted to the floor.
 - 3. External and internal steel surfaces to be painted shall be thoroughly cleaned and phosphatized prior to application of paint. They shall then be primed with a corrosion-resisting coating. Cabinet and door finish shall be manufacturer's standard.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The starter shall be installed per the manufacturer's specifications with a minimum clearance of 4 inches on each side of the enclosure.
- B. An "as built" wiring diagram shall be included for making the appropriate electrical connections.
- C. Verify motor alignment prior to operation.

3.02 FIELD QUALITY CONTROL

A. TESTS

- 1. The services of a qualified manufacturer's technical representative shall be available to test and start up all solid state reduced voltage starters furnished under this specification.
- 2. The manufacturer shall supply certified test results, upon request, to confirm that the controller has been tested to substantiate designs according to applicable ANSI and NEMA Standards. The tests shall verify not only the performance of the unit and integrated assembly, but also the suitability of the enclosure venting,

rigidity and bus bracing. In addition, the unit shall be factory tested in accordance with ANSI standards.

3. Manufacturer shall be prepared to show proper evidence of having tested for noise immunity on both input and output power connections. Noise testing shall be performed in accordance with NEMA ICA 2-230.40.
4. Install overload relay thermal elements based on motor nameplate rating. If capacitors are installed between the relay and motor, select thermal elements based on the measured motor current. Adjust other overcurrent protective devices to settings per the coordination study.
5. Megger each bus, phase-to-phase and phase-to-ground.

3.03 MONITORING

- A. The solid state starter manufacturer shall install an Electro Industries/Gaugetech DM Series 3 phase digital multifunction power monitor to each starter. The unit shall transmit the phase voltages and currents by way of an RS485 digital communications port to the City of Canton SCADA System ARTU. The manufacturer shall mount the unit on the front of the enclosure and provide the required potential transformers on the line side of the starter unit and current transformers on the load side of the starter unit. Connections from the multifunction power monitor to the SCADA system shall be completed by Dexter Fortson Associates personnel as described in Section 16900.

****END OF SECTION****

SECTION 16162

AUTOMATIC TRANSFER SWITCHES

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Automatic Transfer Switches.

1.02 RELATED SECTIONS

- A. Generators are specified in Section 16216.

1.03 REFERENCE STANDARDS

- A. The automatic transfer switch shall conform to the requirements of NEMA Standard ICS-2-447 and Underwriters' Laboratories UL-1008, and shall be UL listed as follows:
 - 1. For use in emergency systems in accordance with Articles 700, 701, and 702 of the National Electrical Code.
 - 2. Rated in amperes for total system transfer including control of motors, electric discharge lamps, electric heating and tungsten filament lamp loads as referred to in Paragraph 30.9 of UL-1008.

1.04 WORK INCLUDED

- A. The work includes supplying Automatic Transfer Switch(es) as specified herein.
- B. The equipment supplied and installed shall meet the requirements of the NEC and all applicable local codes and regulations. All equipment shall be of new and current production by a MANUFACTURER who has 25 years of experience building this type of equipment. Manufacturer shall be ISO9001 certified.

1.05 ACCEPTABLE MANUFACTURERS

- A. The transfer switch shall be manufactured by ASCO, Square D, Zenith, Kohler, or alternate acceptable to the Engineer.

1.06 SUBMITTALS

- A. Submit shop drawings.
- B. Operator's Manual: Each transfer switch shall be furnished with an operator's manual providing installation and operating instructions.

1.07 WARRANTY

- A. The manufacturer's standard warranty shall in no event be for a period of less than one (1) year from date of initial start-up of the system and shall include repair parts, labor, reasonable travel expense necessary for repairs at the job site. Submittals received without written warranties as specified will be rejected in their entirety.

PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. The transfer switch shall be rated for the voltage and ampacity as shown on the plans and shall have 600 volt insulation on all parts in accordance with NEMA standards.
- B. Each automatic transfer switch shall consist of a power transfer module and a control module, interconnected to provide complete automatic operation. The automatic transfer switch shall be mechanically held and electrically operated by a single-solenoid mechanism energized from the source to which the load is to be transferred. The switch shall be rated for continuous duty and be inherently double throw. The switch shall be mechanically interlocked to ensure only one of two possible positions - normal and emergency.
- C. The current rating shall be a continuous rating when the switch is installed in an unventilated enclosure, and shall conform to NEMA temperature rise standards. Designs which require cabinet ventilation are unacceptable and do not meet this specification.
- D. The unit shall be rated based on all classes of loads, i.e., resistive, tungsten, ballast and inductive loads. Switches rated 400 amperes or less shall be UL listed for 100% tungsten lamp load.
- E. As a precondition for approval, all transfer switches complete with accessories shall be listed by Underwriters Laboratories, under Standard UL 1008 (automatic transfer switches) and approved for use on emergency systems.
- F. The withstand current capacity of the main contacts shall not be less than 20 times the continuous duty rating when coordinated with any molded case circuit breaker established by certified test data.
- G. Temperature rise tests in accordance with UL 1008 shall have been conducted after the overload and endurance tests to confirm the ability of the units to carry their rated currents within the allowable temperature limits.
- H. The transfer switches shall be supplied with a solid state control panel as detailed further in these specifications.

2.02 CONTROL

- A. Sensing and control logic shall be solid-state. Interfacing relays shall be industrial control grade plug-in type with dust covers.
- B. All phases of the normal shall be monitored line-to-line. Close differential voltage sensing shall be provided. The pickup voltage shall be field adjustable from 85% to 100% of nominal and the dropout voltage shall be adjustable from 75% to 95% of the pickup value. The transfer to emergency will be initiated upon reduction of normal source to 85% of nominal voltage and retransfer to normal shall occur when normal source restores to 95% of nominal.
- C. The following time delays shall be provided:

1. A time delay to override momentary normal source outages. The time delay shall be field adjustable from 0.5 to 6 seconds and factory set at 1 second.
2. A time delay on retransfer to normal source. The time delay shall be automatically bypassed if the emergency source fails and normal source is available. The time delay shall be field adjustable from 0 to 30 minutes and factory set at 5 minutes.
3. An unloaded running time delay for emergency generator cool_down. The time delay shall be field adjustable from 0 to 5 minutes and factory set at 5 minutes.
4. A time delay on transfer to emergency. The time delay shall be field adjustable from 0 to 5 minutes for controlled timing of load transfer to emergency, and factory set at zero.

D. The following features and accessories shall be provided:

1. Independent single phase voltage and frequency sensing of emergency source. The pickup voltage shall be adjustable from 85% to 100% of nominal. Pickup frequency shall be adjustable from 90% to 100% of nominal. Transfer to emergency upon normal source failure when emergency source voltage is 90% or more of nominal and frequency is 95% or more of nominal.
2. A contact that closes when normal source fails and one that opens when normal source fails, rated 10 Amps, 120V ac.
3. A white signal light to indicate when the automatic transfer switch is connected to the normal source. A yellow signal light to indicate when the automatic transfer switch is connected to the emergency source.
4. Two auxiliary contacts that are closed when the automatic transfer switch is connected to normal and two auxiliary contacts that are closed when the automatic transfer switch is connected to emergency. Rated 10 Amps, 120 volts, 60 Hz. AC.
5. A test switch to momentarily simulate normal source failure.
6. Reset switch to manually bypass time delay on retransfer to normal.
7. A permissive start/stop feature to provide for start/stop of the generator from a remote site regardless of the presence of normal utility power.
8. The automatic transfer switch shall be provided with Electro Industries/Gauge Tech series DM multi-function power monitors. The multi-function power monitors shall transmit, via RS-485 digital communications, each phase voltage of both normal and emergency power source to the City of Canton SCADA system. The automatic transfer switch manufacturer shall provide, and install, all potential transformers, the multifunction power monitors, and interconnections between the two at the factory.

2.03 SEQUENCE OF OPERATION

- A. The ATS shall incorporate adjustable three phase under-voltage sensing of the normal source.
- B. When the voltage of any phase of the normal source is reduced to 80% of nominal voltage, for a period of 0-10 seconds (programmable) a pilot contact shall close to initiate starting of the engine generator.
- C. The ATS shall incorporate adjustable single phase under-voltage sensing of the emergency source.

- D. When the emergency source has reached a voltage value within 10% of nominal voltage and achieved frequency within 5% of the rated value, the load shall be transferred to the emergency source after a programmable time delay.
- E. When the normal source has been restored to not less than 90% of rated voltage on all phases, the load shall be re-transferred to the normal source after a time delay of 0 to 30 minutes (programmable). The generator shall run unloaded for 5 minutes (programmable) and then automatically shut down. The generator shall be ready for automatic operation upon the next failure of the normal source.
- F. If the engine generator should fail while carrying the load, retransfer to the normal source shall be made instantaneously upon restoration of proper voltage (90%) on the normal source.
- G. The transfer switch shall be equipped with a solid state control panel. The control panel shall perform the operational and display functions of the transfer switch. The display functions of the control panel shall include ATS position and source availability.
- H. The control panel shall include indicators for timing functions, and ATS test switch.
- I. The control panel shall be provided with calibrated pots (accessible only by first opening the lockable cabinet door) to set time delays, voltage and frequency sensors. The ATS shall be capable of being adjusted while the controls are energized and the unit in automatic mode. Designs which force a "programming mode" or require the controls to be de-energized during adjustment are unacceptable.
- J. The control panel shall be opto-isolated from its inputs to reduce susceptibility to electrical noise and provided with the following inherent control functions and capabilities:
 1. An LED display for continuous monitoring of the ATS functions.
 2. Built-in diagnostic display.
 3. Test switch to simulate a normal source failure.
 4. Time delay to override momentary normal source failure prior to engine start. Field programmable 0-10 seconds (continuously adjustable via a calibrated potentiometer factory set at 3 seconds).
 5. Time delay on retransfer to normal source, continuously adjustable 0-30 minutes, factory set at 30 minutes. If the emergency source fails during the retransfer time delay, the transfer switch controls shall automatically bypass the time delay and immediately retransfer to the normal position.
 6. Time delay on transfer to emergency, continuously adjustable 0-15 seconds, factory set at 1 second.
 7. An in-phase monitor or time delayed neutral shall be provided to prevent excessive transient currents from switching motor loads.
 8. An interval-type automatic clock exerciser with load/no load selectability shall be incorporated in the ATS.

2.04 CONSTRUCTION AND PERFORMANCE

- A. The automatic transfer switch shall be of double throw construction operated by a reliable electrical mechanism momentarily energized. There shall be a direct mechanical coupling to facilitate transfer in 6 cycles or less.

- B. The normal and emergency contacts shall be mechanically interlocked such that failure of any coil or disarrangement of any part shall not permit a neutral position.
- C. For switches installed in systems having ground fault protective devices, and/or wired so as to be designated a separately derived system by the NEC, a 4th pole shall be provided. This additional pole shall isolate the normal and emergency neutrals. The neutral pole shall have the same withstand and operational ratings as the other poles and shall be arranged to break last and make first to minimize neutral switching transients. Add-on or accessory poles that are not of identical construction and withstand capability are not acceptable.
- D. The contact structure shall consist of a main current carrying contact, which is a silver alloy with a minimum of 50% silver content. The current carrying contacts shall be protected by silver tungsten arcing contacts on all sizes above 400 Amps.
 - E. The transfer switch manufacturer shall submit test data for each size switch required for this project, showing that it can withstand fault currents of the magnitude and the duration necessary to maintain the system integrity. Minimum UL listed withstand and close into fault ratings shall be as indicated on the electrical plans.
- F. The automatic transfer switch manufacturer shall certify sufficient arc interrupting capabilities for 50 cycles of operation between a normal and emergency source that are 120 degrees out of phase at 480 volts, 600% of rated current at .50 power factor. This certification is to ensure that there will be no current flow between the two isolated sources during switching.
- G. All relays shall be continuous duty industrial type with wiping contacts. Customer interface contacts shall be rated 10 amperes minimum. Coils, relays, timers and accessories shall be readily front accessible. The control panel and power section shall be interconnected with a harness and keyed disconnect plugs for maintenance.
- H. Main and arcing contacts shall be visible without major disassembly to facilitate inspection and maintenance.
- I. A manual handle shall be provided for maintenance purposes with the switch de-energized. An operator disconnect switch shall be provided to defeat automatic operation during maintenance, inspection or manual operation.
- J. The switch shall be mounted in a NEMA 1 indoor non-ventilated enclosure unless otherwise indicated on the plans.
- K. The operating transfer time in either direction shall not exceed one-sixth (1/6) of a second.
- L. All contacts, coils, springs and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.
- M. Automatic transfer switches utilizing components of molded-case circuit breakers, contactors, or parts thereof which have not been intended for continuous duty or repetitive load transfer switching are not acceptable.

- N. To afford the advantage of a single source of supply to the owner, the automatic transfer switch shall be supplied by the manufacturer of the engine generator set and covered under the same warranty program.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install equipment in accordance with manufacturer's recommendations, the project drawings and specifications, and all applicable codes. Installation of the system includes but is not limited to pouring a concrete pad for floor mounted automatic transfer switch(es), receiving and offloading the equipment, providing all labor, permits and material to install the total system.

3.02 START-UP AND TESTING

- A. Coordinate all start-up and testing activities with the Engineer and Owner.
 - 1. Tests: Certified laboratory test data on a switch of the same design and rating shall be provided by the automatic switch manufacturer to confirm the following switching abilities:
 - a. Overload and endurance at 480 volts AC per Tables 21.2, 23.1 and 23.2 of UL-1008.
 - b. Temperature rise tests after the overload and endurance tests to confirm the ability of the transfer switches to carry their rated current within the allowable temperature limits of the insulation in contact with current-carrying parts.
 - c. Withstand current tests per Paragraph 25 of UL-1008 for 100,000 amperes rms symmetrical, at 480 volts and an X/R ratio of 6.6, when used with current limiting fuses.
 - d. No welding of contacts. Transfer switch must be operable by the normal means after the withstand current tests.
 - e. Dielectric tests at 1960 volts, rms, minimum after the withstand current test.
 - f. The complete automatic transfer switch shall be tested as to ensure proper operation of the individual components and correct overall sequence operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.
 - g. The complete automatic transfer switch shall be subjected to a dielectric strength test per NEMA standard ICS 1-109.21, after the withstand current test.
 - h. The control panel shall meet or exceed the voltage surge withstand capability in accordance with ANSI/IEEE Standard C37.90a, latest edition, and the impulse withstand voltage test in accordance with the proposed NEMA Standard ICS 1-109.
- B. Operation and Maintenance Manuals

1. Provide five (5) sets of operation and maintenance manuals covering the generator, switchgear, and auxiliary components. Include parts manuals, final as-built wiring interconnect diagrams and recommended preventative maintenance schedules.

C. Training

Provide one day of on-site training to instruct the owner's personnel in the proper operation and maintenance of the equipment. Review operation and maintenance manuals, parts manuals, and emergency service procedures.

****END OF SECTION****

SECTION 16180

SEPARATELY ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Thermal Magnetic Molded Case Circuit Breakers.

1.02 RELATED SECTIONS

1.03 REFERENCES

- A. The circuit breaker(s) referenced herein shall be designed and manufactured according to the latest revision of the following standards.

1. NEMA AB 1 1993 - (National Electrical Manufacturers Association) Molded Case Circuit Breakers and Molded Case Switches
2. UL 489 - (Underwriters Laboratories Inc.) Molded Case Circuit Breakers and Circuit Breaker Enclosures
3. UL 943 - Standard for Ground Fault Circuit Interrupters
4. CSA C22.2 No. 5.1 - M91 - (Canadian Standard Association) Molded Case Circuit Breakers
5. Federal Specification W-C-375B/GEN - Circuit Breakers, Molded Case; Branch Circuit and Service
6. National Fire Protection Association NFPA - 70 (National Electrical Code)
7. UL[®] 50 - Cabinets and Boxes
8. NEMA[®] 250 - Enclosures for Electrical Equipment

1.04 SUBMITTALS

- A. Submit shop drawings in accordance with NEMA classification as noted above and additional information as noted in the following paragraphs.
- B. Reference Data: Submit one set of full size (11 x 14-inch) time current curves on log-log transparency paper for all overcurrent protective devices.

1.05 QUALIFICATIONS

- A. To be considered for approval, the manufacturer shall furnish products listed by Underwriters Laboratories Incorporated (UL), or testing firm acceptable to the authority having jurisdiction as suitable for application specified.

- B. The overcurrent protection device manufacturing facility shall be Registered by Underwriters Laboratories Inc. to the International Organization for Standardization ISO 9000 Series Standards for quality.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Molded Case Circuit Breakers shall be as manufactured by Square-D, General Electric, Cutler Hammer or engineer approved alternate.

2.02 MOLDED CASE CIRCUIT BREAKERS

A. Molded Case Circuit Breaker Characteristics - General

1. Circuit breakers shall be constructed using glass reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
2. Circuit breakers shall have not less than 14 k ampere symmetrical interrupting rating at 480 volts.
3. Circuit breakers shall have an over center, trip free, toggle operating mechanism which will provide quick-make, quick-break contact action. The circuit breaker shall have common tripping of all poles.
4. The circuit breaker handle shall reside in a tripped position between ON and OFF to provide local trip indication. Circuit breaker escutcheon shall be clearly marked ON and OFF in addition to providing International I/O markings.
5. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker.
6. Each circuit breaker shall be equipped with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit breaker tripping mechanism for maintenance and testing purposes.
7. Manufacturer shall provide electronic and hard copy time/current characteristic trip curves (and I_p & I_t let through curves for current limiting circuit breakers) for each type of circuit breaker.
8. Circuit breaker handle accessories shall provide provisions for locking handle in the ON and OFF position. All circuit breaker accessories shall be UL listed.
9. All circuit breakers shall be UL Listed for reverse connection without restrictive line and load markings and be suitable for mounting in any position.
10. Breakers with a frame size of 600 amp through 3000 amp shall be UL listed and labeled for 100% application per NEC

B. Thermal-Magnetic Circuit Breakers

1. Circuit breakers shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.
2. Thermal trip elements shall be factory preset and sealed. Circuit breakers shall be true rms sensing and thermally responsive to protect circuit conductor(s) in a 40° C ambient temperature.
3. Circuit breaker frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker.

3.03 ENCLOSURE

- A. Circuit breaker enclosures shall be furnished and installed at locations as shown on the drawings. Enclosures shall be of the type approved, indicated, and specified herein.
- B. Main Circuit breaker enclosures shall be identified for use as service equipment and are to be labeled for this application.
- C. The circuit breaker operating handle shall be directly operable through the front cover of the NEMA Type 4X stainless steel enclosure.
- D. Provisions for padlocking the circuit breaker in the OFF position shall be provided.
- E. The integrated equipment short circuit current rating shall be equal to the interrupting rating at the supply voltage marked on the circuit breaker installed, up to 200,000 rms symmetrical amperes short circuit current, or as shown on enclosure wiring diagram.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install circuit breakers in accordance with manufacturer's instructions, the National Electrical Code and applicable local codes.
- B. Provide an engraved nameplate (MAIN CIRCUIT BREAKER) with 3/16 inch minimum height black letters on a white background, mounted on the front of the enclosure with stainless steel screws.

****END OF SECTION****

SECTION 16216

ENGINE DRIVEN GENERATOR SETS

PART 1 - GENERAL

1.01 SCOPE

- A. This specification defines the requirements for an emergency or standby Electric Generator Set. The generator set shall consist of an engine directly coupled to an electric generator, together with the necessary controls and accessories to provide electric power for the duration of any failure of the normal power supply.

1.02 REFERENCES

- A. The equipment covered by these specifications shall be designed, tested, rated, assembled and installed in strict accordance with all applicable standards of ANSI, NEC, ISO, U.L., IEEE and NEMA.

1.03 RELATED SECTIONS

- A. Division 3 - Concrete
- B. Division 15 – Mechanical
- C. Automatic Transfer Switches are specified in Section 16162.

1.04 WORK INCLUDED

- A. The work includes supplying a complete integrated emergency generator system. The system consists of a diesel generator set with related component accessories and Automatic Transfer Switch(es) as specified herein.

1.05 SYSTEM DISCRIPTION

- A. The generator set shall have the following characteristics:

Voltage	480
Phase	3
Connection	Y
Wire	4
Hertz	60
Power Factor	0.8

The generator set shall be capable of starting and running the following loads without exceeding the maximum voltage and frequency variations specified herein, or the maximum temperature limitations of the engine and generator. The generator set shall be capable of starting all motor loads in the order listed, with the non-inductive load applied first.

Non inductive load, kW :

5

Motor loads

<u>NO.</u>	<u>H.P.</u>	<u>FLA</u>	<u>LRA</u>	<u>SPF*</u>	<u>RPF*</u>
1.	35	39	277		
2.	35	39	277		

ACCEPTABLE MANUFACTURERS

- A. Quality and Experience: All materials and parts of the generator set shall be new and unused. Each component shall be of current manufacture from a firm regularly engaged in the production of such equipment. Units and components offered under these specifications shall be covered by the manufacturer's standard warranty on new machines, a copy of which shall be included in the submittal.
- B. There shall be one source responsibility for warranty, parts and service through a local representative with factory trained service personnel.
- C. Generator Set
 - 1. Caterpillar
 - 2. Cummins/Onan
 - 3. Generac
 - 4. Katolight

1.06 SUBSTITUTION

- A. Proposed deviations from the specifications shall be treated as follows:
 - 1. Requests for substitutions shall be made a minimum of ten (10) days prior to bid date. Manufacturers catalog data shall accompany each request and authorized acceptance shall be by addenda only.
 - 2. The emergency power system has been designed to a generic set of electrical and physical characteristics. The equipment sizing, spacing, electrical wiring, ventilation equipment, fuel and exhaust components have all been sized and designed around standard equipment. Should any substitutions need to be made, the CONTRACTOR shall bear the responsibility for notifying the engineer in accordance with 16216.1.07.A.1 above, the installation, coordination and operation of the system as well as any engineering and redesign costs, which may result from such substitutions.

1.07 SUBMITTALS

- A. Engine-generator submittals shall include the following information

1. Factory published specification sheet indicating standard and optional accessories, ratings, etc.
 2. Manufacturer's catalog cut sheets of all auxiliary components such as Automatic Transfer Switches, battery charger, control panel, enclosure, main circuit breaker, etc.
 3. Dimensional elevation and layout drawings of the generator set, enclosure and transfer switchgear and related accessories.
 4. Weights of all equipment.
 5. Concrete pad recommendation, layout and stub-up locations of electrical and fuel systems.
 6. Interconnect wiring diagram of complete emergency system, including generator, switchgear, day tank, remote pumps, battery charger, jacket water heater, remote alarm indications.
 7. The bidder shall submit with his submittal an estimate of engine mechanical data including heat rejection, exhaust gas flows, combustion air and ventilation air flows, noise data, fuel consumption, etc. when operating at 100% load. These estimates shall be based on manufacturer's data.
 8. Generator electrical data including temperature and insulation data, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
 9. Generator resistances, reactances, and time constants.
 10. Generator motor starting capability.
 11. Control panel schematics.
 12. Oil sampling analysis, laboratory location, and information.
 13. Manufacturer's and dealer's written warranty.
 14. Manufacturer's statement that the Generator shall fully start and carry the entire Lift Station connected load.
- B. Operation and Maintenance Information. The system supplier shall furnish five sets of operating, maintenance and parts manuals covering all components for the generator set system. The supplier shall also instruct the owner in operation and maintenance of the unit.

1.08 WARRANTY

- A. The manufacturer's standard warranty shall in no event be for a period of less than two (2) years from date of initial start-up of the system and shall include repair parts, labor, reasonable travel expense necessary for repairs at the job site, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of repair. Submittals received without written warranties as specified will be rejected in their entirety.

1.09 PARTS AND SERVICE QUALIFICATIONS

- A. Bids shall be accepted only on engine driven generator sets which can be properly maintained and serviced without causing the purchaser either to carry expensive parts stock or to be subjected to the inconvenience of long periods of interrupted service because of lack of available parts. The bidder shall specify the nearest location of permanent parts outlets from which parts may be obtained.
- B. The engine-generator supplier shall have service facilities within 75 miles of the project site and maintain 24-hour parts and service capability. The distributor shall stock parts as needed to support the generator set package for this specific project.
- C. The dealer shall maintain qualified, factory trained service personnel that can respond to an emergency call within 2 hours of notification, 24 hours per day.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. The equipment supplied and installed shall meet the requirements of the NEC and all applicable local codes and regulations. All equipment shall be of new and current production by a MANUFACTURER who has 25 years of experience building this type of equipment. Units and components offered under these specifications shall be covered by the manufacturer's standard warranty on new machines, a copy of which shall be included in the submittal. Manufacturer shall be ISO9001 certified.
- B. The system shall be free of injurious torsional and bending vibrations within a speed range from 10% below to 10% above synchronous speed.
- C. The system shall be adequately guarded both physically and electrically for protection of operating personnel.

2.02 ENGINE

- A. General Description. The engine shall be of the internal combustion type equipped to operate on No. 2 diesel fuel.
- B. Engine Power Rating. The rated net horsepower of the engine at the generator synchronous speed, with all accessories, shall not be less than that required to produce the KW required by paragraph 1.01. The horsepower rating shall take into account generator efficiency and all parasitic losses such as fan, battery charger, etc. The generator set shall be capable of producing the required KW (without overload) for the duration of the power outage (standby rating), under the following ambient conditions:

Altitude, feet	1000
Ambient temperature range, °F	0-100
Humidity at max. ambient temp. %	80

- C. Fuel and Oil Consumption. Accompanying the supplier's bid, the bidder shall supply fuel and oil consumption estimates based on engine manufacturer's data, a copy of which shall

be included in the submittal.

- D. Governor (Engine Speed Control). The engine shall be equipped with a suitable governor to maintain frequency within limits, as specified below, by controlling engine and generator speed.
1. Type: isochronous
 2. Stability: 1/4% maximum steady state frequency variation at any constant load from no load to full load.
 3. Regulation: 1/4% maximum frequency deviation between no-load steady state and full-load steady state.
 4. Transient: 5% maximum frequency dip on most severe motor starting condition. See paragraph 1.01.
 5. Transient: 2 seconds maximum recovery time for maximum motor start.
 6. The manual speed adjusting control shall be mechanical or electrical if located on the generator set or electrical if located in a remote control panel.
- E. Engine Crank-Start System. The engine shall be electric start, provided with a solenoid energized motor, with either positive engagement or clutch drive to the engine.
1. Lead-calcium batteries shall be furnished to provide power to the engine cranking motor. The batteries shall be designed for operation at a minimum ambient temperature of 0 °F.
 2. The voltage shall be as required by the engine manufacturer.
 3. The batteries shall be capable of a minimum of four crank cycles (rolling) of the specified prime mover and have sufficient current available for "break-away" currents for the particular engine used at the specified worse case temperature.
 4. A float type battery charger, compatible with the batteries selected, shall be furnished which shall maintain the starting batteries at full charge. The charging system shall permit charging from either the normal or the emergency power source. It shall have a high rate and low rate charging system. A voltmeter shall indicate the charge rate and the circuit will be protected by either fuses or circuit breakers. The charger or charging circuit shall be so designed that it will not be damaged during the engine cranking, achieved, for example, by a current limiting charger or a crank disconnect relay. It shall also be capable of recharging a discharged battery in 12 hours while carrying normal loads.
- F. Engine Cooling System. The engine shall be liquid cooled. The type of liquid cooling system shall be a unit mounted radiator. The radiator capacity shall be suitable for operation in the ambient temperature specified in paragraph 2.02, plus the air temperature rise across the engine.
- G. Air Supply/Exhaust System.
1. Cleaner: An air cleaner and silencer shall be furnished as recommended by the engine manufacturer and shall be located and mounted as recommended by the engine manufacturer.
 2. Exhaust: An exhaust system of suitable size, configuration and material in

accordance with engine manufacturer's recommendations shall connect the exhaust outlet of the engine to the silencer. The type of silencer shall meet the requirements of engine manufacturers and shall be residential silencing type.

- a. The exhaust system and silencer shall have the configuration shown on the drawings, and shall be of such size that back pressure on the system will not exceed the back pressure permitted by the manufacturer's recommendation. A flexible connection shall be mounted at the engine exhaust outlet and the discharge end of the exhaust line shall be protected against entry of precipitation. Piping within reach of personnel shall be protected by screening or suitable lagging. All exhaust piping shall be gas tight.
- b. A wall thimble shall be used where the exhaust pipe passes through a wall to the outside of the building. The thimble shall prevent the possible combustion of the wall paneling materials.

H. Engine Protective Devices. The following engine protective devices shall be provided, and an indicating light shall be supplied for use with each device specified.

1. Alarm system for high water temperature and/or low oil pressure.
2. Automatic engine shutdown for high water temperature and/or low oil pressure.
3. Combination alarm and shutdown system for high water temperature and/or low oil pressure.
4. Engine overspeed automatic shutdown device.
5. Engine failed to start indicator light (overcrank).
6. Alarm for low coolant level.
7. A shunt trip and undervoltage trip shall be incorporated to cause the circuit breaker to open simultaneously with any automatic shutdown of the engine.

I. Fuel Supply for Engine.

1. Main Fuel Storage Tank: A dual wall sub base fuel tank shall be provided with adequate capacity to allow the diesel-generator unit to operate one pump and the ancillary loads continuously for 36 hours. The tank shall be constructed of aluminized steel with all access ports and vents located on the top horizontal surface. The tank shall be pressure and load tested according to UL 142 and shall be UL listed. The tank shall be capable of supporting the weight of the generator, isolators and enclosure, and shall have four lifting eyes capable of lifting the entire generator set package. Low level and leak detector float switches shall be provided, both wired to control panel alarm lights, and a tank mounted fuel gauge.
2. Main Fuel Delivery System: A system shall be supplied to deliver an adequate amount of fuel to the engine from the storage tank. Pipe sizes shall be no smaller than the minimum recommended by the engine manufacturer to avoid fuel flow restriction. The engine supply and return line shall be equipped with a length of flexible fuel lines, unions and gate valves. No copper lines are acceptable.
3. The system shall include an engine driven transfer pump of sufficient lift and capacity to deliver fuel at the maximum required rate from the storage tank to the engine. A check valve shall be furnished in supply line at engine.
4. A day tank shall be located in the engine room. The day tank shall be provided with a check valve in the supply line to the engine. The tank shall be new and

unused and shall not be galvanized. An AC electric pump shall be furnished to transfer fuel from the main storage tank to the day tank. Lift and capacity of the pump shall be adequate to deliver fuel to the day tank at a rate in excess of the maximum fuel rate of the engine. The tank shall also be equipped with a manual hand priming pump.

5. The tank shall be sized to allow full capacity generator operation for a minimum of two hours without refilling.

2.03 GENERATOR

- A. Description. The generator shall meet all requirements of NEMA MG-1, Part 22, in design, performance and factory test procedures. The regulator shall be factory wired and tested with the generator. The generator shall have the characteristics and ratings required by paragraph 22.10.
- B. Excitation System. The generator shall be equipped with a permanent magnet generator (PMG) excitation system. Both the PMG and the rotating brushless exciter shall be mounted outboard of the bearing. The system shall supply a minimum short circuit support current of 300% of the standby rating for 10 seconds. The rotating exciter shall use a three phase full wave rectifier assembly with hermetically sealed silicon diodes protected against abnormal transient conditions by a multiplate selenium surge protector.
- C. Construction. The insulation system of both the rotor and stator shall be of NEMA Class H materials and shall be synthetic and non-hygroscopic. Field windings shall be on the rotor, and the rotor core shall be shrunk-fit and keyed to the shaft. The stator winding shall be of 2/3 pitch design to eliminate the third harmonic. Units rated above 1500 kW or 601 volts or higher shall be form wound.
 1. The temperature rise of both the rotor and the stator shall be in accordance with the applicable sections of NEMA MG-1-22, BS-5000 part 99, or CSA C22.2, for the type of service intended. The generator shall be self-ventilated.
- D. Conduit Box. Load connections shall be made in the front-end mounted junction box. The generator construction will allow connection to the load through the top, bottom or either side of the junction box.
 1. The conduit box shall contain two compartments: one to house the rotating rectifier and PMG, and the other to house the connection area and regulator. This is to separate the rotating elements from the load connection and voltage regulator adjustments.
- E. Verification of Performance. All performance and temperature rise data submitted by the bidder shall be the result of the actual test of the same or duplicate generators. Temperature rise data shall be the result of full load, 0.8 power factor heat runs at the rated voltage and hertz. All performance testing shall be done in accordance with MIL-STD-705 and/or IEEE Standard-115.

- F. Efficiency. The generator efficiency shall be determined in accordance with NEMA MG-1, paragraph 22.44. All test results shall be submitted to the Engineer for approval.

2.04 VOLTAGE REGULATION

- A. The generator shall be equipped with a voltage regulator to maintain voltage within limits as specified below:
 1. Stability: 1/2% maximum voltage variation at any constant load from no load to full load.
 2. Regulation: 1% maximum voltage between no load steady state and full load steady state.
 3. Transient: 25% maximum voltage dip in most severe motor starting condition. See paragraph 1.01.
 4. Transient: 2 seconds maximum voltage recovery time with application or removal of 0.8 P.F. full load.
- B. The regulator shall be a solid state type using transistors or SCR's. The unit shall include volts/hertz under speed protection, 3 phase RMS sensing, and overexcitation protection. The regulator shall also provide loss of sensing protection, regulator current limit, temperature protection and an engine unloading circuit. EMI suppression shall be provided meeting MIL-STD-461B, part 9 standards.

2.05 GENERATOR FULL MAIN LINE CIRCUIT BREAKER

- A. A generator main circuit breaker shall be provided rated at 100 amperes minimum frame size and 600 volts. The interrupting capability shall be greater than the generator short circuit capability, but not less than **14,000** symmetrical amperes at 480 volts. The breaker continuous current trip rating shall be selected to provide overload protection for the generator.
- C. The breaker shall include 3 normally open and 3 normally closed auxiliary contacts.
- D. The breaker shall be a Square D Type FC, or alternate as manufactured by General Electric or Westinghouse.

2.06 AUTOMATIC START AND STOP CONTROLS

- A. General Description. Automatic starting and stopping controls shall be furnished to start the engine automatically when the normal electric power fails or falls below specific limits and to stop the engine automatically after the normal power supply resumes. The signal for starting or stopping the engine shall be from an external auxiliary contact. The controls shall be capable of operating at 50% of normal DC system supplied voltage.
- B. Engine Cranking Control. Crank control and time delay relays shall provide at least one cranking period. If only one cranking period is provided, its duration shall be at least 15 seconds. If more than one cranking attempt is provided, each cranking period shall be for at least 7 seconds, and the cranking attempts shall be separated by appropriate rest periods.

A sensing device shall automatically disconnect the starting circuit when the engine has started. If the engine has not started at completion of the starting program, the overcranking signal shall so indicate. The engine starting controls shall be locked out and no further starting attempts shall take place until the overcranking device has been manually reset.

- C. Selector Switch. A selector switch shall be incorporated in the automatic engine start and stop controls. It shall include an "off" position that prevents manual or automatic starting of the engine, a "manual" or "handcrank" position that permits the engine to be started manually by the pushbutton on the control cabinet and run unloaded; an "automatic" position which readies the system for automatic start or stop on demand of the automatic load transfer switch or a programmed exerciser.
- D. Manual Test Operation. It shall be possible to start the engine manually and run it unloaded by a manual pushbutton on the control cabinet that causes the engine to start, run and stop through the automatic start and stop controls.

2.07 INSTRUMENTATION

- A. Instruments and Controls. The following engine and generator instruments and controls shall be furnished and installed:
 - 1. A.C. ammeter
 - 2. A.C. voltmeter
 - 3. Voltage adjusting rheostat
 - 4. Frequency Meter (Digital Electronic)
 - 5. Governor speed adjusting control
 - 6. Water temperature gauge
 - 7. Oil Pressure gauge
 - 8. Manual start/stop control
 - 9. Voltmeter/ammeter phase selector switch
 - 10. Power factor meter or var meter
 - 11. Elapsed time meter
 - 12. Panel lights
 - 13. Indicator lights for engine alarm

All wiring and interconnections shall be in accordance with commercial electrical standards.

- B. Location
 - 1. All of the foregoing instruments, lights and controls shall be mounted in a control panel on the generator set. All instrumentation must be isolated from engine generator set vibration.
 - 2. In addition, an ammeter, voltmeter, dial type frequency meter, "generator ready" light, a start/stop control, and an audible alarm and alarm light shall be provided in a generator control panel to be remotely wall mounted. The audible alarm and alarm light shall operate for any of the engine or generator alarms provided on the

local control panel. Cable between the local and remote control panels shall be provided.

- C. Panel Design. All instruments, controls and indicating lights shall be properly identified. All wires shall be individually identified and must agree with wiring diagrams provided.
- D. Terminals on all terminal blocks shall be individually identified.

2.08 ACCESSORIES

- A. Enclosure. The entire engine-generator assembly, including the battery, battery charger, day tank, lift pump, control panel, and radiator shall be enclosed in a steel or aluminum sound attenuated enclosure suitable for an outdoor environment. The enclosure shall be rated NEMA 3R, and shall be of adequate strength to withstand a 90 MPH wind without damage. Provisions shall be made on the enclosure for mounting the engine exhaust silencer. Louvers or dampers shall be provided to allow adequate radiator ventilation during operation without reducing the rating of the engine-generator unit. Doors shall be provided as required for access to the engine and control panel. Generator pad / platform shall have a maintenance walk a minimum of 3'-0" wide around three sides of the generator, also see plans. Stairs shall be provided from grade to the pad / platform where the elevation difference is greater than 1' - 0" from final grade to the top of the generator pad / platform.
- B. Block Heater. An engine block heater shall be provided to keep the engine coolant at a temperature of 85° F with the ambient temperature at the minimum specified in paragraph 2.02. The heater shall be suitable for operation at **240** volts ac, single phase.
- C. Control Panel Heater. A heater shall be provided in the control panel to keep the interior of the panel above 40° F when at the minimum ambient temperature specified in paragraph 2.02. The heater shall be operated by a thermostat, and shall be suitable for operation at 120 volts ac, single phase.

2.09 TRANSFER SWITCH

- A. See Section 16162 Automatic Transfer Switches.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install equipment in accordance with manufacturer's recommendations, the project drawings and specifications, and all applicable codes. Installation of the system includes but is not limited to pouring a concrete pad for the generator set and automatic transfer switch, receiving and offloading the equipment, providing all labor, permits and material to install the total system.
- B. Mounting. The mounting of the generator set shall be sufficiently rigid to maintain alignment and to minimize the engine and generator stresses. The floor loading shall not

exceed 5000 lbs. per sq. ft. A suitable number of spring type, vibration, rubber type, and fiberglass isolators shall be inserted between the engine generator set and the floor.

3.02 START-UP AND TESTING

- A. Acceptance Test. A complete system load test shall be performed after all equipment is installed. The extent of testing shall be at the discretion of the engineer. The completed generator set shall be tested at 1.0 P.F. for a period of one hour at full load prior to shipment to the job site. In addition, the generator set supplier shall include in his bid the cost of an on site, full load test (using portable resistive type load banks or building load or combination thereof) for a minimum of four hours in the presence of a representative of the owner and/or engineer before final acceptance.
- B. Coordinate all start-up and testing activities with the Engineer and Owner.
- C. After installation is complete and normal power is available, the manufacturer's local dealer shall perform the following:
 - 1. Verify that the equipment is installed properly.
 - 2. Check all auxiliary devices for proper operation, including battery charger, jacket water heater(s), generator space heater, remote annunciator, etc.
 - 3. Test all alarms and safety shutdown devices for proper operation and annunciation.
 - 4. Check all fluid levels.
 - 5. Start engine and check for exhaust, oil, fuel leaks, vibrations, etc.
 - 6. Verify proper voltage and phase rotation at the transfer switch before connecting to the load.
 - 7. Connect the generator to building load and verify that the generator will start and run all designated loads in the plant.
- D. Perform a 4 hour load bank test at full nameplate load using a load bank and cables supplied by the local generator dealer. Observe and record the following data at 15 minute intervals:
 - 1. Service meter hours
 - 2. Volts AC - All phases
 - 3. Amps AC - All phases
 - 4. Frequency
 - 5. Power factor or Vars
 - 6. Jacket water temperature
 - 7. Oil Pressure
 - 8. Fuel pressure
 - 9. Ambient temperature

- E. Operation and Maintenance Manuals
1. Provide five (5) sets of operation and maintenance manuals covering the generator, switchgear, and auxiliary components. Include parts manuals, final as-built wiring interconnect diagrams, start-up test reports, and recommended preventative maintenance schedules.
 2. Ventilation Requirements. The bidder shall submit with his submittal an estimate of air flow requirements for cooling and combustion, plus an estimate of heat rejection of the engine and generator when operating at 100% load. These estimates shall be based on manufacturer's data.
- F. Training
1. Provide one day of on-site training to instruct the owner's personnel in the proper operation and maintenance of the equipment. Review operation and maintenance manuals, parts manuals, and emergency service procedures.
- G. The CONTRACTOR shall provide a full tank of diesel fuel for the completion of all testing.

****END OF SECTION****

SECTION 16450

GROUNDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Power system grounding.
- B. Communication system grounding.
- C. Electrical equipment and raceway grounding and bonding.

1.02 RELATED SECTIONS

- A. Wire and Cables are specified in Section 16120.

1.03 SYSTEM DESCRIPTION

- A. The system consists of ground electrode for building grounding and connections thereto of structures, equipment and electrical systems.
- B. This Section is intended to supplement the requirements of the NEC, particularly Article 250, and to differentiate among options allowed by the NEC. This Section is not intended to reiterate explicit requirements of the NEC.
- C. Within this Section the following definitions apply:
 - 1. Ground Cluster: An assembly of three or more driven ground rods; spaced not closer than ten feet apart; each rod connected to the others in a linear configuration; and providing a resistance to ground of not more than 10 ohms.
 - 2. Connect or Bond: For underground or otherwise inaccessible locations – a permanent connection made by exothermic welding, brazing, or similar process. For exposed and accessible locations - a connection made with clamps, bolts or similar fittings approved for the purpose.

1.04 SUBMITTALS

- A. Submit product data.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Bare Conductors: ASTM B-8; stranded; hard drawn copper. Size as indicated on the plans.

- B. Insulated Conductors: Grounding conductors in conduit shall be insulated. All insulated grounding conductors shall be copper, and shall be the size indicated on the drawings. Where no size is indicated, the grounding conductors shall be sized according to the National Electrical Code, but shall not be smaller than No. 12 AWG.
- C. Ground Rods: UL 425H; 5/8-inch x 10 feet; high strength steel core with metallically bonded copper jacket.
- D. Connectors: Grounding conductors shall be spliced, where required, using exothermic welds. Equipment enclosures shall be grounded using copper compression ring tongue terminals unless grounding lugs are provided for this purpose.
- E. Hardware: All clamps, bolts, washers, nuts, and miscellaneous hardware used in grounding shall be copper or bronze.

2.02 EQUIPMENT

- A. Service Entrance Equipment
 - 1. Bond service entrance equipment ground bus to the ground electrode with a size conductor indicated on the drawings.
 - 2. If a metallic cold water pipe is available for a grounding electrode make connection on the street side and bond around the water meter.
 - 3. Prior to energizing the system remove the neutral link and Megger the system neutral. Repair any grounds then replace the neutral link.
- B. Buildings
 - 1. Bond all steel building columns to the ground grid.
 - 2. Provide outside access to the ground ring in at least one location by means of a 48-inch coiled pigtail buried approximately 18-inches below grade located in a ground well per detail on plans. Ground well shall be for making ground system resistance test. Note location(s) on the as-built drawings.
- C. Separately Derived Systems
 - 1. Ground transformer enclosures and, where solidly grounded systems are indicated, the secondary neutral to one of the following:
 - a. The ground ring where transformer is located on the bottom floor.
 - b. The building steel,
 - c. Other electrode as permitted by NEC if none of the above is available.

2.03 MANUFACTURES

- A. Conductors: Shall be as manufactured by Aetna, Cablec, Continental, Okonite, Rockbestos, American Insulated Wire, Kerite, Southwire, Pirelli, Triangle, or engineer approved alternate.
- B. Ground Rods: Shall be as manufactured by Copperweld, Blackburn, or Engineer approved alternate.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Except as noted, use insulated ground conductors only where installed in a raceway. Use bare conductors for the ground grid, ground rod connections, and bonding of buildings, structures etc. Where a bare conductor is installed in a raceway use only non-metallic raceways; do not install bare conductors in metallic raceways.
- B. Ground rods shall be located where required by the NEC, as directed by the utility and/or as indicated on the drawings, and driven to their full length. All connections to ground rods shall be made using an exothermic weld. Drive ground rods so the top is 3 to 6-inches below finished grade. If rock is encountered then rods may be driven at an angle or grounding plates, as approved by the Engineer, may be used.
- C. Ground clusters shall consist of three driven ground rods spaced a minimum of 10' apart in a linear line and bonded together with #2 AWG solid bare copper conductor.
- E. The service entrance ground bus shall be bonded to a grounding electrode system in accordance with NEC 250.50.
- F. All metallic cabinets and enclosures for electrical equipment shall be grounded. Grounding of motors shall be through a grounding conductor as indicated on the plans run in conduit to the ground bus in the cabinet, panel, or control center supplying power to the motor. Where no size is indicated the minimum size shall be as listed in NEC Table 250.122. Cabinets shall be grounded to their own ground bus where applicable. All cabinet ground buses shall be connected to the grounding electrode as indicated on the drawings.
- G. Conduit shall not be used as a grounding conductor except for itself. Grounding bushings shall be used where conduit size 1 ¼" and larger enters an enclosure. All grounding bushings within an enclosure shall be wired together and connected internally to the enclosure ground bus or lug with a bare copper conductor.
- H. Unless noted otherwise in the drawings or in these specifications a single grounding conductor run in conduit shall be in PVC or non-ferrous metal conduit. If a steel conduit is called for the grounding conductor shall be bonded to the steel conduit at each end with an approved bonding assembly.
- I. All convenience receptacles shall be the grounding type, and a grounding conductor shall be run from the lighting panel ground bus for each receptacle circuit.
- J. The neutral bus of all panelboards shall be grounded to the service entrance panelboard ground bus or as allowed by NEC 250.20 and 250.30. The neutral to ground bond shall be made in one location only per NEC 250.

- K. Where bare conductors emerge from concrete encasement, provide a 4-inch length of Schedule 40 PVC conduit set in the concrete to protect the conductor.

3.02 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Notify the Owner's representative at least one week in advance that the ground ring for each building is ready for inspection. Obtain written notice to proceed before filling trenches, pouring slabs, or otherwise covering the work.

3.03 TESTING

- A. Ground resistance testing shall be done in accordance with IEEE standard 81-1993 to confirm that the resistance of the grounding system is 10 ohms or less (test shall not be run within 72 hours of last rain fall). Ground resistance testing shall be done with the power off and the grounding electrode conductor isolated from the utility, and the service to prevent coupling. The testing equipment shall use the fall of potential method of earth resistance measurement. The test equipment must be designed to reject the effects of stray ac and dc currents on readings.
- B. A test report shall be submitted to the engineer and included in the O & M manual for the project. The report shall include but not be limited to:
- Date of test
 - Time of day
 - Weather condition (ex. 82°F, 82% RH, cloudy)
 - Date of last rain fall $\geq \frac{1}{2}$ " in a 24 hour period
 - Soil type
 - Minimum of five (5) readings
 - A plot of all readings indicating a level spot in the curve at the system resistance.
- C. All ground resistance testing shall be done in the presence of the Engineer. If test measurements indicate a grounding system resistance of greater than 10 ohms, additional grounding cable and rods shall be installed as directed by the Engineer. Ground resistance testing as described herein shall be repeated after the additional grounding has been installed. The installation of additional grounding and repeat testing shall be done until the 10 ohm grounding system resistance has been achieved.
- D. Test equipment for ground resistance measurement shall be Vibroground by Associated Research, Megger null balance by Biddle, or alternate approved by the Engineer.

****END OF SECTION****

SECTION 16620

TRANSIENT VOLTAGE SURGE SUPPRESSION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Transient Voltage Surge Suppression (TVSS) System as shown on the drawings and described herein, shall be provided.

1.02 REFERENCED STANDARDS

- A. Design, manufacturing and assembly of elements of TVSS system materials and devices herein specified shall be in accordance with the standards of the below listed organizations.
 1. American National Standards Institute (ANSI)
 2. National Electrical Manufacturers Association (NEMA)
 3. National Fire Protection Association (NFPA)
 4. National Electrical Code, NFPA-70 (NEC)
 5. Underwriters Laboratories, Inc. (UL)
 6. Certified Ballast Manufacturers (CBM).
 7. Certified by Electrical Testing Laboratories (ETL).

1.03 SYSTEM DESCRIPTION

- A. The system shall be furnished and installed by a Surge Suppression Supplier in accordance with U.L. Standards 1449 and 1283. All devices described herein shall be independently tested in accordance with ANSI/IEEE C62.41-1991 high exposure waveform of (20kV - 1.2/50 μ s, 10kA 8/20 μ s) for category C, (6kV-1.2/50, 3kA 8/20 μ s) for category B equipment, and (6kV-1.2/50 μ s, 200A 0.5 μ s-100 kHz) for category A equipment.

1.04 SUBMITTALS

- A. Submit product data. Include clamping voltages L-L, L-N, and L-G; response time; and test data.

PART 2 – PRODUCTS

2.01 GENERAL

- A. All material shall be U.L. listed for the use and locations indicated on the drawings or as herein specified.
- B. Manufacturers: The Transient Voltage Surge Suppression devices shall be as manufactured by Advanced Protection Technologies, L.E.A. Dynatek, or approved equal.

2.02 CATEGORY 'C' - SERVICE ENTRANCE EQUIPMENT

- A. Surge suppression equipment for service entrance location shall be listed for use at service entrance equipment and shall meet U.L. and ANSI/IEEE Standards as listed in paragraph 1.0. Surge Suppression Equipment shall be listed for and suitable for mounting with the service entrance equipment so that all leads are kept short and in a straight line to the suppressor without bends. Service entrance surge suppression devices shall meet both the U.L. 1449 clamping voltage and ANSI/IEEE C62.41-1991 Category C3 clamping voltage maximum values as follows:

Voltage	U.L. 1449		ANSI/IEEE C62.41-1991 C3	
	L-N	N-G	L-N	N-G
120/208	400	400	675	675
277/480	800	800	1250	1250

- B. The unit shall meet or exceed a maximum single impulse current rating (L-N) of 125,000 amperes per phase. The unit shall be capable of protecting against and surviving 1000 ANSI/IEEE C62.41-1991 Category C transients without failure or degradation of the U.L. 1449 clamp voltage by more than 10%. The unit shall have a response time no greater than 5 nanoseconds for any individual protection mode.

2.03 INSTRUMENTATION CIRCUIT PROTECTION

- A. Surge suppression equipment for instrumentation circuits shall be for use with field transmitters and instrumentation equipment operating on 24 – 28 V systems. The surge suppression equipment shall be suitable for mounting in control panels and/or at the field instrument. The unit shall meet or exceed the maximum single impulse current rating of 10,000 amperes. The maximum clamping voltage shall be 50 V for L-L and 70 V for L-G at 1 kA (L+L)-G, 10/1000 μ s, 500 V/ μ s: L-G. The unit shall be capable of protecting against and surviving 1000 - 1 kA 10/1000 μ s and/or 20 - 20 kA 8/20 μ s transients without failure. The unit shall have a response time no greater than 5 nanoseconds for any individual protection mode.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Surge suppression devices shall be installed in accordance with the manufacturer's instructions to provide the shortest, straight line lead length practicable.
1. Conductors connecting TVSS device to equipment busses shall be the largest size permitted by the manufacturer and shall not exceed three (3) feet in total length.

3.02 QUALITY ASSURANCE

- A. Factory Tests: All units shall be provided with manufacturer's certified test results in accordance with U.L. 1449 and 1283 Standards and Recommended Practice of ANSI/IEEE Standard C62.41-1991.

****END OF SECTION****

SECTION 16990

LIFT STATION CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Duplex lift station pump controls as shown on the drawings and described herein.
- B. Cherokee County Water and Sewerage Authority (CCWSA), SCADA system for remote monitoring, control, and alarm reporting.

1.02 RELATED SECTIONS

- A. Motor starters Section 16155 and 16156.
- B. Wire and cable Section 16110.
- C. Transient Voltage Surge Suppression Section 16620.

1.03 REFERENCED STANDARDS

- A. Design, manufacturing, and assembly of the Lift Station Control Panel materials and devices herein specified shall be in accordance with the standards of the below organizations.
 - 1. American National Standards Institute (ANSI)
 - 2. National Electrical Manufacturers Association (NEMA)
 - 3. National Fire Protection Association (NFPA)
 - 4. National Electrical Code, NFPA 70 (NEC)
 - 5. NFPA 70E
 - 6. Underwriters Laboratories, Inc. (U.L.)
 - 7. Certified Ballast Manufacturers (CBM)
 - 8. Certified by Electrical Testing Laboratories (ETL)

1.04 SUBMITTALS

- A. Submit shop drawings showing certified dimensions and data on all accessories, enclosures, and NEMA classifications as noted above and in the following paragraphs.
- B. Elementary Diagrams: Provide a separate elementary diagram for each starter unit showing numbered terminal points and interconnections to the first level of remote devices.

- C. Provide fabrication and installation submittals indicating layout and dimensions of all equipment, terminals, circuit breakers, control power devices, and interior and exterior enclosures and panels.

1.05 QUALITY ASSURANCE

- A. All motor starters specified in this section shall be NEMA rated devices.

1.06 CONTROL OPERATION

- A. The pump station shall provide control for two 460 volt, 3 phase, 3 wire, 35 HP, submersible pumps. The wet well shall have five levels of operation, High Level Alarm, Start Lead Pump, Start Lag Pump, Stop Both Pumps, and Low Level Alarm.
- B. Operation of the controls shall be as follows: Upon wet well rise, at a preprogrammed wet well level, the Multismart Pump Station Manager Controller shall initiate a contact closure and start the Lead Pump. Should the wet well continue to rise to a preprogrammed level, the Pump Controller shall initiate a contact closure and start the Lag Pump. Both pumps shall run simultaneously until the wet well lowers to a preprogrammed level and the Pump Station Controller shall shut down both pumps. Upon shut down an alternator within the Pump Station Controller shall alternate between the two pumps for the next cycle. Should the wet well reach a preprogrammed high level the controller logic shall close a contact to sound a local alarm horn and beacon and send an alarm signal to the Dexter Fortson ARTU SCADA unit. Should the wet well be drawn down to a preprogrammed low level, an alarm will be initiated in the same manner as that of the High Level.
- C. Monitoring the lift station pump operations, generator operations, and normal and emergency power status, pump status, and wet well levels, shall be accomplished through the SCADA system. The SCADA system communicates through a Dexter Fortson Associates ARTU and radio antenna system to the CCWSA's base station controller. The SCADA system. The system monitors and records pump status (ON, OFF, AUTO), number of start and run times, phase to phase and phase ground voltage for each motor and power factor, normal utility, and standby generator and pump failures. The system monitors the automatic transfer switch position, the generator status (ON, OFF), starts, run time, failure to start, and fuel leak. The ARTU provides a Man Down alarm upon activation of a switch at the pump station and also monitors its own communication and power status.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The System Supplier shall be regularly engaged in the type of work called for by these specifications and must demonstrate systems capabilities by having the resources to successfully perform the work as called for in the specifications. Resources shall be defined as equipment, personnel, plant and service. The system supplier shall have a minimum of five years of experience, providing systems similar to that herein specified

and shall provide a list of similar use installations that have been in satisfactory operation for not less than one year.

2.02 EQUIPMENT

A. ARTU Unit:

1. The SCADA ARTU unit and related antenna system shall be the standard product supplied to the Cherokee County Water and Sewerage Authority by Dexter Fortson, Associates, 901 Ploof Drive, Birmingham, Alabama, 35023 at (205) 432-2716. The control panel supplier shall coordinate with Dexter Fortson, Associates for mounting the ARTU and its associated equipment within the lift station control cabinet.

B. Pump Station Controller:

1. A Multismart Pump Station manager Controller shall be installed within the cabinet for local, manual, and automatic station level and pump control. The unit shall be mounted within the control cabinet and provided with additional auxiliary contacts on each pump H-O-A switch to provide status to the ARTU unit.
2. The controller shall receive a 4-20 mA level signal from a Mercoïd series PBLT2 Submersible Level Transducer. DC power for the transducer operation shall be supplied from terminals within the Pump Station Controller. The unit shall be provided with a sufficient length of cable to reach the bottom of the wet well and have sufficient range to provide a measurement for the total depth of the wet well.

C. NEMA Rated Motor Starters:

The motor starters shall be RVNR Soft Start with three overload relays. The contactor shall feature double-break, silver cadmium oxide contacts, pressure-type terminals and barriers, free floating armature-magnet frame, molded continuous duty coils and stainless steel springs sized for specific pumps supplied under this contract. Definite purpose contactors, horsepower rated motor starters, and fractional NEMA sizes are not acceptable. A reset pushbutton shall be mounted on the control panel door for the external operation of overload relays for each motor.

D. Overload Relays:

1. Overload relays shall be either melting alloy or bimetallic. Three phase starters shall contain three thermal units. Thermal units shall be selected to cause the relay to trip at an ampere level no greater than 125% of the motor full load amps, for 1.15 service factor motors, or 115% for 1.0 service factor motors.
2. Overload relay contacts shall have a NEMA B600 current rating. Where indicated on the wiring diagrams, a form C alarm contact with a NEMA B600 current rating shall be furnished.
 - a. Melting Alloy Overload Relays: Melting alloy overload relays shall use a eutectic alloy solder to sense motor current and trip the relay upon detecting an overload. Melting alloy overload relays shall remain tripped

until it has cooled and reset manually. A pushbutton shall be provided on the enclosure door for this purpose. All melting alloy overload relays shall contain a trip-free mechanism to allow the relay to trip even when the reset pushbutton is held in the reset position.

- b. Melting alloy overload relays shall be provided with quick trip thermal units. Quick trip thermal units shall be provided for submersible pump applications and shall be sized to match the pump motor characteristics.
- c. Bimetallic Overload Relays. Bimetallic overload relays shall use a bimetal to sense motor current and trip the relay upon detecting an overload. The trip current shall be adjustable from 85 to 115% of the trip current rating. The relays shall be shipped as manual reset type but shall be field convertible to automatic reset.

E. Manual Starters:

Manual starters shall consist of a manually operated contactor and melting alloy overload relays in an enclosure. The number of poles, starter size, voltage, and phase and enclosure type shall be as indicated on the drawings. Control shall be by means of interlocked start-and-stop pushbuttons on the starter door. When indicated on the drawings, provide a low voltage coil to open the starter contacts if power is lost, requiring a manual reset to close the contacts. Likewise, overload relay operation shall require a manual reset. Three phase manual starters shall include one normally open auxiliary contact as specified in 2.03.A.1.

F. Motor Circuit Protection:

Motor circuit protection shall be either thermal magnetic circuit breakers or magnetic motor circuit protectors. Either type shall contain a self test "Trip Selector" permitting a mechanical simulation of the over current tripping device. The protector operating mechanisms are to be quick-make, quick-break and trip free type.

Thermal magnetic breakers shall comply with Federal SPE. W-C 357a as class 2 breakers. Symmetrical amperes interrupting ratings shall be 10,000 amperes minimum for 480 volt rated breakers.

Magnetic motor circuit protectors shall provide instantaneous clearing of faults to a minimum of 10,000 amperes, RMS, symmetrical. The magnetic motor circuit protector shall have an adjustable instantaneous trip setting.

G. Control Power Transformer:

A transformer shall be included to convert the station 480 volt power to 120/208 volts used by the station and control systems. Both primary and secondary circuit breaker protection shall be provided. The transformer shall be sized to provide for the station lighting, control systems power, generator battery charging, and jacket water heater, but not smaller than 3000 VA.

2.03 ACCESSORIES

- A. All relays in the control panel shall be electromechanical with 120 volt AC coils and contacts rated for not less than 1 ampere interrupting at 120 volts.
- B. **Indicating Lights:** Indicating lights shall be provided on the inner control panel door when shown on drawings. Indicating lights shall be round with a round bezel and shall be watertight and oil tight. The lamp for the cap shall be red for "on" and green for "off." Other lamps and colors shall be as shown on the wiring diagram. Indicating lights shall include legend plates.
- C. Pushbuttons shall be provided for all magnetic where shown on the drawings. Pushbuttons for magnetic starters shall be round with a round bezel and shall be watertight and oil tight. The function and quantity of pushbuttons shall be as shown on the drawings and indicated herein. All pushbuttons shall include a legend plate.
- D. **Nameplates:** Engraved nameplates shall be provided for all individually mounted starters to identify the load served. Nameplates shall be engraved with black letters of 3/16 inch minimum height on a white background, fastened to the front of the enclosure with stainless steel screws.
- E. **Receptacle:** A weatherproof duplex receptacle, NEMA 5-20R, with ground fault protection shall be provided on the side of the control panel.
- F. A strip heater and thermostat shall be provided on the inside of the control panel to prevent condensation. The heater shall be suitable for operation at 120 VAC.
- G. A flashing alarm light with wire guard and RED polycarbonate lens suitable for wet locations shall mounted on the top of the enclosure.
- H. An alarm horn with weatherproof enclosure shall be mounted on the side of the control panel. The horn shall be suitable for operation at 120 VAC.
- I. **Enclosure:** The control panel shall be housed in a NEMA 4X stainless steel enclosure suitable for outdoor installations. The enclosure shall be provided with mounting panels for all components, inner doors to protect the components with indicating lights and pushbuttons mounted on the surface with full length hinges and latches. Outer doors shall be provided with stainless steel hardware, piano hinges, and locking handles with provisions for pad locking. Provide suitable legs for mounting and raising the panel above the lift station slab. Ground lugs shall be provided for the interior components as well as providing connection to the station ground electrode.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install the control panel and all components in accordance with the mfr's instructions.
- B. Panel shall be installed level with station slab and bonding conductors installed.

3.02 FIELD QUALITY CONTROL

- A. Install overload relay thermal elements based on motor nameplate rating. If capacitors are installed between the relay and motor, select thermal elements based on the measured motor current. Adjust other -overcurrent protective devices to settings per the coordination study.
- B. Megger each bus, phase-to-phase and phase-to-ground.

****END OF SECTION****

APPENDIX

GeoHydro Engineers

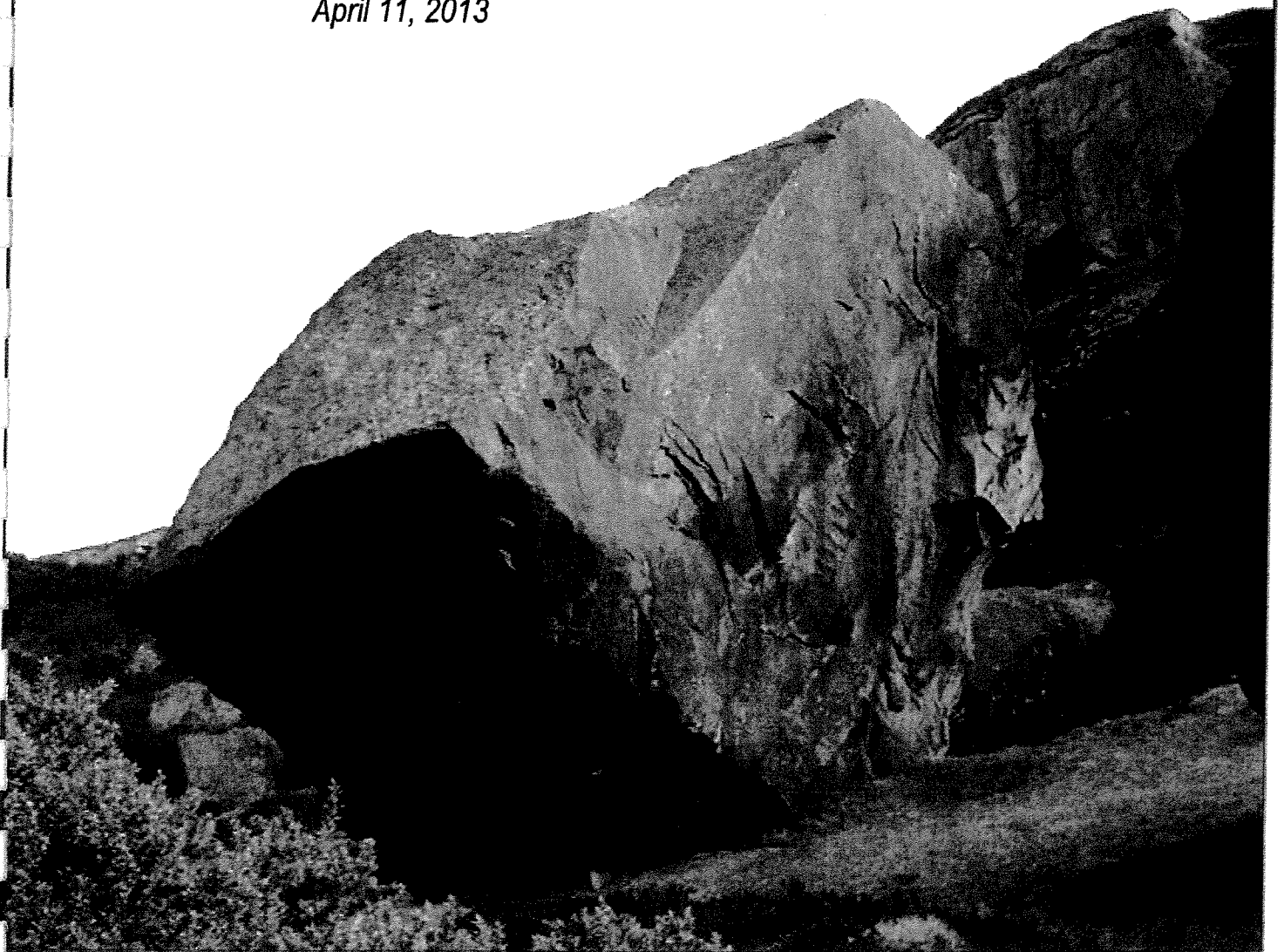
Report of Subsurface Exploration and Geotechnical Engineering Evaluation

GEO HYDRO ENGINEERS

Report of Subsurface Exploration
and Geotechnical Engineering Evaluation

Holly Springs Force Main, Gravity Sewer, and Lift Station
Hydro-Chem Site
Holly Springs, Georgia

*Prepared for Atkins North America, Inc.
April 11, 2013*



Mr. William F. Livingston, P.E.
Atkins North America, Inc.
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Marietta, Georgia 30060

April 11, 2013

**Report of Subsurface Exploration and
Geotechnical Engineering Evaluation
Holly Springs Force Main, Gravity Sewer, and Lift Station – Hydro-Chem Site
Holly Springs, Georgia
Geo-Hydro Project Number 130171.00**

Dear Mr. Livingston:

Geo-Hydro Engineers, Inc. has completed the authorized subsurface exploration and geotechnical engineering evaluation for the above referenced project. The scope of services for this project was outlined in our revised proposal number 15561 dated February 11, 2013. Our understanding of the project is based on our conversations with you as well as our review of proposed alignments identified by you.

PROJECT INFORMATION

The project consists of a new gravity sewer line, force sewer main, and sanitary lift station. The lift station site is located at the west end of the gravel parking lot at the northwest corner of the Hydro-Chem property at 125 Hickory Springs Industrial Drive in Holly Springs, Georgia. Figure 1 in the Appendix shows the approximate lift station location. Figure 3 in the Appendix shows the proposed pipeline alignments.

The proposed lift station will include a wet well and valve pit along with associated site security and access improvements. The area of the proposed lift station is currently wooded and has been used as a gravel parking area and temporary stormwater detention pond. The photo to the right shows the site conditions in the area of the proposed lift station.



The final alignment for the force main has not been established. Three alignments are currently being considered running from the proposed lift station to the Holly Springs Train Depot Community Center.

The three alignments being considered for the force water main are shown on Figure 3 in the Appendix.

The gravity sewer alignment will parallel Badger Creek, which is located west of the proposed lift station. Moving north from the lift station, the gravity sewer line will be located about 60 feet east of the creek until the alignment reaches Holly Drive. At Holly Drive, the gravity line will cross the creek and continue north along an alignment about 60 feet west of the creek. At the time of this report, the gravity sewer alignment was still in the design phase and the final alignment and profile had not been established.

The gravity sewer alignment is currently wooded with low-lying areas and rolling hills. The site photos below show rock outcroppings visible in the creek bed and along the creek banks.



EXPLORATORY PROCEDURES

The subsurface exploration consisted of two machine-drilled borings and 21 hand auger borings performed at the approximate locations shown on Figures 2 and 3 included in the Appendix. The borings were located in the field by Geo-Hydro based on staked locations of the wet well and valve pit and based on your descriptions of the pipeline alignments. In general, the locations of the borings should be considered approximate. Hand auger borings along Walnut Street, Holly Drive, and Dogwood Knoll Drive were performed on the north shoulder of the road. Hand auger borings along Old Magnolia Way and Palm Street were performed on the east shoulder of the road.

Standard penetration testing, as provided for in ASTM D1586, was performed at select intervals in the machine-drilled borings. Dynamic cone penetrometer testing, as provided for in ASTM STP-399, was performed at select intervals in the hand auger borings. Soil samples obtained from the drilling operation were examined and classified in general accordance with ASTM D2488 (Visual-Manual Procedure for Description of Soils). Soil classifications include the use of the Unified Soil Classification System described in ASTM D2487 (Classification of Soils for Engineering Purposes). The soil classifications also include our evaluation of the geologic origin of the soils. Evaluations of geologic origin are based on our experience and may be subject to some degree of interpretation.

Descriptions of the soils encountered, groundwater conditions, standard penetration resistances, and other pertinent information are provided in the test boring records and hand auger logs included in the Appendix.

REGIONAL GEOLOGY

The project site is located in the northern Piedmont Geologic Province of Georgia. Soils in this area have been formed by the in-place weathering of the underlying crystalline rock, which accounts for their classification as "residual" soils. Residual soils near the ground surface, which have experienced advanced weathering, frequently consist of red brown clayey silt (ML) or silty clay (CL). The thickness of this surficial clayey zone may range up to roughly 6 feet. For various reasons, such as erosion or local variation of mineralization, the upper clayey zone is not always present.

With increased depth, the soil becomes less weathered, coarser grained, and the structural character of the underlying parent rock becomes more evident. These residual soils are typically classified as sandy micaceous silt (ML) or silty micaceous sand (SM). With a further increase in depth, the soils eventually become quite hard and take on an increasing resemblance to the underlying parent rock. When these materials have a standard penetration resistance of 100 blows per foot or greater, they are referred to as partially weathered rock. The transition from soil to partially weathered rock is usually a gradual one, and may occur at a wide range of depths. Lenses or layers of partially weathered rock are not unusual in the soil profile.

Partially weathered rock represents the zone of transition between the soil and the indurated metamorphic rocks from which the soils are derived. The subsurface profile is, in fact, a history of the weathering process which the crystalline rock has undergone. The degree of weathering is most advanced at the ground surface, where fine grained soil may be present. And, the weathering process is in its early stages immediately above the surface of relatively sound rock, where partially weathered rock may be found.

The thickness of the zone of partially weathered rock and the depth to the rock surface have both been found to vary considerably over relatively short distances. The depth to the rock surface may frequently range from the ground surface to 80 feet or more. The thickness of partially weathered rock, which overlies the rock surface, may vary from only a few inches to as much as 40 feet or more.

Stream valleys in the Piedmont Region may contain alluvial (water deposited) soils, depending on ground surface topography, stream flow characteristics, and other factors. By nature, alluvial soils can be highly variable depending upon the energy regime at the time of deposition. Coarse materials such as sand or gravel are deposited in higher energy environments, while fine grained materials such as silt and clay are deposited in low energy environments. Alluvial soils may also contain significant organic materials, and are frequently in a loose, saturated condition. In many cases, fine grained alluvial soils will be highly compressible and have relatively low shear strength.

Overall geologic conditions along sections of the gravity and force main alignments have been modified by previous grading activities for the roadways, utilities, residential lots, etc.

TEST BORING SUMMARY

Machine-Drilling Borings (Lift Station)

Starting at the ground surface, borings B-1 and B-2 encountered about 3 and 4 inches of topsoil, respectively. Beneath the topsoil, borings B-1 and B-2 encountered fill material extending to depths of about 6 and 8 feet, respectively. The fill was classified as sandy silt and silty sand with standard penetration resistances ranging from 2 to 4 blows per foot.

Beneath the fill material, both borings encountered alluvial (water-deposited) soils extending to a depth of about 12 feet. The alluvium was classified as sandy silt and silty clay with varying amounts of rock fragments. Standard penetration resistances recorded in the alluvium ranged from 3 to 5 blows per foot.

Beneath the alluvial soils, both borings encountered residual soil typical of the Piedmont Region. The residuum was typically classified as micaceous silty sand. Standard penetration resistance values recorded in the residuum ranged from 4 to 27 blows per foot.

Boring B-2 encountered conditions causing auger refusal at a depth of 27 feet. Auger refusal is the condition that prevents further advancement of the boring using conventional soil drilling techniques. The material causing auger refusal may consist of a boulder, a lens or layer of rock, the upper surface of relatively massive rock, or other hard material.

Twenty-four hours after drilling completion, groundwater was encountered in borings B-1 and B-2 at depths of 10 and 11 feet, respectively. The borings were backfilled with soil cuttings after the groundwater check.

Hand Auger Borings (Force Main and Gravity Sewer)

Starting at the ground surface, hand auger borings H-08 through H-21 encountered fill material extending to depths ranging from 1 to 5 feet. The fill was classified as silty clay, sandy clay, silty sand, and sandy silt with varying amounts of rock fragments and roots. Dynamic cone penetration resistances recorded in the fill ranged from 2 to 15 blows per increment.

Starting at the ground surface, hand auger borings H-02, H-03, H-04, and H-05 encountered alluvial soil classified as sandy clay, clayey sand, silty sand, and sand with varying amounts of rock fragments. Dynamic cone penetration resistances recorded in the alluvium ranged from 2 to 7 blows per increment.

Beneath fill material, alluvial soils, or starting at the ground surface, all of the hand auger borings except H-02, H-03, and H-04 encountered residual soils typical of the Piedmont Region. The residual soils were classified as silty clay, sandy clay, sandy silt, clayey silt, and silty sand with varying mica content and rock fragments.

At the time of drilling, groundwater was encountered in hand auger borings H-02 and H-03 at a depth of about 2 feet. It should be noted that groundwater levels will fluctuate over time depending on seasonal rainfall patterns, development in the surrounding area, and the level of the creek.

Conditions causing hand auger refusal were encountered in hand auger borings H-02, H-03, H-04, H-05, H-06, H-09, H-12, H-15, H-20, and H-21 at depths ranging from 2 to 6½ feet. It should be noted that hand auger equipment is limited in its ability to penetrate hard soils, rocky soils, or below the groundwater level.

For more detailed descriptions of subsurface conditions, please refer to the test boring records included in the Appendix.

EVALUATIONS AND RECOMMENDATIONS

The following evaluations are based on the information available on the proposed construction, the data obtained from the exploratory borings, and our experience with soils and subsurface conditions similar to those encountered at the explored locations. Because the test borings represent a statistically small sampling of subsurface conditions, it is possible that conditions between the test borings may be substantially different from those indicated by the borings.

- Boring B-2 was performed at the proposed wet well location. The boring encountered conditions causing auger refusal at a depth of 27 feet. Based on our understanding of the project, this is below the anticipated excavation depth for the wet well. It is important to note that subsurface profiles in the Piedmont Region often include a zone of less weathered rock above the depth of auger refusal that may require ripping with large equipment to achieve excavation. If planned excavation extends to a depth of about 25 feet, difficult excavation conditions may be encountered during construction of the wet well.
- Twenty-four hours after drilling, borings B-1 and B-2 encountered groundwater at depths of 10 and 11 feet, respectively. Temporary dewatering will be necessary to facilitate construction of the wet well and valve pit.
- The hand auger borings performed along the gravity sewer alignment encountered groundwater at the approximate level of the creek. For planning purposes, the groundwater level along the gravity sewer alignment and portions of the force water main paralleling the creek should be assumed to be at the level of the creek. Depending on the final pipeline design, temporary groundwater control may be necessary to facilitate construction.
- All of the hand auger borings performed along the proposed gravity sewer alignment except for H-01 and H-07 encountered conditions causing auger refusal at depths ranging from about 2 to 3 feet. Borings H-01 and H-07 were performed at topographically high locations more than 10 feet above the level of the creek. The cause of auger refusal in hand auger borings H-02, H-03, and H-04 appeared

to be alluvial soil layers with large amounts of pebbles that prevented advancement of the hand auger borings. Hand auger borings H-05 and H-06 encountered relatively continuous rock that prevented advancement of the hand auger borings. It is unclear if the rock was a boulder, large rock fragment, or the top of mass rock.

- The hand auger borings along the proposed force main alignments along Dogwood Knoll Drive, Holly Drive, Walnut Street, Old Magnolia Way, Palm Street, and the Holly Springs Train Depot Community Center indicate generally favorable excavation conditions for the force main. The cause of auger refusal along the roadways was typically a rock fragment or larger root that prevented advancement of the hand auger borings but would not affect excavation using mechanized equipment. However, we do recommend including a modest budget allowance for difficult excavation along the road alignments.
- Based on the results of the hand auger borings, the fill materials and residual soils encountered along the road alignments should be suitable for reuse as structural fill. The fill materials encountered in hand auger boring H-15 were wet (moisture content several percentage points above optimum) and will require drying before it can be placed as structural fill. The alluvial soils encountered along the creek will also require drying before they can be used as structural fill.

Excavation Characteristics and Reuse of Excavated Materials

Based on the results of the hand auger borings, difficult excavation conditions will likely be encountered along the gravity sewer alignment. The extent of difficult excavation will depend on the final invert elevation and location of the gravity sewer alignment. Difficult excavation conditions may also be encountered along relatively short sections of the force main alignment along the shoulder of the various roadways.

For construction bidding and field verification purposes it is common to provide a verifiable definition of rock in the project specifications. The following is a typical definition of trench rock:

- **Trench Rock:** Material occupying an original volume of at least one-half cubic yard which cannot be excavated with a hydraulic excavator having a minimum flywheel power rating of 123 kW (165 hp); such as a Caterpillar 322C L, John Deere 230C LC, or a Komatsu PC220LC-7; equipped with a short tip radius bucket not wider than 42 inches.

A large fraction of soils excavated adjacent to the creek and below the groundwater level will have moisture contents well above optimum moisture content. Excavated soils with high moisture content will need to be dried back to allow their reuse as structural fill. Based on our experience, drying soils at the site would be impractical given the limited construction area available. There is insufficient area to spread, disc, and mix the excavated soils to reduce their moisture content. From a practical standpoint, we recommend locating an off-site borrow source that can be used to procure readily usable backfill

materials in case the amount of readily usable on-site soils is insufficient. This will be of greater concern for backfilling of trenches along the roads.

Earth Pressure

Based on our experience, the lateral earth pressure distribution for the walls of relatively small and rigid below-grade structures such as the proposed lift station can be approximated by a braced wall configuration. The walls of these structures may be designed for the pressure distribution illustrated by Figure 4 in the Appendix.

Foundation Design

The floors for the wet well and the valve pit will consist of reinforced concrete mats. Indications are that the applied mat bearing pressure for the wet well will be less than the current weight of soil that will be removed during construction. Settlement of the wet well (if any) should be minimal, provided that the bearing surface is properly prepared and stable.

The residual materials below the base of the valve pit will likely be excavated during construction of the adjacent wet well if a sloped excavation is used. The new structural fill material below the valve pit will, based on published correlations between standard penetration resistance and elastic modulus of soil, potentially experience ½-inch to ¾-inch of consolidation during backfilling around the valve pit and wet well. The valve pit, supported by the consolidating material, may experience similar deflection.

We recommend that the wet well and valve pit structures be underlain by a minimum of 12 inches of # 57 stone. The stone should be placed in 6-inch layers and each layer should be thoroughly consolidated with a vibratory plate tamp.

The bottom of the excavations should be evaluated prior to placement of the #57 stone course. This evaluation should be performed by Geo-Hydro to confirm the subgrade does not include any excessively loose or disturbed materials. Proper construction dewatering will be crucial in preserving adequate bearing conditions at the bottom of the excavation.

Buoyant Forces

Following completion of construction and termination of dewatering, groundwater at the lift station will rise, inducing buoyant uplift forces on the wet well.

Buoyant uplift forces will be partially resisted by the dead weight of the structure. However, it will be necessary to extend the mat foundation beyond the walls of the wet well. This mobilizes an additional buoyant weight of soil (50 to 65 pcf). If this approach to resist buoyant forces is not sufficient, it will be necessary to install anchors at the bottom of the structure to supplement uplift resistance. The scope of this exploration is insufficient to develop design recommendations for soil anchors.

Earth Slopes

Temporary construction slopes should be designed in strict compliance with OSHA regulations. The exploratory borings indicate that most soils along the alignment are Type C as defined in 29 CFR 1926.650 (1994 Edition). In general, we recommend that temporary construction slopes be no steeper than 1.5H:1V for excavation depths of 20 feet or less. We expect construction of the gravity sewer and portions of the force water main paralleling the creek to involve excavation extending to or below the groundwater level. Construction slopes below the groundwater level will require temporary shoring to maintain safe excavation conditions. Temporary construction slopes should be closely observed on a daily basis by the contractor's "competent person" for signs of mass movement: tension cracks near the crest, bulging at the toe of the slope, etc. The responsibility for excavation safety and stability of temporary slopes should lie solely with the contractor.

We recommend that extreme caution be observed in trench excavations. Several cases of loss of life due to trench collapses in Georgia point out the lack of attention given to excavation safety on some projects. We recommend that applicable local and federal regulations regarding temporary slopes, and shoring and bracing of trench excavations be closely followed.

Temporary Excavation Bracing

Based on our observations on site, it does not appear that the site is large enough to allow for construction of the wet well and valve pit by sloping back the excavation sides at a gradient no steeper than 1.5H:1V. Site disturbance can be reduced significantly by shoring the pit excavation. Temporary shoring systems such as internally-braced sheet piling or internally-braced soldier pile and wood lagging can be used. The primary disadvantage of internally braced excavation support systems is the obstruction caused by the bracing. The selection and design of a specific excavation bracing system should be left to the contractor. Geo-Hydro and Atkins should review the proposed excavation bracing system.

If at a given location along the proposed pipeline alignments a sloped excavation is not feasible, temporary excavation bracing will be required. We expect that trench boxes will be the primary method to maintain trench stability wherever the excavation cannot be sloped safely. The most appropriate type of excavation bracing will be dictated by subsurface conditions at the specific excavation. Typically, the contractor will design and implement temporary excavation bracing as part of means and methods. Temporary excavation support systems submitted by the contractor should be reviewed by Atkins and Geo-Hydro.

Construction Dewatering

Based on the groundwater levels encountered in the hand auger borings and machine-drilled borings, groundwater will be encountered along the gravity sewer alignment, portions of the force main paralleling the creek, and in the excavations for construction of the lift station. Dewatering should be performed to

maintain the groundwater level approximately 2 to 3 feet below the lowest prevailing excavation depth. In most cases we expect that direct pumping from the excavation will provide satisfactory temporary construction dewatering. However, the actual dewatering approach will be dictated by conditions at the time of excavation. Sand layers or other more permeable soil layers may significantly increase the amount of water inflow into open excavations.

The volume and rate of temporary dewatering actually required during construction is related not only to the prevailing weather conditions, but also the contractor's sequencing of construction activities. Construction specifications should include performance guidelines for temporary dewatering. Performance guidelines allow the contractor to select the actual means and methods of construction dewatering. The following sample specification¹ could be used as a guide for development of actual specifications.

Control of groundwater shall be accomplished in a manner that will preserve the strength of the foundation soils, will not cause instability of the excavation slopes, and will not result in damage to existing structures. Where necessary to these purposes, the water level shall be lowered in advance of excavation, utilizing trenches, sumps, wells, well points, or similar methods. The water level, as measured in piezometers, shall be maintained a minimum of 3 feet below the prevailing excavation level. Open pumping from sumps and ditches, if it results in boils, loss of soil fines, softening of the ground, or instability of slopes, will not be permitted. Wells and well points shall be installed with suitable screens and filters so that continuous pumping of soil fines does not occur. The discharge shall be arranged to facilitate collection of samples by the Engineer.

We recommend that pipe bedding be used where groundwater is encountered. This will provide a level, stable base for pipe installation. We recommend #57 or #78 crushed stone meeting Georgia DOT specifications as pipe bedding. Based on the results of the soil test borings, we recommend assuming that the entire alignment will require pipe bedding to facilitate installation.

Structural Fill Placement

We anticipate that the overburden soils (fill, alluvium, and residuum) can be reused as structural fill to backfill the pipe trench. Materials selected for use as structural fill should be free of organic matter, waste construction debris, and other deleterious materials. In general, the material should not contain rocks having diameters over 4 inches. It is our opinion that the following soils represented by their USCS group symbols will typically be suitable for use as structural fill and are commonly found in abundance in the Piedmont region: (CL), (SM), and (ML). The following soil types are typically suitable but are not abundant in the Piedmont region: (SW), (SP), (SC), (SP-SM), and (SP-SC). The following soil types are considered unsuitable: (MH), (CH), (OL), (OH), and (Pt).

¹ The sample specification was adapted from Construction Dewatering - A Guide to Theory and Practice, John Wiley and Sons, and is not intended for direct use as a construction specification without modifications to reflect specific project conditions.

Laboratory Proctor compaction tests should be performed on representative samples of proposed fill materials to provide data necessary to determine acceptability and for quality control. The moisture content of suitable borrow soils should generally be no more than 4 percentage points above or below their optimum moisture contents at the time of compaction. Tighter moisture limits may be necessary with certain soils.

We expect that a most of the soils excavated adjacent to the creek and at the lift station will have moisture contents too high to allow for proper compaction. Most or all of the alluvial soils will be too wet for immediate reuse and residual soils excavated from elevations approaching and extending below the groundwater level will have moisture contents that will be too high as well. As most of the sewer alignment will be cross country and will not impact utility crossings, roadways, driveways, or rights-of-way, the compaction criteria could be adjusted to allow the reuse of soils with higher moisture contents than otherwise would be allowed for structural fill or backfill applications. The *2010 Water Specifications* (Cherokee County Water & Sewerage Authority) allows a compaction level of 90 percent of the maximum dry density as determined by the standard Proctor test (ASTM D698) in unpaved areas. Considering the relatively constrained site conditions and high moisture content of alluvial soils, it may be difficult to attain even this relatively relaxed standard along the creek.

Air-drying soils can be performed in the warmer, drier periods of the year but drying soil is typically only practical on larger grading sites. One method of reducing the moisture content of soils to a workable level will be to use a chemical agent such as lime to dry the soils, but areas to spread and properly mix soils with lime will be necessary. One or more staging areas near the project alignment could be used to dry wet soils. The contractor should be prepared to dry soils on this project or locate a source of suitable backfill materials. We can provide further guidance concerning the use of lime once a contractor is selected and a plan for addressing wet backfill soils is developed. Budget planning should consider the need to dry or replace wet soils.

Suitable fill material should be placed in thin lifts. Lift thickness depends on type of compaction equipment; but in general lifts of 6 inches loose measurement are recommended. The soil should be compacted by appropriate equipment such as tampers or "Rammax" compactors until sufficient cover is provided to allow the use of small rollers or larger compaction equipment.

Pipe Support

Based on the results of the test borings and our observations, it is likely that conditions varying from loose alluvium to partially weathered rock or rock will be exposed at invert elevation for the water main and gravity sewer lines. In order to limit potential differential settlement and stress concentrations at the interface of dissimilar bearing materials, compressible soils should be removed and pipe bedding consisting of crushed stone should be placed as necessary. Bedding will be needed in conjunction with dewatering as discussed above.

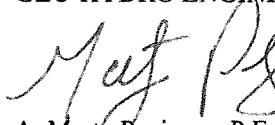
Section 506 of the *2010 Water Specifications* (Cherokee County Water & Sewerage Authority) outlines the requirements for bedding materials and trench foundation stabilization. However, subsurface conditions will vary, and we recommend that Geo-Hydro be present during preparation of bearing surfaces for the pipeline. This will allow adjustments as necessary to comply with the *Standard Specifications* requirements.

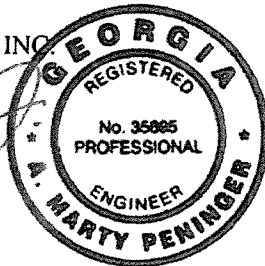
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Geo-Hydro Engineers, Inc. has appreciated the opportunity to work with you on this phase of the project, and we look forward to providing any additional services you may require. If you have any questions concerning this report or any of our services, please call us.

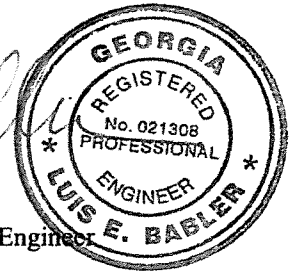
Sincerely,

GEO-HYDRO ENGINEERS, INC.


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Chief Geotechnical Engineer
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AMP/LEB/130171.00 - Holly Springs Force Main, Gravity Sewer, and Lift Station - Hydro-Chem Site

APPENDIX

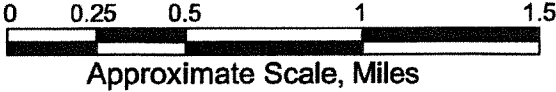
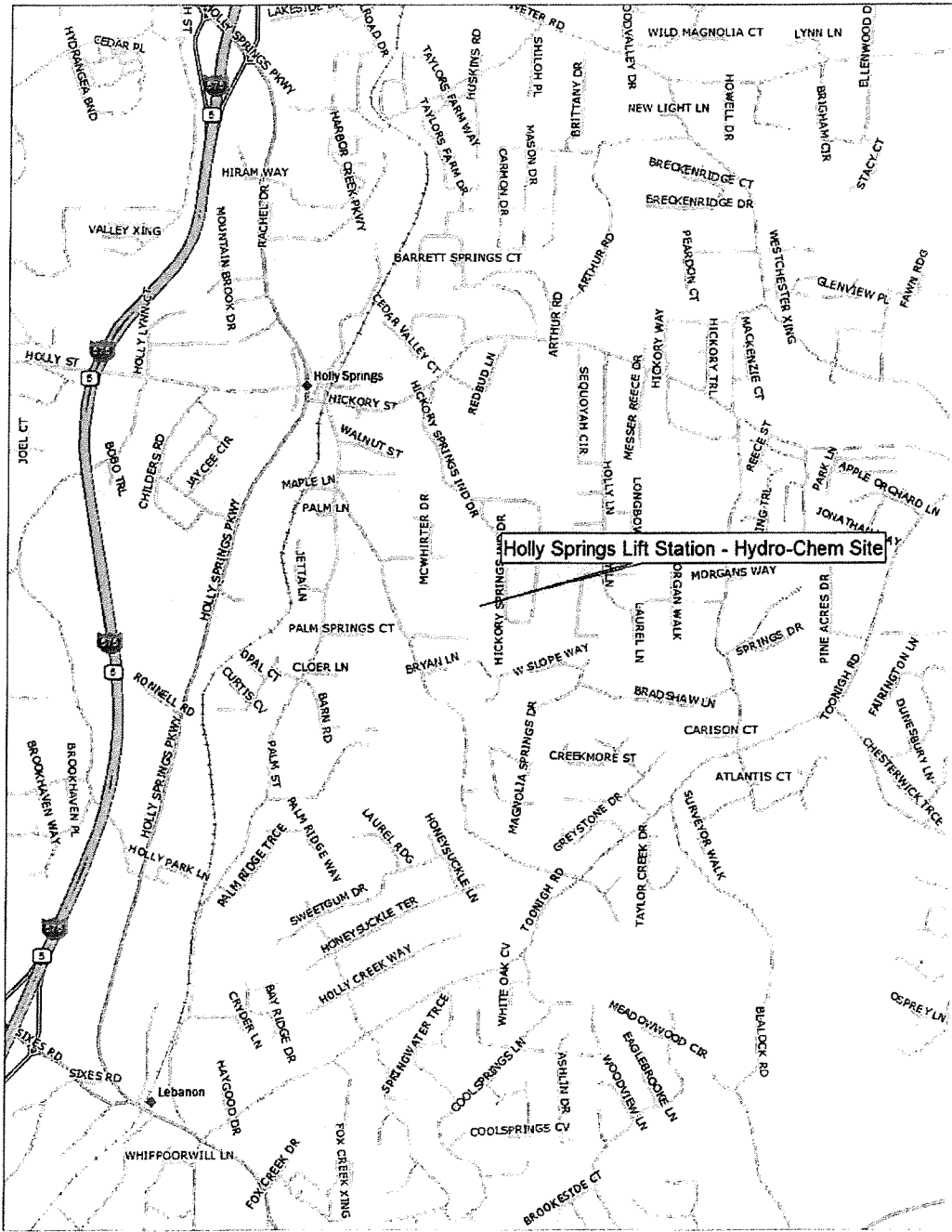
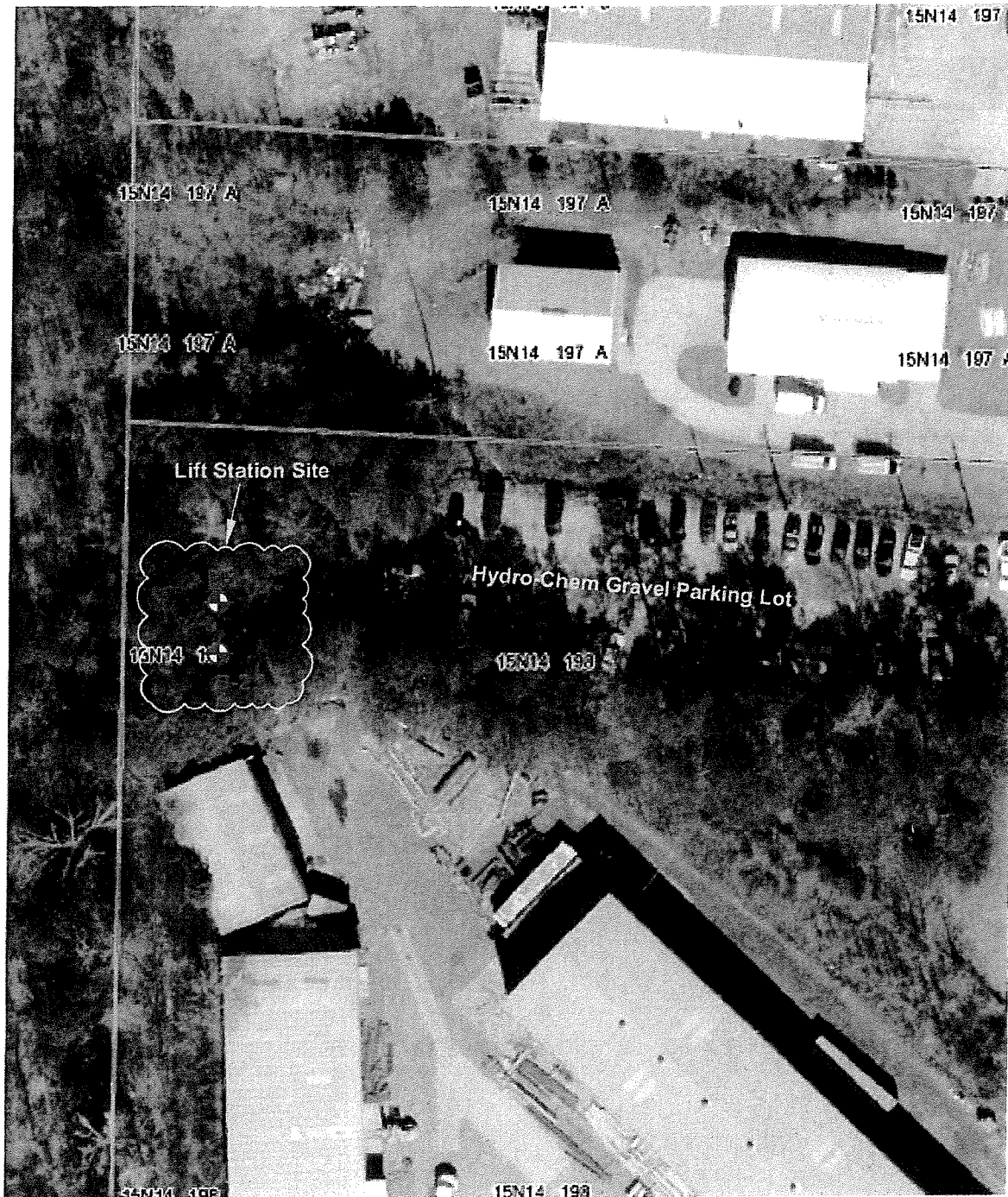


Figure 1: Site Location Plan

Holly Springs Lift Station - Hydro-Chem Site
Hickory Springs Industrial Drive
Holly Springs, Georgia
Geo-Hydro Project Number 130171.00



LEGEND:  Soil Test Boring

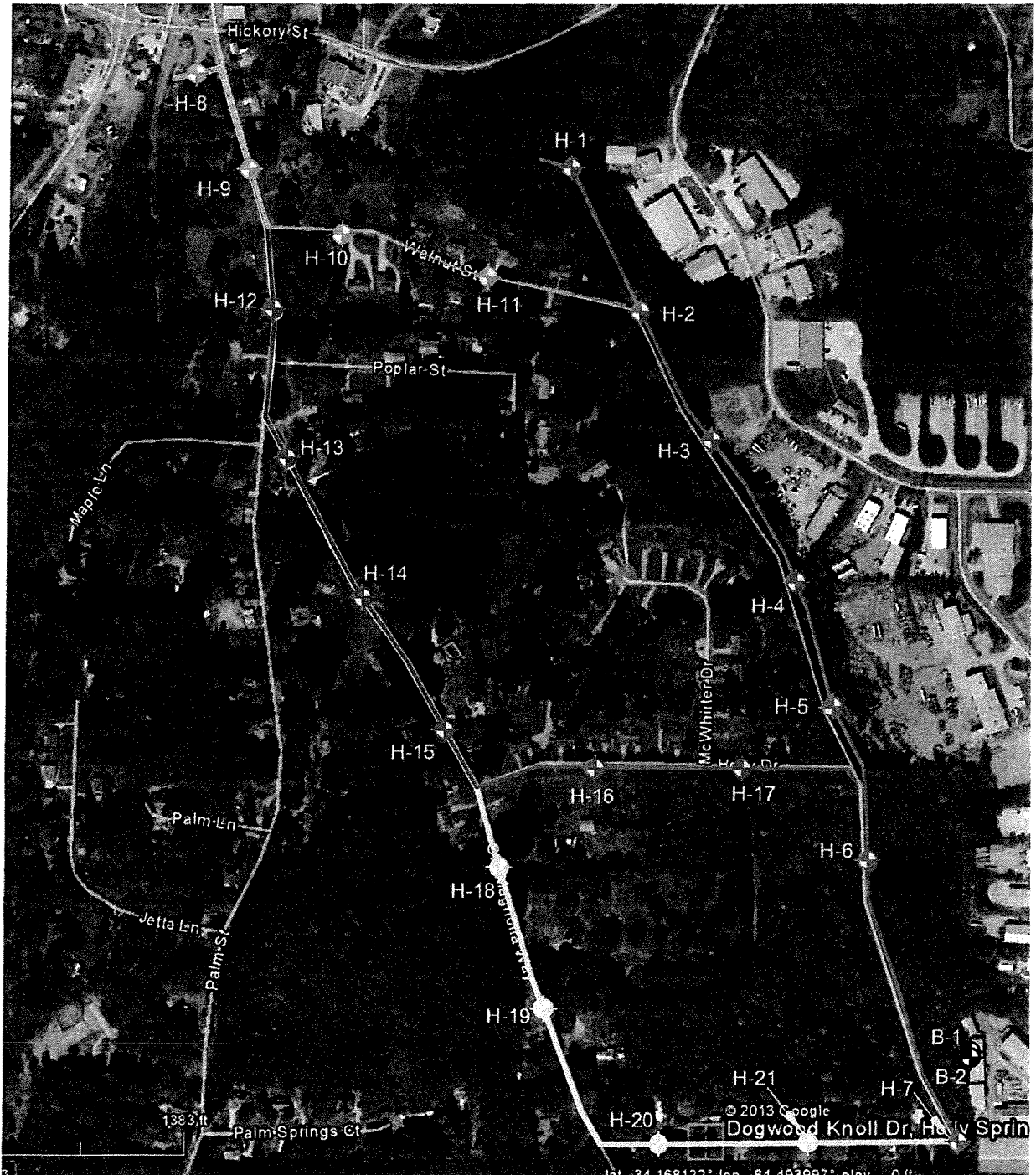
0 30 60 120 180



Approximate Scale: 1"=60'

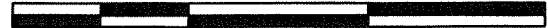
Figure 2: Boring Location Plan

Holly Springs Lift Station - Hydro-Chem Site
Hickory Springs Industrial Drive
Holly Springs, Georgia
Geo-Hydro Project Number 130171.00



- LEGEND:**
- ⊙ Gravity Sewer Hand Auger Boring
 - ⊙ Force Main Option "A" Hand Auger Boring
 - ⊙ Force Main Option "B" Hand Auger Boring
 - ⊙ Force Main Option "C" Hand Auger Boring

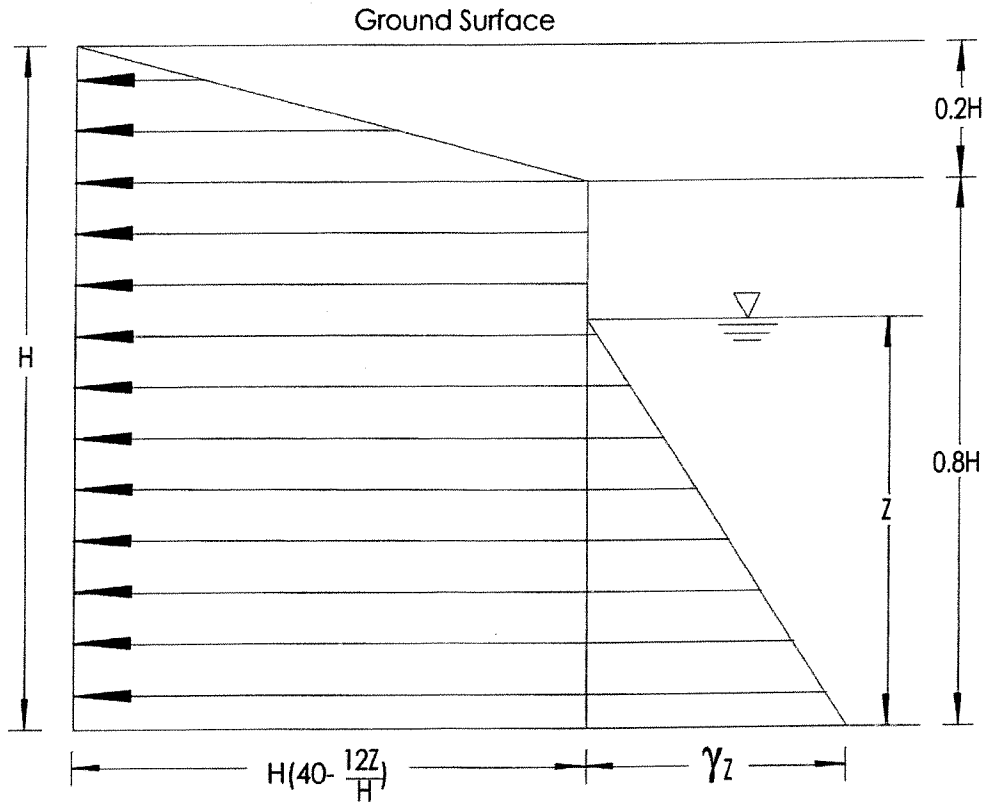
0 250 500 1000 500



Approximate Scale: 1"=500'

Figure 3: Boring Location Plan

Holly Springs Lift Station - Hydro-Chem Site
Holly Springs, Georgia
Geo-Hydro Project Number 130171.00








Where: H = Total depth of wall below the ground surface, feet
 Z = Height of groundwater level above the bottom of the wall, feet
 γ = Unit weight of water (62.4 pcf)
 pressure units are psf

Figure 4: Lateral Earth Pressure Distribution

Holly Springs Lift Station - Hydro-Chem Site
 Hickory Springs Industrial Drive
 Holly Springs, Georgia
 Geo-Hydro Project Number 130171.00

Symbols and Nomenclature

Symbols

	Thin-walled tube (TWT) sample recovered
	Thin-walled tube (TWT) sample not recovered
	Standard penetration resistance (ASTM D1586)
50/2"	Number of blows (50) to drive the split-spoon a number of inches (2)
65%	Percentage of rock core recovered
RQD	Rock quality designation - % of recovered core sample which is 4 or more inches long
GW	Groundwater
	Water level at least 24 hours after drilling
	Water level one hour or less after drilling
ALLUV	Alluvium
TOP	Topsoil
PM	Pavement Materials
CONC	Concrete
FILL	Fill Material
RES	Residual Soil
PWR	Partially Weathered Rock
SPT	Standard Penetration Testing

Penetration Resistance Results		Approximate
	Number of Blows, N	Relative Density
Sands	0-4	very loose
	5-10	loose
	11-20	firm
	21-30	very firm
	31-50	dense
	Over 50	very dense
		Approximate
	Number of Blows, N	Consistency
Silts and	0-1	very soft
	2-4	soft
Clays	5-8	firm
	9-15	stiff
	16-30	very stiff
	31-50	hard
	Over 50	very hard

Drilling Procedures

Soil sampling and standard penetration testing performed in accordance with ASTM D 1586. The standard penetration resistance is the number of blows of a 140-pound hammer falling 30 inches to drive a 2-inch O.D., 1.4-inch I.D. split-spoon sampler one foot. Rock coring is performed in accordance with ASTM D 2113. Thin-walled tube sampling is performed in accordance with ASTM D 1587.

B-1

Test Boring Record



Project: Holly Springs Lift Station - Hydro-Chem Site		Project No: 130171.00
Location: Hickory Springs Industrial Drive, Holly Springs, Georgia		Date: 3/29/13
Method: HSA- ASTM D1586	GWT at Drilling: 14 feet	G.S. Elev:
Driller: B&C - Auto Hammer	GWT at 24 hrs: 10 feet	Logged By: AMP

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)															
						0	10	20	30	40	50	60	70	80	90	100					
	0 - 3		[Cross-hatched symbol]	Topsoil (Approximately 3 inches)																	
	3 - 5		[Diagonal lines symbol]	Soft orange-brown to gray fine sandy silt (ML) (FILL)	4																
	5 - 10		[Wavy lines symbol]	Soft to firm fine sandy silt (ML) (ALLUVIUM)	2																
	10 - 13	▼	[Wavy lines symbol]		3																
	13 - 15	▼	[Dotted symbol]	Firm tan and brown micaceous silty fine sand (SM) (RESIDUUM)	5																
	15 - 13				13																
	13 - 20				14																
	20 - 40			Boring Terminated at 20 feet																	

Remarks:

TEST BORING RECORD HOLLY SPRINGS LIFT STATION - HYDRO-CHEM SITE.GPJ GEO HYDRO.GDT 4/11/13

B-2

Test Boring Record



Project: Holly Springs Lift Station - Hydro-Chem Site		Project No: 130171.00
Location: Hickory Springs Industrial Drive, Holly Springs, Georgia		Date: 3/29/13
Method: HSA- ASTM D1586	GWT at Drilling: 13 feet	G.S. Elev:
Driller: B&C - Auto Hammer	GWT at 24 hrs: 11 feet	Logged By: AMP

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N	Standard Penetration Test (Blows/Foot)														
						0	10	20	30	40	50	60	70	80	90	100				
	0 - 4		[Cross-hatched symbol]	Topsoil (Approximately 4 inches) Very loose brown to orange-brown silty fine sand (SM) (FILL)	3															
	4 - 10		[Wavy line symbol]	Soft orange silty clay (CL) with rock fragments (ALLUVIUM)	2															
	10 - 15		[Dotted symbol]	Very loose to loose gray to tan highly micaceous silty fine sand (SM) (RESIDUUM)	3															
	15 - 20		[Dotted symbol]	Very loose to loose gray to tan highly micaceous silty fine sand (SM) (RESIDUUM)	8															
	20 - 25		[Dotted symbol]	Very loose to loose gray to tan highly micaceous silty fine sand (SM) (RESIDUUM)	4															
	25 - 27		[Dotted symbol]	Very firm dark brown micaceous silty fine sand (SM)	27															
	27 - 40			Auger Refusal at 27 feet																

Remarks:

TEST BORING RECORD HOLLY SPRINGS LIFT STATION - HYDRO-CHEM SITE.GPJ GEO HYDRO.GDT 4/11/13

HAND AUGER LOG H-01



Date Performed: 4/8/13

Logged by: MP

Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1		Red-orange clayey silt (ML) (RESIDUUM)		5			
2				10			
3				>25			
4				>25			
5		Tan micaceous silty fine sand (SM)					
6				>25			
7							
8		Hand Auger Terminated at 8 feet No Groundwater Encountered		21			
9							

HAND AUGER LOG H-02

Date Performed: 4/8/13

Logged by: FW

Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1		Gray fine sandy clay (CL) (ALLUVIUM)		3			
2		Gray fine sandy clay (CL) with rock fragments (ALLUVIUM)		2			
3		Auger Refusal at 3 feet Groundwater Encountered at 2 feet					
4							
5							
6							
7							
8							
9							

* Penetration resistance was evaluated in accordance with ASTM STP-399. The penetration resistance is the number of blows of a hammer weighing 15 lbs. falling 20 inches to drive a 1.5 inch diameter cone 1.75 inches.

Holly Springs Lift Station - Hydro-Chem Site
Holly Springs, Georgia
130171.00

HAND AUGER HOLLY SPRINGS LIFT STATION AND FORCE MAIN - HAND AUGER LOGS.GPJ LOG A GNNIN07.GDT 4/11/13

HAND AUGER LOG H-03

 Date Performed: 4/8/13

 Logged by: MP

 Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1		Brown to gray silty fine sand (SM) with clay (ALLUVIUM)		3			
2				4			
3		Gray fine to medium sand (SP-SM) with silt and rock fragments (ALLUVIUM)					
4		Hand Auger Refusal at 3 feet Groundwater Encountered at 2 feet					
5							
6							
7							
8							
9							

HAND AUGER LOG H-04

 Date Performed: 4/8/13

 Logged by: FW

 Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1		Brown fine sand (SP-SM) with rock fragments (ALLUVIUM)		7			
2				6			
3		Hand Auger Refusal at 3 feet No Groundwater Encountered					
4							
5							
6							
7							
8							
9							

* Penetration resistance was evaluated in accordance with ASTM STP-399. The penetration resistance is the number of blows of a hammer weighing 15 lbs. falling 20 inches to drive a 1.5 inch diameter cone 1.75 inches.

Holly Springs Lift Station - Hydro-Chem Site
Holly Springs, Georgia
130171.00

HAND AUGER HOLLY SPRINGS LIFT STATION AND FORCE MAIN - HAND AUGER LOGS.GPJ LOG A GNNND7.GDT 4/11/13

HAND AUGER LOG H-05



Date Performed: 4/8/13

Logged by: FW

Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1		Brown clayey sand (SC) (ALLUVIUM)		5			
2		Tan-brown silty fine sand (SM) (RESIDUUM)		3			
3		Hand Auger Refusal at 2 1/2 feet No Groundwater Encountered					
4							
5							
6							
7							
8							
9							

HAND AUGER LOG H-06

Date Performed: 4/8/13

Logged by: MP

Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1		Orange clayey silt (ML) (RESIDUUM)		7			
2		Hand Auger Refusal at 2 feet No Groundwater Encountered		>25			
3							
4							
5							
6							
7							
8							
9							

* Penetration resistance was evaluated in accordance with ASTM STP-399. The penetration resistance is the number of blows of a hammer weighing 15 lbs. falling 20 inches to drive a 1.5 inch diameter cone 1.75 inches.

Holly Springs Lift Station - Hydro-Chem Site
Holly Springs, Georgia
130171.00

HAND AUGER HOLLY SPRINGS LIFT STATION AND FORCE MAIN - HAND AUGER LOGS.GPJ LOG A.GNIN07.GDT 4/11/13

HAND AUGER LOG H-07

Date Performed: 4/8/13

Logged by: MP



Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS	
1		Red-orange clayey fine sand (SC) (RESIDUUM)		4				
2				4				
3								
4						12		
5								
6						25		
7								
8						14		
9		Hand Auger Terminated at 8 feet No Groundwater Encountered						

HAND AUGER LOG H-08

Date Performed: 4/8/13

Logged by: FW

Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS	
1		Red-brown silty clay (CL) (FILL)		15				
2				10				
3								
4						5		
5		Red-brown micaceous fine sandy silt (ML) (RESIDUUM)						
6					24			
7								
8						22		
9		Hand Auger Terminated at 8 feet No Groundwater Encountered						

* Penetration resistance was evaluated in accordance with ASTM STP-399. The penetration resistance is the number of blows of a hammer weighing 15 lbs. falling 20 inches to drive a 1.5 inch diameter cone 1.75 inches.

Holly Springs Lift Station - Hydro-Chem Site
Holly Springs, Georgia
130171.00

HAND AUGER - HOLLY SPRINGS LIFT STATION AND FORCE MAIN - HAND AUGER LOGS.GPJ LOG A.GNND07.GDT 4/11/13

HAND AUGER LOG H-09

 Date Performed: 4/8/13

 Logged by: FW

 Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1		Red-brown silty clay (CL) (FILL)		5			
2				9			
3		Orange-red silty fine sand (SM) with rock fragments					
4				14			
5		Red-brown micaceous silty fine sand (SM) with rock fragments					
6		Hand Auger Refusal at 5 1/2 feet No Groundwater Encountered		>25			
7							
8							
9							

HAND AUGER LOG H-10

 Date Performed: 4/8/13

 Logged by: FW

 Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1		Red-brown fine sandy clay (CL) with roots and rock fragments (FILL)		9			
2				8			
3							
4		Orange-brown micaceous fine sandy silt (ML) (RESIDUUM)		9			
5		Orange-brown and black micaceous silty fine sand (SM)					
6				14			
7							
8		Hand Auger Terminated at 8 feet No Groundwater Encountered		22			
9							

* Penetration resistance was evaluated in accordance with ASTM STP-399. The penetration resistance is the number of blows of a hammer weighing 15 lbs. falling 20 inches to drive a 1.5 inch diameter cone 1.75 inches.

Holly Springs Lift Station - Hydro-Chem Site
Holly Springs, Georgia
130171.00

HAND AUGER HOLLY SPRINGS LIFT STATION AND FORCE MAIN - HAND AUGER LOGS.GPJ LOG A GINN07.GDT 4/11/13

HAND AUGER LOG H-11

 Date Performed: 4/8/13

 Logged by: FW

 Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1	X	Red-brown fine sandy clay (CL) with rock fragments (FILL)		13			
2	X	Red-brown fine sandy clay (CL) (FILL)		6			
3	X						
4	X	Tan-brown micaceous silty fine sand (SM) (RESIDUUM)		>25			
5	X						
6	X			>25			
7	X						
8	X	Hand Auger Terminated at 8 feet No Groundwater Encountered		>25			
9	X						

HAND AUGER LOG H-12

 Date Performed: 4/8/13

 Logged by: MP

 Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1	X	Red-brown silty fine sand (SM) (FILL)		4			
2	X	Tan silty fine sand (SM) (RESIDUUM)		3			
3	X						
4	X			11			
5	X	Hand Auger Refusal at 4 1/2 feet No Groundwater Encountered					
6	X						
7	X						
8	X						
9	X						

* Penetration resistance was evaluated in accordance with ASTM STP-399. The penetration resistance is the number of blows of a hammer weighing 15 lbs. falling 20 inches to drive a 1.5 inch diameter cone 1.75 inches.

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HAND AUGER, HOLLY SPRINGS LIFT STATION AND FORCE MAIN - HAND AUGER LOGS.GPJ LOG A.GNIND7.GDT 4/11/13

HAND AUGER LOG H-13

Date Performed: 4/8/13

Logged by: MP



Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS	
1		Light brown silty fine sand (SM) (FILL)		8				
2				6				
3								
4		Red-orange silty fine sand (SM) (RESIDUUM)		21				
5								
6						>25		
7								
8		Hand Auger Terminated at 8 feet No Groundwater Encountered		25				
9								

HAND AUGER LOG H-14

Date Performed: 4/8/13

Logged by: MP

Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

HAND AUGER, HOLLY SPRINGS LIFT STATION AND FORCE MAIN - HAND AUGER LOGS.GPJ LOG A GNNND7.GDT 4/11/13

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS	
1		Red-brown silty clay (CL) (FILL)		8				
2				4				
3								
4		Light orange-brown micaceous silty fine sand (SM) (RESIDUUM)		13				
5								
6						22		
7								
8		Hand Auger Terminated at 8 feet No Groundwater Encountered		20				
9								

* Penetration resistance was evaluated in accordance with ASTM STP-399. The penetration resistance is the number of blows of a hammer weighing 15 lbs. falling 20 inches to drive a 1.5 inch diameter cone 1.75 inches.

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HAND AUGER LOG H-15

Date Performed: 4/8/13

Logged by: MP



Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1		Orange-brown fine sandy clay (CL) (FILL)		7			
2				2			
3							
4				2			
5		Orange silty clay (CL) (RESIDUUM)		9			
6							
7		Auger Refusal at 6 1/2 feet No Groundwater Encountered					
8							
9							

HAND AUGER LOG H-16

Date Performed: 4/8/13

Logged by: MP

Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

HAND AUGER HOLLY SPRINGS LIFT STATION AND FORCE MAIN - HAND AUGER LOGS.GPJ LOG A GNN07.GDT 4/11/13

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1		Red silty clay (CL) (FILL)		10			
2				6			
3		Orange fine sandy silt (ML) (RESIDUUM)		14			
4							
5							
6				12			
7		Purple and tan micaceous silty fine sand (SM)					
8				>25			
9		Hand Auger Terminated at 8 feet No Groundwater Encountered					

* Penetration resistance was evaluated in accordance with ASTM STP-399. The penetration resistance is the number of blows of a hammer weighing 15 lbs. falling 20 inches to drive a 1.5 inch diameter cone 1.75 inches.

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HAND AUGER LOG H-17

 Date Performed: 4/5/13

 Logged by: BI

 Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN.	RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1		Red-brown fine sandy clay (CL) (FILL)						
2		Tan-brown highly micaceous silty fine sand (SM) (RESIDUUM)			5			
3					7			
4					11			
5								
6								
7								
8		Hand Auger Terminated at 8 feet No Groundwater Encountered			8			
9								

HAND AUGER LOG H-18

 Date Performed: 4/8/13

 Logged by: MP

 Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

HAND AUGER HOLLY SPRINGS LIFT STATION AND FORCE MAIN - HAND AUGER LOGS.GPJ LOG A GNNN07.GDT 4/11/13

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN.	RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1		Brown silty fine sand (SM) (FILL)			6			
2		Orange silty clay (CL) (RESIDUUM)			4			
3		Orange micaceous fine sandy silt (ML)						
4					12			
5								
6		Tan micaceous silty fine sand (SM)			22			
7								
8		Hand Auger Terminated at 8 feet No Groundwater Encountered			>25			
9								

* Penetration resistance was evaluated in accordance with ASTM STP-399. The penetration resistance is the number of blows of a hammer weighing 15 lbs. falling 20 inches to drive a 1.5 inch diameter cone 1.75 inches.

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HAND AUGER LOG H-19

Date Performed: 4/8/13

Logged by: MP



Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1		Red-brown fine sandy silt (ML) (FILL)		9			
2		Red-brown micaceous silty fine sand (SM) (RESIDUUM)		22			
3							
4					>25		
5							
6					>25		
7							
8		Hand Auger Terminated at 8 feet No Groundwater Encountered					
9					>25		

HAND AUGER LOG H-20

Date Performed: 4/5/13

Logged by: BI

Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1		Red-brown fine sandy silt (ML) (FILL)					
2		Red-tan silty fine sand (SM) with rock fragments		4			
3							
4					6		
5		Hand Auger Refusal at 5 1/2 feet No Groundwater Encountered					
6							
7							
8							
9							

* Penetration resistance was evaluated in accordance with ASTM STP-399. The penetration resistance is the number of blows of a hammer weighing 15 lbs. falling 20 inches to drive a 1.5 inch diameter cone 1.75 inches.

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HAND AUGER, HOLLY SPRINGS LIFT STATION AND FORCE MAIN - HAND AUGER LOGS.GPJ, LOG A.GMNDZ.GDT, 4/11/13

HAND AUGER LOG H-21

Date Performed: 4/5/13

Logged by: BI



Equipment: Hand Auger and Penetrometer

Elevation(ft): _____

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	LAB TESTS
1		Red-brown fine sandy clay (CL) (FILL)					
2		Red-brown micaceous fine sandy clay (CL) (RESIDUUM)		6			
3		Tan-brown micaceous silty fine sand (SM)					
4				>25			
5		Hand Auger Refusal at 5 feet No Groundwater Encountered					
6							
7							
8							
9							

HAND AUGER HOLLY SPRINGS LIFT STATION AND FORCE MAIN - HAND AUGER LOGS.GPJ LOG A GNNW7.GDT 4/11/13

* Penetration resistance was evaluated in accordance with ASTM STP-399.
The penetration resistance is the number of blows of a hammer weighing 15 lbs. falling 20 inches to drive a 1.5 inch diameter cone 1.75 inches.

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