

CONTRACT DOCUMENTS
AND
TECHNICAL SPECIFICATIONS
RIDGEWOOD
WATER PRODUCTION FACILITY

for

BRUNSWICK-GLYNN COUNTY
JOINT WATER & SEWER COMMISSION
BRUNSWICK, GEORGIA
Project No. 417

September, 2019



Elmo A. Richardson, Jr., P.E., LLC
CONSULTING ENGINEERS
4875 RIVERSIDE DRIVE, SUITE 101
MACON, GEORGIA 31210
Phone: 478/ 757-1903



**INVITATION TO BID
RIDGEWOOD
WATER PRODUCTION FACILITY
TO THE
BRUNSWICK-GLYNN COUNTY
JOINT WATER AND SEWER COMMISSION**

**Mandatory Pre-Bid Meeting on Wednesday, November 13, 2019 at 2:00 p.m. EST
JWSC Commission Chambers
1703 Gloucester Street
Brunswick Georgia 31520**

Bids Due by 12:00 NOON, EST on Tuesday, December 3, 2019

**Office of the Director of Procurement
Joint Water and Sewer Commission
1703 Gloucester Street
Brunswick, Georgia 31520**

**Please Label Bids with Firm's Name and Address
"Sealed Bid - IFB No. 20-011 Ridgewood Water
Production Facility - Project 417"**

Invitation for Bids

Sealed bids for **RIDGEWOOD WATER PRODUCTION FACILITY, GLYNN COUNTY, GEORGIA** will be received by the Brunswick-Glynn County Joint Water and Sewer Commission (JWSC) at the JWSC's Office of the Director, 1703 Gloucester Street, Brunswick, Georgia 31520 until **12:00 p.m. local time, Tuesday, December 3, 2019** at which time and place they will be publically opened and read aloud.

Plans, specifications and bidding documents are available free of charge at the JWSC website <https://www.bgjwsc.org/invitation-to-bid-no-20-011-ridgewood-water-production-facility-project-no-417-for-the-bgjwsc/>

The work to be performed under this contract shall consist of furnishing all labor, materials, tools, equipment and incidentals required to construct complete in place and ready to operate a new water production facility. More specifically the work includes, but is not limited to:

- Site grubbing, clearing and improvements
- Erosion and sedimentation controls
- Modifications to existing well, piping and flow meter
- Construction of a pre-stressed concrete ground storage tank with aerator and level controls
- Installation of tank drains, yard piping and connections
- Construction of pump building with high service pumps, piping, control and electrical system, chemical feed equipment, Multi-Site SCADA and ancillary equipment
- Demolition of existing structures and equipment

The Bidder is **encouraged** to examine the location of the work and inform himself fully as to the conditions present at the site. The water production facility site is secured; therefore site visits must be coordinated through the JWSC Planning and Construction Division at (912) 261-7127, attention Pamela Crosby, at least 24 hours in advance. A **mandatory pre-bid meeting** will be held in the JWSC main conference room, 1703 Gloucester Street, Brunswick, Georgia 31520 on Wednesday, November 13, 2019 at 2:00 p.m. EST followed by a site visit. The deadline for questions will 5:00 p.m. EST on Friday, November 15th. Please submit all questions in writing to the Procurement Director, Pamela Drury-Crosby via e-mail pcrosby@bgjwsc.org

A bid guarantee in an amount not less than five percent (5%) of the amount bid must accompany each bid. Acceptable forms of bid guarantees are: a bid bond, certified check or cashier's check made payable to the Brunswick-Glynn County Joint Water and Sewer Commission. Performance and Payment bonds, each in an amount equal to hundred percent (100%) of the contract amount will be required of the successful Bidder.

The Brunswick-Glynn County Joint Water and Sewer Commission provides equal opportunity for all businesses and does not discriminate against any person or business because of race, color, religion, sex, national origin, disability or veteran status. This policy ensures all segments of the business community have access to supplying the goods and services needed by the JWSC.

The JWSC reserves the right to reject any and all bids, waive technicalities and make an award in the best interest of the JWSC.

**BIDDING DOCUMENTS
AND
TECHNICAL SPECIFICATIONS**

**RIDGEWOOD WATER PRODUCTION FACILITY
GLYNN COUNTY, GEORGIA**

TABLE OF CONTENTS

BIDDING DOCUMENTS

Advertisement for Bids
Instruction to Bidders
Bid Form
Oath
Bid Bond
Representation
Legal and Character Qualifications
Affidavit

FORM OF CONTRACT

Part A - Contract Form
Part B - Performance Bond
Part C - Payment Bond
Part D - Affidavit of Payment of Claims
Part E - Certificate of Insurance
Part F - Certificate of Drug Free Workplace
Part G - E-Verify Contractor Affidavit and Agreement
Part H - E-Verify Subcontractor Affidavit and Agreement

GENERAL CONDITIONS

SPECIAL CONDITIONS

SCADA Scope

TECHNICAL SPECIFICATIONS (Elmo A. Richardson, Jr., P.E., LLC))

Geotechnical Report:

**- Report of Geotechnical Exploration Water Production Facilities -
JWSC - Ridgewood Well, Glynn County, Georgia. E&A Project No.
4338-000 prepared by Ellis & Associates, Inc. dated May 19, 2014**

Index to Technical Specifications
Ridgewood Water Production Facility
Joint Water & Sewer Commission
Brunswick, GA

<u>Section No.</u>	<u>Title</u>
01010	Summary of Work
01016	Occupancy
01025	Measurement & Payment, Cash Allowances
01055	Construction Staking
01060	Regulatory Requirements
01091	Codes and Standards
01340	Shop Drawings, Product Data & Samples
01510	Temporary Facilities
01540	Job Site Security
01610	Transportation & Handling
01611	Storage & Protection
01710	Cleaning
01720	Record Documents
02010	Subsurface Conditions
02050	Demolition
02100	Site Preparation
02125	Erosion & Sedimentation Control
02140	Dewatering
02200	Earthwork
02221	Trenching, Backfill, Compaction, Embedment & Encasement
02224	Trench Excavation & Backfill
02226	Subgrade Construction and Preparation
02228	Waste Material Disposal
02523	Concrete Sidewalk and Driveway
02610	Piping
02611	Site Piping Manholes & Appurtenances
02665	Water Mains & Accessories
02666	Pipe Testing & Acceptance
02675	Disinfection of Potable Water Facilities
02830	Fencing
03050	Concrete Work
03200	Concrete Reinforcement
03300	Cast in Place Concrete
03602	Nonmetallic Grouting
05100	Structural Steel
05120	Structural Metals
05500	Metal Fabrications
05501	Anchor Bolts
07600	Flashing & Sheet Metal
07900	Joint Sealers
08225	Institutional Compartment Doors
08710	Door Hardware
09900	Painting
10425	Signs

10521	Fire Extinguishers
11311	Horizontal Split Case Pumps
13200	Prestressed Concrete Storage Tank
13201	Fabric Baffle Curtain
15000	General Mechanical Requirements
15094	Pipe Supports & Hangers
15170	Motors
15835	Terminal Heat Transfer Units
15865	Axial Fans
16100	Electrical
16310	Packaged Engine Generator System
16496	Enclosed Automatic Transfer Switch
Appendix A	Geotechnical Exploration

BIDDING DOCUMENTS

Office of the Director of Procurement

**Pamela Crosby
Joint Water and Sewer Commission
1703 Gloucester Street
Brunswick, Georgia 31520**

*Advertisement for Bids
Instructions to Bidders
Bid Form
Oath
Bid Bond
Representation
Legal and Character Qualifications
Affidavit
E-Verify Affidavit Contractor
E-Verify Affidavit Subcontractor*

Instructions to Bidders

1. Intent

It is intended that the Instructions to Bidders, General Conditions, Construction Plans and Technical Specifications shall define and describe the complete work to which they relate. Requests for clarification during the bidding period must be submitted in writing or e-mailed to the Contract Project Representative identified in Paragraph 2.0 of the General Conditions on or before **5:00 p.m. EST on Friday, November 15, 2019**. Requests for clarification received after this date will not be considered. Responses to requests for clarification will be issued by addendum to all qualified bidders (**see paragraph 3 below**) and will also be posted on the JWSC website (www.bgjwsc.org).

2. Work to be Done

The work to be performed under this contract consists of furnishing all labor, materials, tools, equipment and incidentals required to construct complete in place and ready to operate a new water production facility. More specifically the work includes, but is not limited to:

- Site grubbing, clearing and improvements
- Erosion and sedimentation controls
- Modifications to existing well, piping and flow meter
- Construction of a pre-stressed concrete ground storage tank with aerator and level controls
- Installation of tank drains, yard piping and connections
- Construction of pump building with high service pumps, piping, control and electrical systems, chemical feed equipment and ancillary equipment
- Demolition of existing structures and equipment
- Installation of Multi-site SCADA improvements as per scope included following Special Conditions

3. Site Examination

The Bidder is **encouraged** to examine the location of the work and inform himself fully as to the conditions present at the site. A **mandatory pre-bid meeting** will be held in the JWSC main conference room, 1703 Gloucester Street, Brunswick, Georgia 31520 on **Wednesday, November 13, 2019, at 2:00 p.m. EST** followed by a site visit for anyone interested in attending.

4. Bid and Contract Security

A bid guarantee in an amount not less than five percent (5%) of the amount bid must accompany each bid. Acceptable forms of bid guarantees are: a bid bond, certified check or cashier's check made payable to the Brunswick-Glynn County Joint Water and Sewer Commission. The JWSC will return bid guarantees, other than bid bonds, to unsuccessful bidders as soon as practicable, but not sooner than the execution of a contract with the successful bidder. If for any reason whatsoever the successful Bidder withdraws from the competition after opening the bids, or refuses to execute the Contract, the Owner will proceed on the Bid Bond or deposit the certified check or cashier's check as damages for the Bidder's failure to enter into a contract for the work.

Performance and Payment bonds, each in an amount equal to one hundred percent (100%) of the contract amount will be required of the successful Bidder.

The Surety of the Bid Bond, Performance Bond, and Payment Bond shall be a surety company authorized to do business in the State of Georgia, shall be listed in the Department of the Treasury Circular 570, and shall have an underwriting limitation in excess of one hundred percent (100%) of the bid amount. The Bonds and Surety shall be subject to approval by the JWSC legal counsel.

Attorneys-in-fact who sign and seal Bid Bonds or Contract Bonds must file with each bond a certified and effectively dated copy of their power of attorney.

5. Determination of Successful Bidder

The contract will be awarded to the lowest responsive, responsible Bidder; if awarded.

The determination of the Bidder's **responsibility** will be made by the JWSC based on whether the Bidder:

1. maintains a permanent place of business,
2. has the appropriate technical experience,
3. has adequate plant and equipment to do the work properly and expeditiously,
4. has suitable financial means to meet obligations incidental to this work, and
5. is appropriately licensed for the described work in the State of Georgia.

The Bidder shall furnish, to the JWSC, all such information and data for this purpose as the JWSC may request. The JWSC reserves the right to reject any bid if the evidence submitted by, or investigation of, the Bidder fails to satisfy the JWSC that he is properly qualified to carry out the obligations of the Contract.

The determination of **responsiveness** will be made by the JWSC based on a consideration of whether the Bidder has submitted a complete Bid Form without irregularities, excisions, special conditions, or alternative bids for any item unless specifically requested in the Bid Form.

6. Bid Alternates

Bidders are requested to review bid alternates, if any, as outlined on the Bid Form.

7. Contract Time

Contract time shall consist of two hundred seventy (300) consecutive calendar days for the completion of work, to be computed from the date of the Notice to Proceed. Time is of the essence and is an essential element of this Agreement, and the Contractor shall pay to the JWSC, not as a penalty, but as liquidated damages, the sum of **One Thousand Dollars (\$1,000.00)** for each calendar day that he shall be in default of completing the work within the time limit named herein.

8. Bid Form

Bids shall be submitted on the Bid Form included. Bids shall be based upon lump sum prices as indicated by the Bid Form. Where errors or omissions result in discrepancies in proposal totals, prices per unit as submitted will be binding. Final payment will be based upon completion and acceptance of the work by the JWSC.

9. Submission of Bids

Bids shall be submitted at the time and place designated in the Invitation for Bids. On the outside of the envelope containing the Bid shall be noted the following:

SEALED BID

RIDGEWOOD WATER PRODUCTION FACILITY GLYNN COUNTY, GEORGIA

JWSC PROJECT NO. 417

Bidder shall submit ***an original, five (5) hard copies and one electronic copy (USB-preferred)*** of its Bid in an opaque sealed envelope at the time and place indicated in the Invitation. The outside of the envelope containing the Bid also shall be marked with the Bidder's name, address and Georgia Utility Contractor's License Number.

All blanks in the Bid must be completed and written or printed in ink.

Bids by corporations must be executed in the corporate name by the president or vice-president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal must be affixed and attested to by the secretary or an assistant secretary of the corporation. The corporate address and state of incorporation must be shown on the Bid Form.

Bids by partnerships must be executed in the partnership name and signed by a partner, whose title must appear under the signature and the official address of the partnership must be shown on the Bid Form.

The address, telephone number, facsimile number and email address for communications regarding the Bid must be shown on the Bid Form.

All names and titles must be typed or printed in ink below the signature.

The Bid shall contain an acknowledgement of receipt of all Addenda, if any. The numbers of each Addendum must be filled in on the Bid Form.

The *Oath, Bid Bond, Representation, Legal and Character Qualifications, Affidavit, E-Verify Affidavit Contractor and E-verify Affidavit Subcontractor (if applicable)* forms in this IFB shall be submitted with the Bid, and be executed in proper form.

IN ACCORDANCE WITH O.C.G.A. § 13-10-91, NO PROPOSAL FOR THE PHYSICAL PERFORMANCE OF SERVICES WILL BE CONSIDERED UNLESS THE BID INCLUDES A SIGNED, NOTARIZED E-VERIFY AFFIDAVIT AS SET FORTH HEREIN.

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

BID FORM

DATE SUBMITTED:

PROJECT NAME:

Ridgewood Water Production Facility
Glynn County, Georgia
JWSC Project No. 417

SUBMITTED TO:

Brunswick - Glynn County Joint
Water and Sewer Commission
1703 Gloucester Street
Brunswick, Georgia 31520

SUBMITTED BY:

Company Name:

Address:

Georgia Utility Contractor's License No.

Acknowledge Receipt of Addenda Numbers

The undersigned as BIDDER hereby declares that the only person or persons interested in the BID as principal or Principals is or are named herein and that no other person than herein mentioned has any interest in the BID or in the Contract to be entered into; that this BID is made without connection with any other person or parties making a BID, and that it is in all respects fair and in good faith without collusion or fraud.

The BIDDER declares that he has examined the site of the work and informed himself fully in regard to all conditions pertaining to the place where the work is to be done; that he has examined the plans and specifications for the work and the documents relative thereto; and has read all General and Special Conditions furnished prior to the opening of bids; that he has satisfied himself relative to the work to be performed.

The BIDDER proposes and agrees, if the BID is accepted, to contract with the Brunswick - Glynn County Joint Water and Sewer Commission to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor to complete the work in full and complete accordance with the shown, noted, described and reasonably intended requirements of

the plans, specifications and contract documents to the full and entire satisfaction of the Brunswick - Glynn County Joint Water and Sewer Commission with a definite understanding that no money will be allowed for extra work except as set forth in the attached General Conditions and contract documents for the prices set forth below.

ITEM 1 - WATER PRODUCTION FACILITY

For furnishing all skill, labor, material, and equipment, as required, to construct complete in place and ready to operate a new water production facility including, but not limited to, demolition of existing structures and equipment; site clearing and improvements; erosion and sedimentation controls; modifications to the existing well, piping and flowmeter; construction of new pre-stressed concrete ground storage tank with aerator; yard piping and connections; new pump building with high service pumps, electrical systems, emergency generator, chemical feed equipment and ancillary equipment; cleanup and complete surface restoration; and all other work and appurtenances required, the lump sum amount of:

WPF BID AMOUNT

\$ _____

ITEM 2 – OWNERS CONTINGENCY ALLOWANCE

The Bidder shall include the following allowances in his total base bid. These allowances are established to provide for unforeseen conditions. Work covered by these allowances shall only be authorized by written direction of the Brunswick-Glynn Joint Water and Sewer Commission.

Owners Contingency Allowance

\$ 75,000.00

TOTAL BASE BID (ITEMS 1 AND 2) _____
(Written Amount)

\$ _____

DEDUCTIVE ALTERNATE

Contractor shall deduct \$ _____ to delete furnishing and installation of natural gas generator, transfer switch, controls, cable, generator pad and other associated equipment.

LIST OF MAJOR SUBCONTRACTORS

The Bidder expressly agrees that:

1. If awarded a Contract as a result of this Proposal, the major Subcontractors used in the prosecution of the work will be those listed below.
2. The following list includes all Subcontractors who will perform work in the amount of approximately \$10,000 or more on this Contract.
3. The Subcontractors listed below are financially responsible and meet the required qualifications as stated in the specifications to perform the work required.

Category	Name of Subcontractor	Address

The Bidder further agrees to accomplish all work and provide all material for the lump sum price submitted, and understands that the lump sum price is subject to adjustment by either increase or decrease, only through a properly executed change order.

The Bidder further proposes and agrees to commence work under this contract, with adequate force and equipment, on a date to be specified in a written order of the Owner and shall fully complete all work hereunder within three hundred (300) consecutive calendar days from and including said date.

The undersigned further agrees that, in case of failure on his part to execute the said Contract and Bonds within fifteen (15) consecutive calendar days after receipt of the conformed Contract Documents, the check or bid bond accompanying this Bid and the monies payable thereto, shall be paid into the funds of the Owner as liquidated damages for such failure otherwise, the check or Bid Bond accompanying this Bid shall be returned to the undersigned.

I understand that collusive bidding is a violation of state and federal law and can result in fines, prison sentences, and civil damage awards. I agree to abide by all conditions of this Invitation for Bids and certify that I am authorized to sign this Bid for the Bidder.

This the _____ day of _____ 2019.

Company Name: (Please Type or Print)

Person Authorized to Sign:

Name: _____

Name: _____

Street: _____

Signature: _____

City: _____

Title: _____

State: _____ Zip: _____

Telephone Number: () _____

Fax Number: () _____

E-Mail: _____

EXPERIENCE AND REFERENCES:

The Bidder shall provide references relative to work it has done of a similar nature as solicited in this Invitation for Bids. Give references that will afford the JWSC opportunity to judge as to experience, skill, business standing and financial ability.

Project	Brief Scope of Project	Project Owner (Title)	Phone Number	Address

Oath

**State of Georgia
City of Brunswick
County of Glynn**

I, _____ (name of individual), solemnly swear
that in the procurement of the contract for

**RIDGEWOOD WATER PRODUCTION FACILITY
GLYNN COUNTY, GEORGIA**

JWSC PROJECT NO. 417

that I, nor any other person associated with me or my business, corporation or partnership,
has prevented or attempted to prevent competition in the bidding or Bids of said project or
from submitting a bid for this project by any means whatever.

Lastly, I swear that neither I, nor any other person associated with me or my business,
Corporation or partnership has caused or induced any other bidder to withdraw his/her bid
from consideration for this project. Said oath is filed in accordance with the requirements
set forth in O.C.G.A. § 36-91-21 (e).

This the _____ day of _____ 2019.

Name of Party: _____

Corporate or Partnership Name: _____

Sworn to and subscribed before me this the _____ day of _____ 2019

NOTARY PUBLIC:

Name: _____

My Commission Expires: _____

(SEAL)

BID BOND

**State of Georgia
City of Brunswick
County of Glynn**

KNOW ALL MEN BY THESE PRESENT, that we, _____
_____, as Principal, and
_____, as Surety, are held and firmly bound

unto the Brunswick-Glynn County Joint Water and Sewer Commission (JWSC) in the not to

exceed sum of _____ Dollars
(\$ _____) lawful money of the United states, for the payment of which sum well
and truly to be made, we bind ourselves, our heirs, personal representatives, successors
and assign, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted to the JWSC a Bid for:

**RIDGEWOOD WATER PRODUCTION FACILITY
GLYNN COUNTY, GEORGIA**

JWSC PROJECT NO. 417

NOW THEREFORE, the conditions of this obligation are such that if the Bid be accepted, the Principal shall, within fifteen days (15) days after receipt of conformed Contract Documents, execute a contract in accordance with the Bid upon the terms, conditions and prices set forth therein, and in the form and manner required by the JWSC and execute a sufficient and satisfactory Performance Bond and Payment bond payable to the JWSC, each in an amount of one hundred percent (100%) of the total contract price, in form and with security satisfactory to the JWSC, then this obligation shall be void; otherwise, it shall be and remain in full force and virtue in law; and the Surety shall, upon failure of the Principal to comply with any or all to the foregoing requirements within the time specified above, immediately pay to the aforesaid JWSC, upon demand, the amount hereof in good and lawful money of the United States of America, not as a penalty, but as liquidated damages.

This bond is given pursuant to and in accordance with the provisions of O.C.G.A. § 36-91 - 50 **et seq.**, as amended from time to time, and all the provisions of the law referring to this character of bond as set forth in said sections or as may be hereinafter enacted and these are hereby made a part hereof to the same extent as if set out herein in full.

(Continued on Next Page)

IN WITNESS WHEREOF, the said Principal has hereunder affixed its signature and said Surety has hereunto caused to be affixed its corporate signature and seal, by its duly authorized officers, on

This the _____ day of _____, 2019.

PRINCIPAL: _____

Signed and sealed in the
Presence of:

By: _____

Title: _____

1. _____

2. _____

(Seal)

SURETY: _____

By: _____

Title: _____

Signed and sealed in the
Presence of:

1. _____

2. _____

(Seal)

REPRESENTATION

EQUAL EMPLOYMENT OPPORTUNITY (EEO) PRACTICE:

EEO Plan. The successful Bidder will develop and implement an EEO policy that, as a minimum, will recruit, hire, train, and promote, at all levels, without regard to race, color, religion, national origin, sex, or age, except where sex or age is a bona fide occupational qualification.

EEO For Veterans/Handicapped: The successful Bidder will also provide equal employment opportunities for qualified disabled veterans, handicapped persons and veterans of the Vietnam Era.

EEO For Successful Bidder Programs: The successful Bidder, will ensure equal employment opportunity applies to all terms and conditions of employment, personnel actions, and successful Bidder-sponsored programs. Every effort shall be made to ensure that employment decisions, programs and personnel actions are non-discriminatory. That these decisions are administered on the basis of an evaluation of an employee's eligibility, performance, ability, skill and experience.

EEO Acquisitions: The successful Bidder will develop and implement a policy that will give equal opportunity to the purchase of various goods and services from small businesses and minority-owned businesses.

a. Does the Bidder have the above EEO policy in place?

☐ Yes

☐ No

b. If the answer to a. above is no, will the Bidder have such a policy in place for the project?

☐ Yes

☐ No

Statement of Assurance: The Bidder herein assures the JWSC that it is in compliance with Title VI & VII of the 1964 Civil Rights Act, as amended, in that it does not on the grounds of race, color, national origin, sex, age, disability, or veteran status, discriminate in any form or manner against employees or employers or applicants for employment and is in full compliance with A.D.A.

Firm's Name

Authorized Signature

Title

Date

LEGAL AND CHARACTER QUALIFICATIONS

Convictions. Has the Bidder (including parent corporation, if applicable) or any principal ever been convicted in a criminal proceeding (felonies or misdemeanors) in which any of the following offenses were charged?

	Yes	No		Yes	No
a. Fraud	☐	☐	h. Obstruction of justice (or any other misconduct affecting public or judicial officers' performance of their official duties)		
b. Embezzlement	☐	☐			
c. Tax Evasion	☐	☐		☐	☐
d. Bribery	☐	☐	i. False/misleading advertising	☐	☐
e. Extortion	☐	☐	j. Perjury	☐	☐
f. Jury Tampering	☐	☐	k. Conspiracy to commit any of the Foregoing offenses		
g. Anti-Trust Violations	☐	☐		☐	☐

Civil Proceedings: Has the Bidder or any principal ever been a party, or is now a party, to a civil proceeding in which it was held liable for any of the following?

	Yes	No		Yes	No
a. Unfair/anti-competitive business practices	☐	☐	c. Violations of securities laws (state & federal)	☐	☐
			d. False / misleading advertising	☐	☐
b. Consumer fraud misrepresentation	☐	☐	e. Violation of local Government ordinances	☐	☐

License Revocation: Has the Bidder or any principal ever had a business license revoked, suspended, or the renewal thereof denied, or is a party to such a proceeding that may result in same?

Yes ☐ No ☐

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

AFFIDAVIT

This Bid is submitted to Brunswick-Glynn County Joint Water and Sewer Commission (JWSC) by the undersigned who is an authorized officer of the company and said company is licensed to do business in Georgia. Further, the undersigned is authorized to make these representations and certifies these representations are valid. The Bidder recognizes that all representations herein are binding on the Company and failure to adhere to any of these commitments, at the JWSC's option, may result in a revocation of the granted contract.

Consent is hereby given to the JWSC to contact any person or organization in order to make inquiries into legal, character, technical, financial, and other qualifications of the Bidder.

The Bidder understands that, at such time as the JWSC decides to review this Bid, additional information may be requested. Failure to supply any requested information within a reasonable time may result in the rejection of the Bid with no re-submittal rights.

The successful Bidder understands that the JWSC, after considering the legal, financial, technical, and character qualifications of the Bidder, as well as what in the JWSC's judgment may best serve the interest of its rate payers and employees, may grant a contract.

The successful Bidder understands that this bid is made without prior understanding, agreement, or connection with any corporation, firm or person submitting a bid for the same, and is in all respects fair and without collusion or fraud. I understand that collusive bidding is a violation of state and federal law and can result in fines, prison sentences, and civil damage awards.

Any contract issued will be on the basis of the Bidder's service, financial plans and arrangements being feasible and adequate to fulfill the conditions set forth in this project and the successful Bidder's response.

Company Name: _____

Authorized Person: _____ Signature: _____
(Print/Type)

Title: _____ Date: _____

Address: _____

Telephone: _____ Fax: _____ Email: _____

FORM OF CONTRACT

Office of the Director
Brunswick-Glynn County Joint Water and Sewer Commission
1703 Gloucester Street
Brunswick, Georgia 31520
(912) 261-7112 Phone
(912) 261-7178 Fax
E-Mail: pcrosby@bgjwsc.org

PART A	<i>Contract Form</i>
PART B	<i>Performance Bond</i>
PART C	<i>Payment Bond</i>
PART D	<i>Affidavit of Payment of Claims</i>
PART E	<i>Certificate of Insurance</i>
PART F	<i>Certificate of Drug Free Workplace</i>
PART G	<i>E-Verify Contractor Affidavit and Agreement</i>
PART H	<i>E-Verify Sub-Contractor Affidavit and Agreement</i>

PART A - CONTRACT FORM

**CONTRACT FOR SERVICES
BY AND BETWEEN
BRUNSWICK-GLYNN COUNTY JOINT WATER AND SEWER COMMISSION
AND**

THIS AGREEMENT made and entered into by and between the **BRUNSWICK-GLYNN COUNTY JOINT WATER AND SEWER COMMISSION**, a public corporation created by Local Act of the General Assembly of the State of Georgia, acting by and through its Commissioners (hereinafter referred to as the "JWSC") and _____ a _____ (State of Incorporation) corporation licensed to do business in the State of Georgia (hereinafter referred to as the "Contractor").

WHEREAS, The JWSC issued an Invitation for Bids on or about _____, 2019 (hereinafter referred to as the "Solicitation") from qualified vendors to provide for its **RIDGEWOOD WATER PRODUCTION FACILITY, GLYNN COUNTY, GEORGIA, JWSC PROJECT NO. 417** (hereinafter referred to as the "**Project**"); and

WHEREAS, the Contractor submitted a qualified bid in response to the Solicitation; and

WHEREAS, the JWSC, at a regular meeting held on _____, 2019, authorized the award of the Project to the Contractor; and

WHEREAS, it is the intention of the parties hereto to enter into this contract (hereinafter referred to as the "Agreement") in order to provide a statement of the respective covenants, conditions and agreements in connection with the performance of services by Contractor to the JWSC.

NOW THEREFORE, FOR AND IN CONSIDERATION of the mutual covenants and conditions set forth herein, and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties agree as follows:

1. INDEPENDENT CONTRACTOR STATUS AND RESPONSIBILITIES

- (a) In the performance of the Project services required under this Agreement, Contractor shall be an "independent contractor" with the authority and responsibility to control and direct the performance and details of the Project Work and services required under this Agreement; provided, however, JWSC shall have a right to inspect Work in progress to determine whether, in JWSC's opinion, the Project services are being performed by Contractor in accordance with the provisions of this Agreement.

- (b) ALL persons hired or used by Contractor shall be Contractor's employees and agents and Contractor shall ensure that such persons are qualified to engage in the activity and services in which they participate. Contractor shall be responsible for the accuracy, completeness and adequacy of any and all work and services performed by Contractor's employees and agents and shall ensure that all applicable licensing and operating requirements of federal, state, county and municipal governments, and all applicable accreditation and other standards of quality generally accepted in the field of Contractor activities are complied with and satisfactorily met.
- (c) Contractor expressly agrees to assume the sole and entire liability (if any liability is determined to exist) to its employees, agents and other persons for all loss, damage or injury caused by Contractor's employees and agents in the course of their employment. The mere participation in the performance of Project services under this Agreement shall not constitute nor be construed as employment with JWSC and shall not entitle Contractor or Contractor's employees, agents or subcontractors to vacation, sick leave, retirement or other benefits afforded by employees of the JWSC. Contractor shall be responsible for payment of applicable income, social security and any other federal, state, and/or local taxes and fees.
- (d) Contractor assumes sole responsibility for completion of the Project undertaken pursuant to this Agreement. The JWSC shall consider Contractor the sole point of contact with regard to contractual matters. Subcontracting of any part of the Project Work or services contemplated by this Agreement may not be entered by Contractor without prior written approval by the JWSC.

2. **CONTRACT DOCUMENTS**

- (a) This Agreement consists of this document and other documents which are incorporated herein by reference as though set forth fully herein (hereinafter referred to in this Agreement as the Contract Documents), as follows:
 - (1) JWSC's Solicitation, dated _____ including Addendums, if any.
 - (2) Contractor's Bid for **RIDGEWOOD WATER PRODUCTION FACILITY – GLYNN COUNTY, GEORGIA, JWSC PROJECT NO. 417** dated _____, 2019.

(3) This Agreement, which includes the following Parts:

Part A:	Contract Form
Part B:	Performance Bond
Part C:	Payment Bond
Part D:	Affidavit of Payment of Claims
Part E:	Certificate of Insurance
Part F:	Certificate of Drug Free Workplace
Part G:	E-Verify Contractor Affidavit and Agreement
Part H:	E-Verify Subcontractor Affidavit and Agreement

- (b) In case of any conflicts, the terms and conditions set forth in this Agreement shall control over the terms and conditions of the documents incorporated herein by this Section 2, Contract Documents.

3. **SCOPE OF WORK**

- (a) Contractor agrees to provide all the skill labor, materials and equipment necessary to carry out, in good faith, the complete requirements of the Project specified as **RIDGEWOOD WATER PRODUCTION FACILITY – GLYNN COUNTY, GEORGIA, JWSC PROJECT NO. 417** in strict conformity with all sections of the Solicitation, whose program services together with the Contractor's Bid, the Invitation for Bids, Instructions to Bidders, General Conditions, Construction Plans, Standards for Water and Sewer Design and Construction, this Agreement and all addenda hereto annexed, and the Contract Documents shall form essential parts of this Agreement as if fully contained herein.
- (b) Contractor agrees to perform all Project services as contemplated herein in a manner that does not jeopardize the safety of Contractor's workers, JWSC personnel or any other person, including providing and maintaining all necessary precautions for the protection of the public. In addition, Contractor agrees to perform the Project contemplated herein in a manner that poses no threat to the environment or violates any federal, state or local statute, ordinance, rule or regulation regarding environmental concerns.
- (c) Contractor agrees to keep the rights-of-way, easement area and adjacent property free from accumulations of waste materials, rubbish and other debris resulting from the Work, and progressively as the Work is completed he shall remove all waste materials, rubbish and debris from and about the work areas and shall leave the site clean.

4. NOTICE TO PROCEED; LIQUIDATED DAMAGES

- (a) **Notice to Proceed:** The Contractor agrees to commence the Project included in this Agreement on a date to be specified in a written Notice to Proceed and shall fully complete the Project within a period of **Three Hundred (300)** consecutive calendar days after the effective commencement date.
- (b) **Liquidated Damages:** Time is of the essence and is an essential element of this Agreement, and the Contractor shall pay to the JWSC, not as a penalty, but as liquidated damages, the sum of **One Thousand Dollars (\$1,000.00)** for each calendar day that he shall be in default of completing the work within the time limit named herein. These fixed liquidated damages are not established as a penalty but are calculated and agreed upon in advance by the JWSC and the Contractor due to the uncertainty and impossibility of making a determination as to the actual and consequential damages incurred by the JWSC and its rate payers as a result of the failure on the part of the Contractor to complete the Work on time. Such liquidated damages referred to herein are intended to be and are cumulative and shall be in addition to every other remedy now or hereafter enforceable at law, in equity, by statute or under this Agreement.

5. COMPENSATION

- (a) The JWSC agrees to pay the Contractor, in current funds, for the performance of this Agreement based on the units and lump sum pricing for the Project and listed at Exhibit "A," which sums shall also pay for all loss or damage arising out of the nature of the Project aforesaid, or in the performance of the Project and for all expenses incurred by, or in consequence of the Project, its suspension or discontinuance, and for well and faithful completion of the Project and the whole thereof, as herein provided.
- (b) The JWSC and Contractor agree that the Construction Plans, Standards for Water and Sewer Design and Construction, and all Addenda thereto together are as fully a part of the Contract as if attached or herein repeated. The Contractor, recognizing the particular requirements of the JWSC budgetary process, agrees to waive the terms of O.C.G.A. § 13-11-1 **et seq.**, known as the Georgia Prompt Pay Act. Contractor agrees that the Work and services required by this Agreement may require inspection and approval of the JWSC's engineers or consultants and that the time of repayment shall be tolled for a reasonable time as required for said inspection and approval.
- (c) Contractor further agrees to toll the time for payment herein under for an additional and reasonable period of time for the JWSC representative overseeing the Project or Work contemplated by this Agreement to approve the Work and/or services performed.

- (d) The JWSC shall have forty-five (45) days from approval by the JWSC representative in which to pay the Contractor; subject to any documentation requests by the JWSC as necessary to allow the JWSC to evaluate the completeness and accuracy of monies due.

6. TERM OF AGREEMENT

- (a) This Agreement shall be for a period of **Three Hundred (300)** consecutive calendar days after the effective commencement date of the Work
- (b) This Agreement is binding on the parties as of date last written below.

7. INSURANCE

Contractor shall not commence Work on the Project under this Agreement until all insurance set forth in the Solicitation, Section 7.0, Insurance (**see** General Conditions), has been obtained and such insurance certificates have been approved by the JWSC. The certificates of insurance shall indicate the JWSC as an additional named insured and that the coverages are primary and not contributory with any similar insurance purchased by the JWSC, and shall contain a provision that such coverage shall not be cancelled until at least thirty (30) days prior written notice has been given to the JWSC.

8. INDEMNIFICATION

To the fullest extent permitted by laws, statutes, rules and regulations, the Contractor shall indemnify and hold harmless the JWSC, its officers, directors, employees, agents and other consultants of each and any of them from and against all claims, costs, damages, losses and expenses, including but not limited to all fees and charges of engineers, attorneys and other professionals and all court costs, arising out of or resulting from the performance of the Work, but only to the extent caused in whole or in part by acts or omission of the Contractor, its officers, directors, employees, agents, and anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, costs, damage, loss or expense is caused in part by a party indemnified hereunder. In any and all claims against the JWSC or any of its agents or employees, the indemnification obligation shall not be limited in any way by the amount or type of damages. Contractor shall not indemnify JWSC, its agents or employees for their own, sole negligence.

9. **ASSIGNMENT**

Contractor shall not assign or transfer any part of or the entire Project to be performed under this Agreement, or any right accruing hereunder, without the express written consent of JWSC. The JWSC may condition any consent and approval upon such terms and provisions that JWSC may deem necessary. Further, no assignment of claims for money due or to become due to Contractor under this Agreement shall be effective unless the assignment of such claim is first approved, in writing, by the JWSC.

10. **PROHIBITED DISCRIMINATION**

Contractor shall comply with all applicable federal and state laws prohibiting discrimination against any person on the grounds of race, color, religion, sex, national origin, age, disability, veteran status or any other status protected by law, in employment or in any condition of employment with Contractor or in participation in the benefits of the Work provided by Contractor under this Agreement.

11. **COMPLIANCE WITH ALL LAWS**

Contractor shall observe and comply with the laws of the State of Georgia which require authorization or licensing to conduct business in the State. Notwithstanding statutory exemptions or exclusions, Contractor agrees to subject itself to the jurisdiction and process of the Courts of the State of Georgia as to all matters and disputes arising or to arise under this Agreement and the performance thereof, including all issues relating to liability for taxes, licenses or fees levied by the State.

12. **REMEDIES; DISPUTE RESOLUTION**

- (a) Contractor irrevocably consents that any legal action or proceeding arising out of or in any manner relating to this Agreement shall be brought in any court in Glynn County, Georgia. Contractor designates the Secretary of the State of Georgia as its agent for service of process, provided no such agent located in Georgia is on file with the said Secretary. Contractor, by the execution and delivery of this Agreement, expressly and irrevocably assents to and submits to the personal jurisdiction of any court in Glynn County, Georgia, and in any said action or proceeding. Contractor hereby expressly and irrevocably waives any claim or defense in any said action or proceeding based on any alleged lack of jurisdiction, improper venue or ***forum non conveniens*** or any similar basis.
- (b) A dispute between the parties arising out of or in any manner relating to this Agreement, or breach thereof, may be submitted to binding arbitration or resolved in a court of law having jurisdiction of such matters. Once a party elect's arbitration, such election is binding on both parties. An arbitrator selected from a panel in Glynn County, Georgia, provided by the American Arbitration Association shall resolve the dispute. The cost of arbitration shall

be borne equally by the parties. The arbitration decision may be appealed in accordance with State law.

- (c) No provision set forth in this Section is to have the effect to abridge the right of any party to proceed in a court of law or equity.

13. MODIFICATION OF AGREEMENT

No modification, alteration or amendment to the terms of this Agreement shall be effective unless written and signed by the authorized representative of all parties hereto.

14. WAIVER

The failure of either party at any time to enforce or require performance of any provision hereof shall in no way operate as a waiver or affect the right of such party at a later time to enforce the same. No waiver by either party of any condition or the breach of any provision contained in this Agreement, whether by conduct or otherwise, in anyone or more instances, shall be deemed to be or construed as a further or continuing waiver of any such condition or breach, or a waiver of any other condition or of any breach of any other provision contained in this Agreement.

15. TERMINATION OF AGREEMENT

- (a) The JWSC may, at any time upon written notice to the Contractor, terminate this Agreement for convenience, without prejudice to any right or remedy of the JWSC, in whole or as to any portion of the Project, then existing or which may thereafter accrue. If the JWSC terminates this Agreement for convenience, then JWSC's only obligation to Contractor will be for payment of compensation earned up to the date of such termination and all outstanding costs including those materials in transit and un-cancellable.
- (b) When the Contractor's services have been terminated by the JWSC, the Contractor in calculating his termination application for payment, shall develop his outstanding costs, including those materials in transit and un-cancellable with the appropriate percentage markups; subcontractors shall follow the same procedures. All costs must be substantiated by adequate back-up documentation. Any retention or payment of moneys due to the Contractor by the JWSC will not release the Contractor from liability.

- (c) The Contractor may not terminate this Agreement without the JWSC's consent except for failure of the JWSC to pay sums due to the Contractor hereunder. Prior to termination, the Contractor must give written notice to the JWSC allowing thirty (30) days to investigate and remedy any failure or breach hereof. Should the JWSC fail to remedy the failure or breach hereof within such thirty (30) days, the Contractor shall give written notice, addressed to the JWSC Executive Director, sent by certified mail, return receipt requested, of its intention to cease providing services upon a day certain after delivery of such notice.

16. AGREEMENT SECURITY - BONDS

- (a) A bid guarantee in an amount not less than five percent (5%) of the amount bid must accompany each bid. Acceptable forms of bid guarantees are: a bid bond, certified check or cashier's check made payable to the Brunswick-Glynn County Joint Water and Sewer Commission. The JWSC will return bid guarantees, other than bid bonds, to unsuccessful Bidders as soon as practicable, but not sooner than the execution of a contract with the successful Bidder. If for any reason whatsoever the successful Bidder withdraws from the competition after opening the bids, or refuses to execute the Contract, the JWSC will proceed on the Bid Bond or deposit the certified check or cashier's check as damages for the Bidder's failure to enter into a contract for the work.
- (b) Performance and Payment bonds, each in an amount equal to one hundred percent (100%) of the contract amount will be required of the successful Bidder.
- (c) The Surety of the Bid Bond, Performance Bond, and Payment Bond shall be a surety company authorized to do business in the State of Georgia, shall be listed in the Department of the Treasury Circular 570, and shall have an underwriting limitation in excess of one hundred percent (100%) of the bid amount. The Bonds and Surety shall be subject to approval by the JWSC legal counsel.
- (d) Attorneys-in-fact who sign and seal Bid Bonds or Contract Bonds must file with each bond a certified and effectively dated copy of their Power of Attorney evidencing the authority of the individual signing the bond.

17. NOTICES

- (a) All notices, approvals, consents, requests, demands, claims or other communications shall be in writing (collectively referred to as Notice).

(b) It shall be sufficient service of any Notice if the same shall be delivered or mailed by first class registered or certified mail, return receipt requested, postage prepaid and addressed as follows:

(1) If to Contractor:

(2) If to JWSC: Andrew Burroughs, P.E. , Executive Director
Brunswick-Glynn County Joint Water
and Sewer Commission
1703 Gloucester Street
Brunswick, Georgia 31520

(3) Copy to: Hall Booth Smith
Charles Dorminy, JWSC Attorney
3528 Darien Highway, Suite 300
Brunswick, Georgia 31525

(c) Any Notice hereunder shall be deemed to have been given or made as of the time of actual delivery or in the case of mailing when the same should have been received in due course of post. Any notice by facsimile transmission shall be deemed to have been given or made upon receipt and if verified by the facsimile apparatus that the transmission was in fact delivered, including the number to which the facsimile was sent, and the time and date it was transmitted successfully.

(d) The parties hereto may, by Notice given hereunder, designate any different address to which subsequent Notices shall be sent or the person to whose attention the same shall be directed.

18. WARRANT OF AUTHORITY

Each individual executing this Agreement on behalf of any party expressly represents and warrants that he/she has authority to do so, and thereby to bind the party on behalf of which he/she signs, to the terms of this Agreement.

19. ENTIRE AGREEMENT; BENEFIT TO PARTIES

(a) This Agreement and any attached exhibit(s) constitute the final and entire agreement and understanding between the parties hereto regarding the subject matter hereof. No prior written promises, or contemporaneous or subsequent oral promises or representations, shall be binding and are to be without effect in the construction of any of the terms or conditions of this Agreement.

- (b) With the exception of rights expressly conferred herein, nothing expressed or mentioned in or to be implied here from is intended or shall be construed to give to any person other than the parties hereto, any legal or equitable right, remedy or claim under or in respect hereto or any agreement, condition or provision herein contained and no provision shall be construed as creating any debt as against Contractor or JWSC in favor of any such person; this Agreement and the covenants, conditions and provisions hereof being intended to be used for the sole and exclusive benefits of the parties hereto.
- (c) Contractor and JWSC, their successors, executors, administrators and assigns hereby agree to the full performance of the covenants herein contained.

20. GOVERNING LAW

This Agreement shall be governed by and construed in accordance with the laws of the State of Georgia.

21. TIME IS OF THE ESSENCE

Time is of the essence in fulfilling all terms and conditions of this Agreement.

22. EXECUTION IN COUNTERPARTS

This Agreement may be simultaneously executed in several counterparts, each of which shall be an original and all of which shall constitute but one and the same instrument.

23. MISCELLANEOUS PROVISIONS

- (a) Section captions herein are for convenience of reference only and neither limits nor amplifies the provisions of this Agreement.
- (b) Should any term, provision or other part of this Agreement be declared illegal or unenforceable, it shall be excised or modified to conform to the appropriate laws or regulations, and the remainder of the Agreement shall not be affected but shall remain in full force and effect.
- (c) The foregoing whereas clauses are hereby incorporated into this Agreement and made a part thereof.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement in their names under seal, all by their duly authorized officers, as of the date last written below, in two (2) counterparts, each of which shall without proof or accounting for the other counterparts, be deemed an original contract.

By: _____
Name and title of corporate officer

Attest to:

By: _____
Name and title of corporate officer

Date and SEAL

**BRUNSWICK-GLYNN COUNTY JOINT
WATER AND SEWER COMMISSION**

By: _____
G. Ben Turnipseed, Sr., Chairperson

Attest to:

By: _____
Andrew Burroughs, P.E. Executive Director

Date and SEAL

PART A: CONTRACT FORM CONTINUED

Please be advised that the Contract Form, herein above, contemplates the Project described and when the successful Bidder is selected and the Project awarded, then JWSC will provide the successful Bidder with a **RIDGEWOOD WATER PRODUCTION FACILITY – GLYNN COUNTY, GEORGIA, JWSC PROJECT NO. 417** agreement which will include the standard contract provisions as set forth in the Contract Form herein, as applicable.

PART B - PERFORMANCE BOND

**State of Georgia
City of Brunswick
County of Glynn**

KNOW ALL MEN BY THESE PRESENT, that we _____

_____, as Principal, and _____

_____, as Surety, do hereby acknowledge
ourselves indebted and firmly bound and held unto the Brunswick-Glynn County Joint
Water and Sewer Commission (JWSC), for the use and benefit of those entitled thereto in
the not to exceed sum of _____

_____ \$ (_____)

for the payment of which will and truly to be made, in lawful money of the United States, we
do hereby bind ourselves, successors, assigns, heirs, and personal representatives.

BUT THE CONDITION OF THE FOREGOING OBLIGATION OR BOND IS THIS:

WHEREAS, the JWSC has engaged the said Contractor for the not to exceed sum of
_____ \$ (_____)

for the **RIDGEWOOD WATER PRODUCTION FACILITY – GLYNN COUNTY, GEORGIA, JWSC
PROJECT NO. 417** as more fully appears in a written Agreement bearing the same project title, a
copy of which Agreement is by reference hereby made a part thereof.

NOW, THEREFORE, if a said Contractor shall fully and faithfully perform all the
undertakings and obligations under the said agreement or contract herein before referred to
and shall fully indemnify and save harmless the JWSC from all costs and damage
whatsoever which it may suffer by reason of any failure on the part of said Contractor to do
so, and shall fully reimburse and repay the JWSC such default, and shall guarantee all
products and workmanship against defects for a period of one year, then this obligation or
bond shall be null and void, otherwise, it shall remain in full force and effect.

And for value received it is hereby stipulated and agreed that no change, extension of time,
alteration or addition to the terms of the said Agreement or Contract or in the work to be
performed there under, or the Specifications accompanying the same shall in any way
affect the obligations under this obligation or bond, and notice is hereby waived of any such
damage, extension of time, alteration or addition to the terms of the Agreement or Contract or
to the work or to the Specifications.

This bond is given pursuant to and in accordance with the provisions of O.C.G.A. § 36-91 -1
et seq. and all the provisions of the law referring to this character of bond as set forth in said

sections or as may be hereinafter enacted, and these are hereby made a part hereof to the same extent as if set out herein in full.

IN WITNESS WHEREOF, the said Principal has hereunder affixed its signature and said Surety has hereunto caused to be affixed its corporate signature and seal, by its duly authorized officers, on

This the _____ day of _____, 2019, executed in two (2) counterparts.

PRINCIPAL: _____

By: _____

Title: _____

(SEAL)

Signed and Sealed in the Presence of:

1. _____

2. _____

SURETY: _____

By: _____

Title: _____

(SEAL)

Signed and Sealed in the Presence of:

1. _____

2. _____

PART C - PAYMENT BOND

**State of Georgia
City of Brunswick
County of Glynn**

KNOW ALL MEN BY THESE PRESENT, that we _____

_____, as Principal, and _____

_____, as Surety, do hereby acknowledge
ourselves indebted and firmly bound and held unto the Brunswick-Glynn County Joint
Water and Sewer Commission (JWSC), for the use and benefit of those entitled thereto in
the not to exceed the sum of _____

_____ \$ (_____)

for the payment of which will and truly to be made, in lawful money of the United States, we
do hereby bind ourselves, successors, assigns, heirs, and personal representatives.

BUT THE CONDITION OF THE FOREGOING OBLIGATION OR BOND IS THIS:

WHEREAS, the JWSC has engaged the said Contractor for the not to exceed sum of
_____ \$ (_____)

For the **RIDGEWOOD WATER PRODUCTION FACILITY – GLYNN COUNTY, GEORGIA,**
JWSC PROJECT NO. 417 as more fully appears in a written Agreement bearing the same project
title, a copy of which Agreement is by reference hereby made a part thereof.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if said
Contractor and all subcontractors to whom any portion of the work provided for in said
Contract is sublet and all assignees of said Contract and of such subcontractors shall
promptly make payments to all persons supplying him or them with labor, products,
services, or supplies for or in the prosecution of the work provided for in such Contract, or in
any amendment or extension of or addition to said Contract, and for the payment of
reasonable attorney's fees, incurred by the claimants in suits on this bond, then the above
obligation shall be void; otherwise, it shall remain in full force and effect.

HOWEVER, this bond is subject to the following conditions and limitations:

- (a) Any person, firm or corporation that has furnished labor, products, or supplies
for or in the prosecution of the work provided for in said Contract shall have a
direct right of action against the Contractor and Surety on this bond, which right
of action shall be asserted in a proceeding, instituted in the county in which the
work provided for in said Contract to be performed or in any county in which
Contractor or Surety does business. Such right of action shall be asserted in
proceedings instituted in the name of the claimant or claimants for his or their

use and benefit against said Contractor and Surety or either of them (but not later than one year after the final settlement of said Contract) in which action such claim or claims shall be adjudicated and judgment rendered thereon.

- (b) The Principal and Surety hereby designate and appoint _____
_____ as agent of each of them to receive and accept service of process or other pleading issue or filed in any proceeding instituted on this bond and hereby consent that such service shall be the same as personal service on the Contractor and/or Surety.
- (c) In no event shall the Surety be liable for a greater sum than the penalty of this bond, or subject to any suit, action or proceeding thereon that is instituted later than one year after the final settlement of said Contract.
- (d) This bond is given pursuant to and in accordance with the provisions of O.C.G.A. § 36-91-1 **et seq.** and all the provisions of the law referring to this character of bond as set forth in said sections or as may be hereinafter enacted, and these are hereby made a part hereof to the same extent as if set out herein in full.

[Signatures on Next Page]

IN WITNESS WHEREOF, the said Principal has hereunder affixed its signature and said Surety has hereunto caused to be affixed its corporate signature and seal, by its duly authorized officers, on

This the _____ day of _____, 2019, executed in two (2) counterparts.

PRINCIPAL: _____

By: _____

Title: _____

Signed and Sealed in the Presence of :

1. _____

2. _____

(SEAL)

SURETY: _____

By: _____

Title: _____

Signed and Sealed in the Presence of

1. _____

2. _____

(SEAL)

PART D - AFFIDAVIT OF PAYMENT OF CLAIMS
{Submitted with Final Invoice}

_____ this the _____ day of _____, 2019,
appeared before me, _____, a Notary Public, in
and for _____,
and being by me first duly sworn states that all subcontractors and suppliers of labor and materials
have been paid all sums due them to date for work performed or material furnished in the
performance of the Contract between: Brunswick-Glynn County Joint Water and Sewer Commission
(JWSC) and

(Contractor), last signed _____ for the **RIDGEWOOD WATER PRODUCTION**
FACILITY – GLYNN COUNTY, GEORGIA, JWSC PROJECT NO. 417

CONTRACTOR

Company: _____

By: _____

Title: _____

(SEAL)

Sworn to and subscribed before me this the _____ day of _____ 2019.

NOTARY PUBLIC:

Name: _____

My Commission Expires: _____

(NOTARY SEAL)

PART E - CERTIFICATE OF INSURANCE

This is to certify that _____
(Insurance Company)

of _____
(Insurance Company Address)

has issued policies of insurance, as identified by a policy number to the insured name below, and that such policies are in full force and effect at this time. Furthermore, this is to certify that these policies meet the requirements described in the General Conditions of this project; and it's agreed that none of these policies will be canceled or changed so as to affect this Certificate until thirty (30) days after written notice of such cancellation or change has been delivered to:

**BRUNSWICK-GLYNN COUNTY JOINT WATER AND SEWER COMMISSION,
DEPUTY EXECUTIVE DIRECTOR, 1703 GLOUCESTER STREET, BRUNSWICK,
GEORGIA 31520**

It is further agreed that Brunswick-Glynn County Joint Water and Sewer Commission shall be named as an additional insured on the Contractor's policy.

1. Insured: _____

2. Project Name: **RIDGEWOOD WATER PRODUCTION FACILITY -
GLYNN COUNTY, GEORGIA, JWSC PROJECT NO. 417**

3. Policy Number(s): _____

Date: _____
(Insurance Company)

Issued At: _____
(Authorized Representative)

Address: _____

Note: Please attach Certificate of Insurance form to this page.

PART F - CERTIFICATE OF DRUG FREE WORKPLACE

In order to have a drug- free workplace, a business shall:

Publish a statement notifying employees that the unlawful, manufacture, distribution, dispensing, possession, or use of controlled substances is prohibited in the workplace and specifying the actions that shall be taken against employees for violation of such prohibition.

Inform employees about the dangers of drug abuse in the workplace, the business's policy of maintaining a drug-free workplace, any available drug counseling, rehabilitation, and employee assistance programs, and the penalties that may be imposed upon employees for drug abuse violations.

As a condition of working on the commodities or contractual services then under bid, the employee shall notify the employer of any conviction of, or plea of guilty or nolo contendere to, any violation of any controlled substance law of the United States or any State, for a violation occurring in the workplace no later than five (5) days after such conviction.

Impose a sanction on, or require satisfactory participation in a drug abuse assistance or rehabilitation program if such is available in the employee's community, by any employee who is so convicted.

Make a good faith effort to continue to maintain a drug-free workplace through implementation of this section.

As the person authorized to sign this statement, I certify that this firm complies fully with the above requirements.

Company Name:

Authorized Signature:

Title:

Date:

PART G - E-VERIFY CONTRACTOR AFFIDAVIT AND AGREEMENT

Georgia Security Immigration and Compliance (GSIC) Act

The Brunswick-Glynn County Joint Water and Sewer Commission and Contractor agree that compliance with the requirements of O.C.G.A. § 13-10-91 and Rule 300-10-1 -.02 of the Rules of the Georgia Department of Labor are conditions of this Agreement for the physical performance of services.

By executing this affidavit, the undersigned contractor verifies its compliance with O.C.G.A. § 13-10-91, ***stating affirmatively that the individual, firm, or corporation which is contracting with the Brunswick-Glynn County Joint Water and Sewer Commission has registered with and is participating in the federal work authorization program known as: "E-Verify", web address <https://e-verify.uscis.gov/enroll/>*** operated by the United States Citizenship and Immigration Services Bureau of 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], ***in accordance with the applicable provisions and deadlines established in O.C.G.A. § 13-10-91.*** The undersigned Contractor also verifies that he/she/it is using and will continue to use the federal work authorization program throughout the contract period.

The undersigned Contractor 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 Brunswick-Glynn County Joint Water and Sewer Commission, Contractor will secure from each subcontractor(s) similar verification of compliance with O.C.G.A. § 13-10-91 on the Subcontractor Affidavit provided in Rule 300-10-01-.08 or a substantially similar form. Contractor further agrees the Contractor will advise the Brunswick-Glynn County Joint Water and Sewer Commission of the hiring of a new subcontractor and will provide the Brunswick-Glynn County Joint Water and Sewer Commission with a Subcontractor Affidavit attesting to the Subcontractor's name, address, user identification number, and date of authorization to use the Federal Work Authorization Program within five (5) days of the hiring before the Subcontractor begins working on the Project. Contractor also agrees to maintain all records of such compliance for inspection by the Brunswick-Glynn County Joint Water and Sewer Commission at any time and to provide a copy of each such verification to the Brunswick-Glynn County Joint Water and Sewer Commission at the time the subcontractor(s) is retained to perform such services.

(Continued on Next Page)

E-Verify Employment Eligibility Verification User I.D. Number

Date of Authorization to Use Federal Work Authorization Program

Name of Contractor

Title of Authorized Officer or Agent of Contractor

Signature and Printed Name of Authorized Officer or Agent

Sworn to and subscribed before me this the _____ day of _____, 2019.

NOTARY PUBLIC:

Name:

My Commission Expires:

(NOTARY SEAL)

As of the effective date of O.C.G.A. § 13-10-91, the applicable federal work authorization program is the "EEV/Basic Pilot 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).

PART H - E-VERIFY SUBCONTRACTOR AFFIDAVIT AND AGREEMENT

Georgia Security Immigration and Compliance (GSIC) Act

The Brunswick-Glynn County Joint Water and Sewer Commission and Subcontractor agree that compliance with the requirements of O.C.G.A. § 13-10-91 and Rule 300-10-1 -.02 of the Rules of the Georgia Department of Labor are conditions of this Agreement for the physical performance of services.

By executing this affidavit, the undersigned subcontractor verifies its compliance with O.C.G.A. § 13-10-91, ***stating affirmatively that the individual, firm, or corporation which is contracting with _____ a Contractor contracting with the Brunswick-Glynn County Joint Water and Sewer Commission has registered with and is participating in the federal work authorization program known as: E-Verify”, web address <https://e-verify.uscis.gov/enroll/>*** operated by the United States Citizenship and Immigration Services Bureau of 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], ***in accordance with the applicable provisions and deadlines established in O.C.G.A. §13-10-91.*** The undersigned Subcontractor also verifies that he/she/it is using and will continue to use the federal work authorization program throughout the contract period.

The undersigned Subcontractor agrees that, should it employ or contract with any other subcontractor(s) in connection with the physical performance of services pursuant to the contract with the Brunswick-Glynn County Joint Water and Sewer Commission, Subcontractor will secure from such subcontractor(s) similar verification of compliance with O.C.G.A. § 13-10-91 on the Subcontractor Affidavit provided in Rule 300-10-01-.08 or a substantially similar form. Subcontractor further agrees the Subcontractor will advise the Brunswick-Glynn County Joint Water and Sewer Commission of the hiring of a new subcontractor and will provide the Brunswick-Glynn County Joint Water and Sewer Commission with a Subcontractor Affidavit attesting to the Subcontractor's name, address, user identification number, and date of authorization to use the Federal Work Authorization Program within five (5) days of the hiring before the Subcontractor begins working on the Project. Subcontractor also agrees to maintain all records of such compliance for inspection by the Brunswick-Glynn County Joint Water and Sewer Commission at any time and to provide a copy of each such verification to the Brunswick-Glynn County Joint Water and Sewer Commission at the time the subcontractor(s) is retained to perform such services.

(Continued on Next Page)

E-Verify Employment Eligibility Verification User I.D. Number

Date of Authorization to Use Federal Work Authorization Program

Name of Subcontractor

Title of Authorized Officer or Agent of Subcontractor

Signature and Printed Name of Authorized Officer or Agent

Sworn to and subscribed before me this the _____ day of _____, 2019.

NOTARY PUBLIC:

Name: _____

My Commission Expires: _____

(NOTARY SEAL)

As of the effective date of O.C.G.A. § 13-10-91, the applicable federal work authorization program is the "EEV/Basic Pilot 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).

GENERAL CONDITIONS

INDEX:

0.0 Definitions	1.0 Contract Administration
2.0 Contract Project Representative	3.0 Notice of Award of Contract
4.0 Execution of Contract Documents	5.0 Notice to Proceed
6.0 Protest of Award	7.0 Insurance
8.0 Quantities	9.0 Suspension or Termination of Services
10.0 Indemnification	11.0 Assignments
12.0 Laws and Regulations	13.0 Notice and Service Thereof
14.0 Schedule, Reports and Records	15.0 Changes in the Contract
16.0 Payments and Completion	17.0 Contractor's Claim
18.0 Contract Agreement Jurisdiction	19.0 Ownership of Data

0.0 DEFINITIONS

Where used in the Invitation of Bids documentation, the following words and terms shall have the meanings indicated. The meanings shall be applicable to the singular, plural, masculine and feminine of the words and terms.

Acceptance. Formal action of the Owner in determining that the Contractor's work has been completed in accordance with the contract and in notifying the Contractor in writing of the acceptability of the work.

Act of God. A cataclysmic phenomenon of nature, such as a hurricane, earthquake or abnormal flooding. Rain, wind, high water, or other natural phenomenon which might reasonably have been anticipated from historical records of the general locality of the work shall not be construed as acts of God.

Addenda. Supplemental written specifications or drawings issued prior to execution of the contract which modify or interpret the project manual by addition, deletion, clarification, or corrections.

Bid. Offer of a bidder submitted on the prescribed form setting forth the price or prices of the work to be performed.

Bidder. Individual, partnership, corporation, or a combination thereof, includes joint ventures, offering a bid to perform the work.

Contract. The writings and drawings embodying the legally binding obligations between the Owner and the Contractor for completion of the work; Contract Documents attached to the Contract and made a part thereof as provided herein.

Contract Documents. The Contract, Addenda (which pertain to the Contract Documents),

Contractor's Bid (including documentation accompanying the Bid and any post Bid documentation submitted prior to the Notice of Award), the Notice to Proceed, the Bonds, these General Conditions, the Special Conditions, the Specifications and Drawings, together with all Written Amendments, Change Orders, Work Change directives, and Field Orders.

Contract Price. Amount payable to the Contractor under the terms and conditions of the contract. Based on the price given on the bid schedule, with adjustments made in accordance with the contract. The base amount given in the bid schedule shall be a lump sum bid.

Contract Time. Number of consecutive calendar days stated in the contract for the completion of the work or portions thereof.

Contractor. The individual, partnership, corporation, or combination thereof, includes joint ventures that enter into the contract with the Owner for the performance of the work. The term covers subcontractors, equipment and material suppliers, and their employees.

Day. Calendar day.

Defective. An adjective which when modifying the word "work" refers to work, including but not limited to the furnishing of materials, that is unsatisfactory, faulty, deficient, or performed in an unworkmanlike manner, in that it does not conform to or meet the requirements of the Contract, any inspection, reference standard, test or approval referred to in the Contract, or has been damaged prior to a recommendation of final payment.

Direct. Action of the Owner by which the Contractor is ordered to perform or refrain from performing work under the contract.

Directive. Written documentation of the actions of the Engineer or the Owner in directing the Contractor.

Engineer. Whenever the word "Engineer" is used in the contract, it shall be understood as referring to the Engineer of the Owner, or such other Engineer, supervisor or inspector as may be authorized by the Owner to act in any particular area of the Contract.

Equipment. Mechanical, electrical, instrumentation or other device with one or more moving parts, or devices requiring an electrical, pneumatic, electronic, or hydraulic connection.

Furnish. To deliver to the job site or a specified location any item, equipment or material.

Holidays. Legal holidays designated by the Owner.

Install. Placing, erecting, or constructing in place any item, equipment, or material.

May. Refers to permissive actions.

Owner. Brunswick-Glynn County Joint Water and Sewer Commission (JWSC).

Owner's Representative. The person, firm or corporation designated by the Owner.

Paragraph. For reference or citation purposes, paragraph shall refer to the paragraph, or paragraphs, called out by section number and alphanumeric designator where applicable.

Person. The term, person, includes firms, companies, corporations, partnerships, and joint ventures.

Project. The undertaking to be performed under the provisions of the contract.

Punch List. List of incomplete items of work and of items of work which are not in conformance with the contract. The list will be prepared by the Contract Project Representative when the Contractor (1) notifies the Contract Project Representative in writing that the work has been completed in accordance with the contract and (2) requests in writing that the Owner accept the work.

Shall. Refers to actions by either the Contractor or the Owner and means the Contractor or Owner has entered into a covenant with the other party to do or perform the action.

Specifications. That part of the contract documents consisting of written descriptions of the technical features of materials, equipment, construction system, standards, and workmanship.

Work. The labor, materials, equipment, supplies, services, and other items necessary for the execution, completion and fulfillment of the contract.

1.0 CONTRACT ADMINISTRATION

The Contract Administrator for this IFB shall be Mr. Andrew Burroughs, Deputy Executive Director (912) 261-7112. The Contract Administrator shall act as the JWSC's Representative during the execution of any subsequent contract and related amendments. He will evaluate any contract disputes in a fair and unbiased manner. The decisions of the Contract Administrator shall be final and conclusive and binding upon all parties to the contract. Any contractual questions arising during the bidding period or during the contract period(s) are to be addressed to the Contract Administrator at the following address:

Brunswick-Glynn County Joint Water and Sewer Commission
Attn: Mr. Andrew Burroughs, P.E. Deputy Executive Director
1703 Gloucester Street
Brunswick, Georgia 31520
Phone: (912) 261-7112
E-Mail: aburroughs@bgjwsc.org

2.0 CONTRACT PROJECT REPRESENTATIVE

The Contract Project Representative is the JWSC's day-to-day manager of the contracted services. He shall provide the successful Bidder direction and monitor the results within the limits of the contract's terms and conditions. He will decide questions that may arise as to quality and acceptability of services performed. He shall judge as to the accuracy of quantities submitted by the successful Bidder in payment requests and the acceptability of the services that these quantities represent. He will be the point-of-contact for developing contract changes and amendments to be approved by the JWSC. Any project questions arising, subsequent to contract award, are to be addressed to the Contract Project Representative at the following address:

Brunswick-Glynn County Joint Water and Sewer Commission
Attn: Mr. Todd Kline., P.E., Director of Engineering
1703 Gloucester Street
Brunswick, Georgia 31520
Phone: (912) 261-7122
Email: tkline@bgjwsc.org

3.0 NOTICE OF AWARD OF CONTRACT

As soon as possible, and within thirty (30) days after receipt of bids, the JWSC shall notify the successful Bidder of its intent to enter into a contract agreement. Should the JWSC require additional time to award a contract, the time may be extended by mutual agreement between the parties. If an Award of Contract has not been made within thirty (30) days from the bid opening date or within the extension mutually agreed upon, the Bidder may withdraw the bid without further liability on the part of either party.

4.0 EXECUTION OF CONTRACT DOCUMENTS

- 4.1** Within fifteen (15) days subsequent to successful contract negotiations, the JWSC shall furnish the successful Bidder the conformed copies of Contract Documents for execution by him.
- 4.2** Within fifteen (15) days after receipt of the Contract Documents, the successful Bidder shall return all the documents properly executed by him. Attached to each document shall be the certificate of insurance, proper licenses required by Federal, State, or Local authorities, and performance and payment bonds as required herein
- 4.3** Within thirty (30) days after receipt of the Contract Documents, executed by the successful Bidder, certificates of insurances and licenses, the JWSC shall complete the execution of the documents. Distribution of the completed documents will be made upon completion.
- 4.4** Should either party require an extension of any of the time limits stated above, this shall be done only by mutual agreement between both parties.

5.0 NOTICE TO PROCEED

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

6.0 PROTEST OF AWARD

All protests of the award or rejection of a purchase must be filed in writing with the JWSC within ten (10) days after the award of bid or proposal. The protest must describe in detail all alleged deficiencies. Any violations of law not specifically set forth in the protest are deemed waived. The validity of the protest shall be determined by the JWSC Executive Director and the review shall be limited to any alleged violation of federal, state or local law.

7.0 INSURANCE

The successful Bidder shall not commence work under this contract until all insurance described below has been obtained and such insurance has been approved by the JWSC, nor shall the successful Bidder allow any subcontractor to commence work on his subcontract until all similar insurance required of the subcontractor has been so obtained and approved by the successful Bidder.

The successful Bidder shall maintain insurance with companies reasonably acceptable to the JWSC, authorized to do business in Georgia, and having a rating with A.M. Best & Co.

of A-VII or better, unless otherwise approved in writing by the JWSC. Such insurance as will protect the successful Bidder from claims set forth herein below which may arise out of or result from the operations of the successful Bidder under the contract, whether such operations be by the successful Bidder, by anyone directly or indirectly employed by the successful Bidder, or by anyone for whose acts the successful Bidder may be liable including, but not limited to, the following:

- 7.1** Claims under workers' compensation, disability benefit, and other similar employee benefit acts;
- 7.2** Claims for damages because of bodily injury, occupational sickness, disease, or death of any employee of the successful Bidder;
- 7.3** Claims for damages because of bodily injury, sickness, disease, or death of any person other than an employee of the successful Bidder;
- 7.4** Claims for damages insured by usual personal injury liability coverage which are sustained by any other person;
- 7.5** Claims for damages because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- 7.6** Claims for damages because of professional errors and omissions; and
- 7.7** Claims for contractually assumed liability under the contract.

The aforesaid insurance required to be maintained by the successful Bidder may be written under an umbrella policy or policies, but shall not be written for less than the limits of liability specified herein below or less than any limits required by law, whichever is greater. The successful Bidder shall maintain during such time as the successful Bidder is performing hereunder the services, subject to a policy or policies having a deductible not greater than \$25,000 on account of any one occurrence, (i) workers' compensation insurance in an amount not less than the greater of that required by law or \$1,000,000 for injuries, including accidental death to any one person, (ii) commercial general liability insurance with a general aggregate of \$2,000,000 and not less than \$1,000,000 for each occurrence, (iii) automobile liability insurance in an amount not less than a combined single limit of \$1,000,000 for injuries, including accidental death, and (iv) property damage liability insurance in an amount not less than \$1,000,000 on account of any one occurrence with a \$2,000,000 aggregate.

Further, the successful Bidder shall maintain, during the period beginning with the commencement of the performance by the successful Bidder of the services and ending one year after the Project shall be substantially completed, subject to a policy or policies having a deductible not greater than \$25,000 on account of any one claim, professional errors and omissions insurance in an amount not less than \$1,000,000 per claim and annual aggregate with a \$25,000 deductible.

Certificates of insurance indicating that the successful Bidder has obtained such coverage and a copy of the policies evidencing such coverage, if requested by the JWSC, shall be filed with the JWSC prior to the commencement by the successful Bidder of the contracted services. Such certificates shall be in form and substance reasonably acceptable to the JWSC, shall indicate that, except in respect to workers' compensation insurance coverage and professional errors and omissions insurance, JWSC is an additional named insured with respect to such coverage, shall indicate that such coverage is primary and is not contributory with any similar insurance purchased by the JWSC, and shall contain a provision that such coverage shall not be canceled until at least thirty (30) days prior written notice has been given to the JWSC.

8.0 QUANTITIES

None of the various JWSC departments, divisions, employees or agencies, individually or collectively, shall be required to purchase any minimum or maximum amount during the life of any contract, or extension thereof, as a result of this IFB

9.0 SUSPENSION OR TERMINATION OF SERVICES

The anticipated contract between the successful Bidder and the JWSC may be terminated based on any one of the following:

- 9.1** Failure of the Bidder to perform based on the Bidders bankruptcy, lack or loss of skilled personnel, or disregarding laws, ordinances, rules, regulations or orders of any public body having jurisdiction. Should any single, multiple or all of the above conditions occur the JWSC shall have the authority to terminate the contract with written notice to the successful Bidder. The successful Bidder shall be liable for any losses occurring as a result of not abiding by the terms of the contract.
- 9.2** The JWSC may terminate the contract at will. All correspondence of this nature will be forwarded by certified or registered mail with return receipt requested.
- 9.3** Any termination of the successful Bidder services shall not affect any right of the JWSC against the successful Bidder then existing or which may thereafter occur. Any retention of payment of monies by the JWSC due the successful Bidder will not release the successful Bidder from compliance with the Contract Documents.

10.0 INDEMNIFICATION

The successful Bidder will indemnify and hold harmless the JWSC, its officers, employees, and agents, each and any one of them, from and against all claims, damages, losses and expenses including attorneys' fees arising out of or resulting from the performance of the services, provided that any such claims, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property, including the loss of use resulting therefrom; and is caused in whole or in part by any

negligent or willful act or omission of the successful Bidder and anyone directly or indirectly employed by him or anyone for whose acts any of them may be liable. In any and all claims against the JWSC or any of their agents or employees, by any employee of the successful Bidder, directly or indirectly employed by him, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the successful Bidder or under federal and state workers' compensation and disability benefits statutes, and applicable laws relating thereto. No party shall indemnify any other party for their own sole negligence.

11.0 ASSIGNMENTS

The successful Bidder shall not assign the whole or any part of this Contract or any monies due or to become due hereunder without written consent of the JWSC. In case the successful Bidder assigns all or any part of any monies 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 assignee in and to any monies due or to become due to the successful Bidder shall be subject to prior liens of all persons, firms, and corporations for services rendered or materials supplied for the performance of the services set forth in this contract.

12.0 LAWS AND REGULATIONS

The successful Bidder's attention is directed to the fact that all applicable Federal, State and Local laws and ordinances, including rules and regulations of all authorities having jurisdiction over the services, shall apply to the contract throughout. The successful Bidder shall keep himself fully informed of all laws, ordinances and regulations of the Federal, State, County and municipal governments or authorities in any manner affecting those engaged or employed in providing these services or in any way affecting the conduct of the services and of all orders and decrees of bodies or tribunals having any jurisdiction or authority over same. If any discrepancy or inconsistency should be discovered in these Contract Documents or in the specifications herein referred to, in relation to any such law, ordinance, regulation, order or decree, he shall herewith report the same in writing to the JWSC.

The successful Bidder shall at all times observe and comply with all such existing laws, ordinances and regulations, and shall protect and indemnify the JWSC and its agents against the violation of any such law, ordinance, regulation, order or decree, whether by himself or by his employees. Licenses of a temporary nature, necessary for the prosecution of the services, shall be secured and paid for by the successful Bidder.

13.0 NOTICE AND SERVICE THEREOF

13.1 All notices, demands, requests, instructions, approvals, and claims shall be in writing.

13.2 Any notice to or demand upon the Contractor shall be sufficiently given if delivered at the office of the Contractor specified in his bid (or at such other

office as the Contractor may from time to time designate to the JWSC in writing), or if deposited in the United States Mail in a sealed, postage-prepaid envelope, or delivered, with charges prepaid, to any telegraph company for transmission, in each case addressed to such office.

- 13.3** All papers required to be delivered to the JWSC shall, unless otherwise specified in writing to the Contractor, be delivered to the Contract Administrator. Any notice to or demand upon the JWSC will be sufficiently given if delivered to the Office of said Contract Administrator or if deposited in the United States Mail in a sealed, postage-prepaid envelope, or delivered with charges prepaid to any telegraph company for transmission, in each case addressed to said Contract Administrator or to such other representative of the JWSC or to such other address as the JWSC may subsequently specify in writing to the Contractor.

14.0 SCHEDULE, REPORTS, AND RECORDS

The Contractor shall submit to the JWSC schedules, reports, estimates, records and other data as the JWSC may request concerning services performed or to be performed.

15.0 CHANGES IN THE CONTRACT

15.1 Changes in the Service

The JWSC may at any time, as the need arises, order changes within the scope of the services without invalidating the Contract Agreement. If such changes increase or decrease the amount due under the Contract Documents, or in the time required for performance of the services, an equitable adjustment shall be negotiated culminated by the issuance of a Contract Amendment and signed and sealed by the parties. The Contractor shall proceed with the performance of any changes in the services so ordered by the Contract Administrator unless the Contractor believes that such order entitles him to a change in the fee or time or both, in which event he shall give the Contract Administrator written notice thereof within fifteen (15) days after the receipt of the Contract Amendment, and the Contractor shall not execute such amendments pending the receipt of an executed Notice to Proceed instruction from the JWSC.

The JWSC may, when changes are minor or when changes would result in relatively small changes in the Fee or Contract Time, elect to postpone the issuance of a Contract Amendment until such time that a single amendment of substantial importance can be issued incorporating several changes. In such cases, the JWSC shall indicate this intent in a written notice to the Contractor.

15.2 Changes in Contract Price

The contract price shall be changed only by a mutual agreement by the Contractor and the JWSC transmitted as a Contract Amendment. The Contractor shall, when required by the JWSC, furnish to the JWSC the method and justification used in computing the change in price as related to the services ordered.

15.3 Changes in Contract Period

The Contract Period shall be changed only by a Contract Amendment. Changes in the services described in above and any other claim made by the Contractor for a change in the Contract Period shall be evaluated by the JWSC and if the conditions warrant, an appropriate adjustment of the Contract Periods will be made.

16.0 PAYMENTS AND COMPLETION

16.1 Application for Payment

The Contractor shall submit an application for payment (invoice) for services rendered during the preceding calendar month. This application shall be sent to the Contract Project Representative listed in Paragraph 2.0.

16.2 Certificate for Payments

If the Contractor has made application for payment, as above, then the Contract Project Representative will issue a Certificate for Payment to the Finance Division for such amount as is determined to be properly due, or state in writing the item ized and specific reasons for withholding a Certificate. After the Certificate for Payment has been issued, the Finance Division shall pay to the Contractor within thirty (30) days the amount covering services completed. No Certificate for Payment, nor any payment, shall constitute an acceptance of any services not in accordance with the Contract Documents.

16.3 Failure of Payment

If the Contract Project Representative fails to approve an application for payment, through no fault of the Contractor, within seven (7) working days after receipt from the Contractor, or if the Finance Division fails to pay the Contractor within thirty (30) days after receipt of a Certificate for Payment, then the Contractor shall receive interest on the balance due with the interest being one percent (1%) per month not to exceed three (3) months (3%). The JWSC reserves the right to reject the Contract Project Representative's certification of any request for payment by the Contractor without the accrual of interest.

16.4 Governing Document

All parties expressly agree that the provisions of the Georgia Prompt Pay Act, Title 13, Chapter 11, of the Official Code of Georgia Annotated, are superseded by the terms and conditions of this agreement.

16.5 Final Payment

Upon receipt of written notice from the Contractor that all contracted services are complete, the Contract Administrator will, within a reasonable time, review all services and reports. If the Contract Administrator finds the services and reports of the Contractor complete and acceptable in accordance with the provisions of the Contract Documents, he shall, within a reasonable time, direct the Finance Division that final payment be made. The acceptance of final payment shall constitute a waiver of all claims by the Contractor except those previously made in writing and still unsettled.

17.0 CONTRACTOR'S CLAIM

No claim for additional or other compensation beyond the contract price shall be allowable unless the Contractor makes **written demand therefore within thirty (30)** days of the occurrence of any event which gives rise to such claim.

18.0 CONTRACT AGREEMENT JURISDICTION

Contractor irrevocably consents that any legal action or proceeding against it under, arising out of, or in any manner relating to, this Agreement shall be brought in any court in Glynn County, Georgia. Contractor designates the Secretary of the State of Georgia as its agent for service of process, provided no such agent located in Georgia is on file with the said Secretary. Contractor, by the execution and delivery of this Agreement, expressly and irrevocably assents to and submits to the personal jurisdiction of any court in Glynn County, Georgia, and in any said action or proceeding. Contractor hereby expressly and irrevocably waives any claim or defense in any said action or proceeding based on any alleged lack of jurisdiction, improper venue or ***forum non conveniens*** or any similar basis.

19.0 OWNERSHIP OF DATA

All data and other records supplied to the Contractor for this project shall remain the sole property of the JWSC. The Contractor shall not, without written consent, copy or use such records, except to carry out contracted work, and will not transfer such records to any other party not involved in the performance of the Contract pursuant to this IFB, and will return submitted records to the JWSC upon completion of the work hereunder. The JWSC shall have the right, without the consent of the Contractor, to extract such data in industry standard formats, using standard Contractor utilities and at no cost to the JWSC. The JWSC acknowledges that the storage, compilation, format, and layout constitute proprietary and secret trade information of the Contractor, and are protected by Federal copyright law.

SPECIAL CONDITIONS

1.0 EXISTING FACILITY OPERATIONS

The Contractor shall coordinate the work with the Owner so that the construction activities required do not interfere with or prevent the operation of the existing facilities. If at any time, any portion of the facility is out of service, the Contractor must obtain approval from the Owner as to the date, time and length of time that portion of the facility is out of service. Extended outages will require that the Contractor provide, at his expense, any necessary by-pass pumping or other arrangements as required.

Connections to the existing facilities or alteration of existing facilities will be made at times when the facility involved is not in use or at times established by the Owner when the use of the facility can be conveniently interrupted for the period of time needed to make the connection or alteration. Notify the Owner at least ten days prior to relocating any plant piping or taking any existing plant component out of service.

2.0 PROJECT SCHEDULE

The following activities shall be completed by the indicated date or days after Notice to Proceed.

Task or Milestone	Completion (Days after NTP)
Shop Drawing Submittals	
Completion and submission of all Shop Drawings by Contractor	14
Review of Shop Drawings By JWSC/Engineer	28
Re-submittal of Shop Drawings By Contractor (if Required)	35
Review of Shop Drawings By JWSC/Engineer (if Required)	42
Miscellaneous Submittals	
Project Schedule*	14
Schedule of Values*	14
Superintendent Qualifications and Contact Information	14
Substantial Completion of All Work	240
Final Completion of All work	300
* The construction progress schedule shall show the proposed dates of commencement and completion of the various milestones of the work required under the contract as well as the anticipated amounts of each monthly payment that will become due to the Contractor in accordance with the progress schedule. The construction schedule will be a true reflection of the actual construction progress, shall be reviewed and updated monthly and submitted with the monthly periodic payment request. The monthly payment request shall not be considered complete without the accurately updated construction progress schedule.	

3.0 SUBSTITUTIONS

This Section outlines the restrictions and requirements for substitutions, product and manufacturer options, and construction method options.

For the purposes of these Contract Documents, a "substitute item" shall be defined as one of the following:

A product or manufacturer offered as a replacement to a specified product or manufacturer.

A product or manufacturer offered in addition to a specified product or manufacturer.

A "substitute construction method" shall be defined as one of the following:

A mean, method, technique, sequence or procedure of construction offered as a replacement for a specified mean, method, technique, sequence or procedure of construction.

A mean, method, technique, sequence or procedure of construction offered in addition to a specified mean, method, technique, sequence or procedure of construction.

An item or construction method, which is offered where no specific product, manufacturer, mean, method, technique, sequence or procedure of construction is specified or shown on the drawings, shall not be considered a substitute and shall be at the option of the Contractor, subject to compliance with all provisions in the Contract Documents for that item or construction method.

For products specified only by a referenced standard, the Contractor may select any product by any manufacturer, which meets the requirements of the Specifications, unless otherwise indicated in the Contract Documents.

If the manufacturer is named on the drawings or in the Specifications as an acceptable manufacturer, products of that manufacturer meeting all requirements of the drawings and specifications are acceptable.

Whenever the Engineer's design is based upon a specific product or process of a specific manufacturer, that manufacturer shall be so listed in the specifications and such product or process shall be used in the base bid.

Any **Contractor** proposing to furnish products or processes other than those listed as base bid items shall make a written application for approval of the proposed substitution to the JWSC/Engineer at least 15 days prior to the date set for receipt of bids. The minimum information required in the application is listed below.

- A. Documentation demonstrating that the item being proposed as a substitute will fit in the space allowed, perform the same functions and have the same capabilities as the product or process specified.
- B. **A letter signed by an officer of the company certifying compliance with the specifications without exception.**
- C. Installation list with contacts and phone numbers for the same minimum number of installations and years of experience as the specified product or process.
- D. Complete descriptive and technical data addressing all specification requirements.
- E. Complete list of deviations from the specifications as written.
- F. Identification of accessory items required as a result of the proposed substitution.
- G. Identification of all architectural, structural, mechanical, piping, electrical or other modifications required as a result of the proposed substitution.

Whenever a product specification includes minimum experience requirements which the proposed substitution cannot meet, a condition of approval will require that the manufacturer furnish the Owner with a cash deposit or bond acceptable to the Owner in an amount equal to the cost of the product or process which shall remain in effect until the experience requirement has been met.

The burden of proving equivalency of a proposed substitute to an item designated by trade name or manufacturer's name referenced on the drawings or in the specifications rests on the party submitting the request for approval. The JWSC/Engineer will give consideration to reports from reputable independent testing laboratories, verified experience records showing the reputation of the proposed product with previous users or any other written information that is reasonable under the circumstances. The degree of proof required for approval of a proposed substitute as equivalent to a named product is the amount of proof necessary to convince the JWSC/Engineer beyond all doubt. To be acceptable, a proposed substitute must meet or exceed all requirements of the plans or specifications.

If the proposed substitution is approved, an addendum will be issued to all prospective bidders at least five days prior to the date set for the opening of bids listing any and all approved substitutions. If approved the bidder may offer a price for the substitution in the bid form for the Owner's consideration. The bid offered shall include the cost of all additional architectural, structural, mechanical, piping, electrical or other modifications, including engineering and design costs, required as a result of the proposed substitution. The JWSC/Engineer shall be the final judge on questions of equivalence.

4.0 SUBMITTALS

The work under this Section includes submittal to the JWSC/Engineer of shop drawings, product data and samples required by the various sections of these specifications. The submittal contents required are specified under each Section.

4.1 Definitions

Shop Drawings: Shop drawings include technical data, drawings, diagrams, procedures and methodology, performance curves, schedules, templates, patterns, test reports, calculations, instructions, measurements and similar information as applicable to the specific item for which the shop drawing is prepared.

Product Data: Product data includes standard printed information on materials, products and systems, not specifically prepared for this project other than the designation of selections from among available choices printed therein.

Samples: Samples include both fabricated and un-fabricated physical examples of materials, products and units of work, both as complete units and smaller portions of units of work, either for limited visual inspection or more detailed testing and analysis.

4.2 Routing of Submittals

Submittals and routine correspondence shall be routed as follows:

Supplier to Contractor
Contractor to JWSC
JWSC to Engineer
Engineer to JWSC
JWSC to Contractor
Contractor to Supplier

4.3 Submittal Log

The submittal log shall be created by the JWSC/Engineer and issued to the Contractor as the complete listing of submittals required for the project.

4.4 Contractor's Responsibilities

The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall ensure that the material or equipment shall be as described in the submittal. The Contractor shall verify in writing that all features of all products conform to the requirements of the drawings and specifications. Submittal documents shall be clearly edited

to indicate only those items which are being submitted for review. All extraneous material shall be crossed out or otherwise obliterated. The Contractor shall ensure that there is no conflict with other submittals and shall notify the JWSC/Engineer in each case where his submittal may affect the work of another contractor or the Owner. The Contractor shall ensure coordination of submittals among the related crafts and subcontractors.

Before each submittal, the Contractor shall have determined and verified all field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar information with respect thereto; all materials with respect to intended use, fabrication, shipping, handling, storage, assembly and installation pertaining to the performance of the work; and all information relative to the Contractor's sole responsibilities in respect of means, methods, techniques, sequences and procedures of construction and safety precautions and programs incident thereto.

Submittal documents common to more than one piece of equipment shall be identified with the appropriate equipment numbers and specification section and paragraph. Each submittal shall bear a stamp or written indication that the Contractor's obligations under the contract with respect to the Contractor's review and approval of that submittal have been met. Any deviations from the requirements of the drawings and specifications shall be noted on the submittals. The Contractor shall submit six copies of all specified information or submittals may be made electronically. **Submittals which do not have all the information required to be submitted including deviations, are not acceptable and will be returned without review.**

4.5 Review Procedures

The Engineer's review will not extend to means, methods, techniques, sequences or procedures of construction, or to verifying quantities, dimensions, weights, or fabrication processes, or to safety precautions or programs incident thereto. Unless otherwise specified, within fourteen days after receipt of a submittal, The Engineer will review the submittal and return three copies to the Contractor with comments. The returned submittals will indicate one of the following actions:

If the review indicates conformance with the drawings and specifications, submittal copies will be marked **"NO EXCEPTIONS TAKEN"**. In this event, the Contractor may begin to implement the work or incorporate the material or equipment covered by this submittal.

If the review indicates limited corrections are required, submittal copies will be marked **"MAKE CORRECTIONS NOTED"**. The Contractor may begin implementing the work or incorporate the materials or equipment covered by the submittal in accordance with the noted corrections. Where submittal information will be incorporated into Operation and Maintenance data, a corrected copy shall be provided.

If the review indicates that the submittal is insufficient or contains incorrect data, submittal copies will be marked **“AMEND AND RESUBMIT”**. Except at his own risk, the Contractor shall not undertake work covered by this submittal until it has been revised, resubmitted, and returned marked either **“NO EXCEPTION TAKEN”** or **“MAKE CORRECTIONS NOTED”**.

If the review indicates that the submittal does not comply with the drawings and specifications, submittal copies will be marked **“REJECTED - SEE REMARKS”**. Submittals with deviations that have not been clearly identified will be rejected. Except at his own risk, the Contractor shall not undertake work covered by this submittal until it has been revised, resubmitted, and returned marked either **“NO EXCEPTIONS TAKEN”** or **“MAKE CORRECTIONS NOTED”**.

Review of drawings, submittals, or information regarding materials or equipment the Contractor proposes to provide, shall not relieve the Contractor of his responsibility for errors and omissions therein and shall not be regarded as an assumption of risks or liability by the Owner or Engineer or by any officer or employee thereof, and the Contractor shall have no claim under the contract on account of the failure or partial failure, or the method of work, material, or equipment so reviewed. A mark of **“NO EXCEPTION TAKEN”** or **“MAKE CORRECTIONS NOTED”** shall mean that the JWSC/Engineer has no objection to the Contractor, upon his own responsibility, using or providing the materials or equipment proposed.

5.0 INTERPRETATION OF PLANS AND SPECIFICATIONS

All questions regarding the meaning or intent of the plans, specifications and contract documents shall be directed in writing to the JWSC's Contract Project Representative identified in Paragraph 2.0 of the General Conditions. Reference may be made throughout the Contract Documents to the Standards for Water and Sewer Design and Construction of the Brunswick - Glynn County Joint Water and Sewer Commission. In the event of a conflict between the aforementioned Standards and the project plans and specifications prepared by Elmo A. Richardson, Jr., P.E., LLC, the Elmo A. Richardson, Jr., P.E., LLC plans and specifications shall take precedence.

6.0 FIELD ENGINEERING

Field engineering shall include all surveying work required to layout the proposed facilities and control the location of the finished project. The Contractor shall be solely responsible for constructing the project to the correct horizontal and vertical alignment as shown on the drawings and as specified herein. The Contractor shall assume all costs associated with rectifying any work constructed in the wrong location.

The drawings provide the location and/or coordinates of principal components of the project.

6.1 Owner's Responsibilities

The Owner will provide the following:

One (1) vertical control point on the project site with its elevation

A topographic survey (included on the drawings)

The Owner may, acting through the Engineer, order changes to the location of some of the components of the project or provide clarification to questions regarding the correct alignment.

6.2 Contractor's Responsibilities

The Contractor's responsibilities include but are not limited to the following:

Be responsible for setting reference points and/or offsets, establishment of baselines, and all other layout, staking and other surveying required for the construction of the project.

Safeguard all reference points, stakes, grade marks, horizontal and vertical control points, and bear the cost of re-establishing same if disturbed.

Stake out temporary and permanent easements or the limits of construction to ensure that the work is not deviating from the indicated limits.

Record drawing surveys shall be performed in accordance with Paragraph 7.0 of these Special Conditions.

Baselines shall be defined as the line to which the location of the work is referenced, i.e. edge of pavement, road centerline, property line, right of way or survey line.

7.0 RECORD DOCUMENTS

The work under this Section includes but is not limited to the compiling, maintaining, recording and submitting of project record documents as herein specified.

Record documents include but are not limited to the following:

- Drawings
- Specifications
- Change orders and other modifications to the Contract
- Spreadsheet listing of assets and values included in project as single line items costing \$500.00 or more.

- Engineer field orders or written instructions, including requests for information (RFI) and clarification memos
- Reviewed shop drawings, product data and samples
- Test records

The Contractor shall maintain on site an up to date set of Record Drawings

7.1 Record Drawings

Record drawings maintained by the Contractor shall provide dimensions, distances and coordinates to the nearest 0.1 foot. Elevations shall be provided to the nearest 0.01 foot.

Final record drawings shall be prepared by a professional surveyor licensed in the State of Georgia from a post construction field run survey. The Contractor shall pay all surveying and preparation costs associated with the final record drawings. The final record drawings shall provide elevations to the nearest 0.01 foot for all manhole inverts, manholes frames and all other pertinent items constructed by the Contractor. The final record drawings shall provide dimensions, distances and coordinates to the nearest 0.01 foot and angles to the nearest 10 seconds.

Final Record Drawing shall be labeled "FINAL RECORD DRAWINGS" and shall include the name of the surveyor who prepared the drawings as well as the date the drawings were prepared.

Record drawings shall include the following:

Horizontal and vertical location of all exposed and underground piping systems

Location and dimensions of roadways and parking areas

Location of structures including finish floor elevations, tank depths, top and bottom elevations

Horizontal angle and distance between manholes

7.2 Specifications

Legibly mark each section to record the manufacturer, trade name, catalog number and supplier of each product and item of equipment actually furnished. Also record all changes made by Requests for Information (RFI), field order, clarification memorandums of Contract change order.

7.3 Submittal

At the completion of the project, deliver Record Documents to the JWSC/Engineer. Include a signed transmittal letter which lists the title and number of each record document.

SCADA SCOPE

Scope of Supply

Electric Machine Control (EMC) will provide labor, programming, hardware, and start-up required to integrate the Golden Isles 1 WPF, Golden Isles 2 WPF, Ridgeland WPF, and Cate Road Tank into the existing SCADA system and provide for station control.

Water Production Station Controller RTU Upgrade: EMC will replace the DFS RTU with a Schweitzer RTAC Axion Based PLC RTU, 15" HMI C-More touchscreen, and cellular Modem.

Tank Monitoring RTU Upgrade: EMC will replace the DFS RTU with a Schweitzer 2411 Based PLC RTU and cellular Modem.

Note: No instrumentation is provided within the scope of this pricing. Pricing assumes electrical contractor will install panel and pull control wires. EMC will terminate control wires within the RTU and Start-Up.

Electric Machine Controls' Preliminary Scope of Work

- Collect I/O Requirements and Hardware Capability
- Provide Submittal Documentation
- Hardware and Software Design
- Hardware Fabrication and Software Programming
- Hardware and Software Factory Acceptance Test
- Hardware and Software Installation.
- Operator Training
- Final Drawings and Documentation
- Start-Up and Test

General Description of Technology to be used

EMC will use the following technology:

- RTAC SEL-2240 PLC with appropriate Axion I/O.
- SEL 2411 Relay PLC
- Automation Direct C-More 15 Inch Touchscreen.
- SEL-3061 Cellular Router with associated antenna assembly.

Sample BOM for WPF's and Tank RTU's

Description	Qty.
ENCLOSURE	
304SS, Single Door Enclosure, 3-point latching mechanism (lockable), UL Listed Type 3R, 4 and 12	1
Full Sub Pan, Powder Coated White	1
Sunshield (Tank RTU Only)	1
LED Light Fixture with 120 VAC Receptacle	1
ENCLOSURE CLIMATE CONTROL	
120VAC Internal Circulating Fan	1
Fan Bracket	1
Thermostat for Internal Fan	1
100W Heater, Plug in Thermostat, 59F/41F switch Off/On	1
120 VAC CONTROL POWER CIRCUIT	
120VAC Surge Arrestor	1
Rail-mountable socket	1
UPS, 750VA, 120 VAC	1
1489-A Series, Circuit Breakers	AR
Dual Receptacle	1
24 VDC CONTROL POWER CURCUIT	
Circuit Breaker	AR
Power Supply, 24VDC, 5A	1
PLC CONTROL LOGIC	
SEL-2241 RTAC with Axion IO (WPF's)	1
SEL-2411 Relay with I/O (Tank)	1
Conformal Coating	1
COMMUNICATIONS	
SEL-3061 Cellular Router	1

Description	Qty.
Mounting Bracket	1
Cellular Antenna	1
Antenna Ground Plane	1
Lightning Protection with Cable	1
RJ45 Surge Arrestor	1
Ethernet Patch Cable, 30'	1
HMI	
C-more EA9 series touch screen HMI, 15in color TFT LCD, 1024 x 768 pixel, XGA, LED backlight, supports (1) serial, (1) Ethernet and (2) USB ports and (2) memory card slots. (WPF's Only)	1
COMMUNICATIONS	
Ethernet Switch, Unmanaged, 8 Copper Ports	1
OPERATORS INTERFACE DISCRETE	
Selector Switch	AR
Push To Test Pilot Lights	AR
Pushbutton	AR
TERMINAL BLOCKS	
Terminal Block	AR
Ground Terminal Block	AR
FIELD DEVICES	
Field Devices Provided By Others	0

AR - As Required

Physical completion of new complete runs of conduit from the existing MCC to a designated location where the New SCADA panels will be mounted, with wires corresponding to the existing equipment in the sites listed below. In addition to installation of said conduit and wiring safely, and the ability to keep the site live for as long as possible making down time as short as possible. Termination and Startup will be scheduled on same day with electrical and SCADA contractors to be a seamless change over as possible. Old work and material shall be removed and discard according to JWSC or department choices, and discretion. No more than one site will be down at a time if at all possible and coordinated with the Superintendent of the facilities. Allow for time to terminate and test, along with completion of the Ridgewood site to help allow the downtime at one of the other WTP. Conduit and all worked need to be as prepared prior to the shutdown of the site. All work can be completed and coordinated with the continuing work at the Ridgewood WTP location.

Sites to Upgrade:

Golden Isles 1 WTP- 1201 Shell Rd; 31.278298, -81.476734

Golden Isles 2 WTP- Golden Isles Pkwy; 31.277832, -81.506116

EST to upgrade:

Cate Road EST- Golden Isles Pkwy; 31.256535, -81.501730

New Work:

Ridgewood WTP- 1735 Perry Lane Rd; 31.247145, -81.517717

Technical Specifications

Index to Technical Specifications
Ridgewood Water Production Facility
Joint Water & Sewer Commission
Brunswick, GA

<u>Section No.</u>	<u>Title</u>
01010	Summary of Work
01016	Occupancy
01025	Measurement & Payment, Cash Allowances
01055	Construction Staking
01060	Regulatory Requirements
01091	Codes and Standards
01340	Shop Drawings, Product Data & Samples
01510	Temporary Facilities
01540	Job Site Security
01610	Transportation & Handling
01611	Storage & Protection
01710	Cleaning
01720	Record Documents
02010	Subsurface Conditions
02050	Demolition
02100	Site Preparation
02125	Erosion & Sedimentation Control
02140	Dewatering
02200	Earthwork
02221	Trenching, Backfill, Compaction, Embedment & Encasement
02224	Trench Excavation & Backfill
02226	Subgrade Construction and Preparation
02228	Waste Material Disposal
02523	Concrete Sidewalk and Driveway
02610	Piping
02611	Site Piping Manholes & Appurtenances
02665	Water Mains & Accessories
02666	Pipe Testing & Acceptance
02675	Disinfection of Potable Water Facilities
02830	Fencing
03050	Concrete Work
03200	Concrete Reinforcement
03300	Cast in Place Concrete
03602	Nonmetallic Grouting
05100	Structural Steel
05120	Structural Metals
05500	Metal Fabrications
05501	Anchor Bolts
07600	Flashing & Sheet Metal
07900	Joint Sealers
08225	Institutional Compartment Doors
08710	Door Hardware
09900	Painting
10425	Signs

10521	Fire Extinguishers
11311	Horizontal Split Case Pumps
13200	Prestressed Concrete Storage Tank
13201	Fabric Baffle Curtain
15000	General Mechanical Requirements
15094	Pipe Supports & Hangers
15170	Motors
15835	Terminal Heat Transfer Units
15865	Axial Fans
16100	Electrical
16310	Packaged Engine Generator System
16496	Enclosed Automatic Transfer Switch
Appendix A	Geotechnical Exploration

**SECTION 01010
SUMMARY OF WORK**

PART 1 GENERAL

1.01 DESCRIPTION

- A. The Work to be performed under this Contract shall consist of furnishing all labor, materials, tools, equipment and incidentals and performing all Work required to construct complete in place and ready to operate:
- Site Clearing, Grubbing, Finish Grading, Grassing & Improvements for full site complete
 - Erosion & Sedimentation Control BMPs
 - Modifications to Existing Well, Piping and Flowmeters
 - Construction of a Pre-stressed Concrete Ground Storage Tank with Aerator
 - Installation of Yard Piping and Connections
 - Construction of Pump Building complete with High Service Pumps, Electrical Systems, Chemical Feed Equipment, Multi-site SCADA and ancillary equipment.
 - Supply and installation of Emergency Generator, Transfer Switch and ancillaries
 - Demolition of Existing Structures and Equipment
- B. All Work described above shall be performed as shown on the Drawings and as specified. The Contractor shall be responsible for furnishing, unloading, storing and installing all materials as called for in the Plans and these Contract Documents.

1.02 PROJECT LOCATION

The equipment and materials to be furnished will be installed at the locations shown on the Drawings. All work is in Glynn County, Georgia. Ridgewood site is 1735 Perry Lane Road.

1.03 QUANTITIES

The Owner reserves the right to alter the quantities of work to be performed or to extend or shorten the improvements at any time when and as found necessary, and the Contractor shall perform the work as altered, increased or decreased. Payment for such increased or decreased quantity will be made in accordance with the Instructions to Bidders. No allowance will be made for any change in anticipated profits nor shall such changes be considered as waiving or invalidating any conditions or provisions of the Contract and Bond.

1.04 PARTIAL OWNER OCCUPANCY

The existing facilities to which these improvements are being made will continue operation during the period of construction to the maximum extent possible. Necessary service interruptions shall be coordinated with the Owner and minimized.

END OF SECTION

**SECTION 01016
OCCUPANCY**

PART 1 GENERAL

1.01 PARTIAL OCCUPANCY BY OWNER

Whenever, in the opinion of the Engineer, any section or portion of the Work or any structure is in suitable condition, it may be put into use upon the written order of the Engineer and such usage will not be held in any way as an acceptance of said Work or structure, or any part thereof, or as a waiver of any of the provisions of these Specifications and the Contract. Pending final completion and acceptance of the Work, all necessary repairs and replacements, due to defective materials or workmanship or operations of the Contractor, for any section of the Work so put into use shall be performed by the Contractor at Contractor's own expense.

END OF SECTION

**SECTION 01025
MEASUREMENT AND PAYMENT
CASH ALLOWANCES**

PART 1 GENERAL

1.01 SCOPE

- A. This project is bid for a **Lump Sum Price.** Payment for individual items will not be made unless specifically called for by these specifications.
- B. Required items of work and incidentals necessary for the satisfactory completion of the work which are not specifically listed in the Bid shall be considered as incidental to the work. All costs thereof, including Contractor's overhead costs and profit, shall be considered as included in the lump sum price bid for the Work. The Contractor shall prepare the Bid accordingly.
- C. Work includes furnishing all plant, labor, equipment, tools and materials and performing all operations required to complete the work satisfactorily, in place, as specified and as indicated on the Drawings.

1.02 DESCRIPTIONS

- A. Measurement of individual items of work will not be made. This is a lump sum project.
- B. Unless otherwise stated in individual sections of the Specifications or in the Bid, no separate payment will be made for any item of work, materials, parts, equipment, supplies or related items required to perform and complete the work. The costs for all such items required shall be included in the lump sum price bid for the Work.
- C. The Contractor shall furnish a Schedule of Values for the Work. The Schedule of Values will be submitted after Notice of Award and prior to execution of the Notice to Proceed. The Schedule of Values must be submitted to and approved by the Engineer and the Owner. Payment will be made by using the Schedule of Values provided to reflect actual work. Such price and payment shall constitute full compensation to the Contractor for furnishing all plant, labor, equipment, tools and materials and for performing all operations required to provide to the Owner the entire Project, complete in place, as specified and as indicated on the Drawings.
- D. "Products" shall mean materials or equipment permanently incorporated into the work.

1.03 OWNER'S CONTINGENCY

- A. The Contractor shall include the Owner's Contingency in the Bid Total.
- B. Included in the bid schedule is a stipulated sum/price for use upon Owner's instruction as a contingency allowance and shall be utilized only with written pre-approval of OWNER/ENGINEER.
- C. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead, and profit will be included in Work Orders authorizing expenditure of funds from this contingency allowance.
- D. Funds will be drawn from contingency only by Work Order.
- E. Payment for work completed using the contingency shall be based on negotiated, agreed, documented tasks requested by OWNER.
- F. At closeout of Contract, funds remaining in contingency will be credited to Owner by Change Order.

END OF SECTION

**SECTION 01055
CONSTRUCTION STAKING**

PART 1 GENERAL

1.01 SCOPE

- A. Construction staking shall include all of the surveying work required to layout the Work and control the location of the finished Project. The Contractor shall have the full responsibility for constructing the Project to the correct horizontal and vertical alignment, as shown on the Drawings, as specified, or as ordered by the Engineer. The Contractor shall assume all costs associated with rectifying work constructed in the wrong location.
- B. From the information shown on the Drawings and the information to be provided as indicated under Project Conditions below, the Contractor shall:
 - 1. be responsible for setting reference points and/or offsets, establishment of baselines, and all other layout, staking, and all other surveying required for the construction of the Project.
 - 2. safeguard all reference points, stakes, grade marks, horizontal and vertical control points, and shall bear the cost of re-establishing same, if disturbed.
 - 3. stakeout the permanent and temporary easements or the limits of construction to ensure that the Work is not deviating from the indicated limits.
 - 4. be responsible for all damage done to reference points, baselines, center lines and temporary benchmarks, and shall be responsible for the cost of re-establishment of reference points, baselines, center lines and temporary bench marks as a result of the operations.
- C. Baselines shall be defined as the line to which the location of the Work is referenced, i.e., edge of pavement, road centerline, property line, right-of-way or survey line.
- D. Record Drawing surveys shall be performed in accordance with Section 01720 of these Specifications.

1.02 PROJECT CONDITIONS

- A. The Drawings provide the location and/or coordinates of principal components of the Project. The alignment of some components of the Project may be indicated in the Specifications. The Engineer may order changes to the location of some of the components of the Project or provide clarification to questions regarding the correct alignment.

- B. The Engineer will provide the following in the Plans:
 - 1. One vertical control point on the Project site with its elevation.
 - 2. Two horizontal control points on the Project with coordinates.

1.03 QUALITY ASSURANCE

- A. The level of detail of survey required shall be that which the correct location of the pipeline or appurtenances can be established for construction and verified by the Engineer.
- B. Any deviations from the Drawings shall be confirmed by the Engineer prior to construction of that portion of the Project.
- C. Reference Points
 - 1. Reference points shall be placed, at or no more than three feet, from the outside of the construction easement or right-of-way. The location of the reference points shall be recorded in a log with a copy provided to the Engineer for use, prior to verifying reference point locations. Distances shall be accurately measured to 0.01 foot.
 - 2. The Contractor shall give the Engineer reasonable notice that reference points are set. The reference point locations must be verified by the Engineer prior to commencing clearing and grubbing operations.

END OF SECTION

**SECTION 01060
REGULATORY REQUIREMENTS**

PART 1 GENERAL

1.01 SCOPE

- A. The Owner will secure any highway or railroad permits for borings and encroachments as shown on the drawings, if any. The Contractor shall abide by all terms and conditions of these permits.

- B. Permits and Responsibilities: The Contractor shall, without additional expense to the Owner, be responsible for obtaining all other necessary licenses and permits, including building permits, land disturbing activity permits, etc. and for complying with any applicable federal, state, county and municipal laws, codes and regulations, in connection with the performance of the Work.

- C. The Contractor is solely responsible for site safety. The Contractor shall take proper safety and health precautions to protect the Work, the workers, the public and the property of others.

- D. The Contractor shall be responsible for all materials delivered and work performed until completion and acceptance of the Work, except for any completed unit of construction thereof which may have been accepted.

END OF SECTION

**SECTION 01091
CODES AND STANDARDS**

PART 1 GENERAL

1.01 DESCRIPTION

- A. Whenever reference is made to conforming to the standards of any technical society, organization, body, code or standard, it shall be construed to mean the latest standard, code, specification or tentative specification adopted and published at the time of advertisement for Bids. This shall include the furnishing of materials, testing of materials, fabrication and installation practices. In those cases where the Contractor's quality standards establish more stringent quality requirements, the more stringent requirement shall prevail. Such standards are made a part hereof to the extent which is indicated or intended.
- B. The inclusion of an organization under one category does not preclude that organization's standards from applying to another category.
- C. In addition, all work shall comply with the applicable requirements of local codes, utilities and other authorities having jurisdiction.
- D. All material and equipment, for which a UL Standard, an AGA or NSF approval or an ASME requirement is established, shall be so approved and labeled or stamped. The label or stamp shall be conspicuous and not covered, painted, or otherwise obscured from visual inspection.
- E. The standards which apply to this Project are not necessarily restricted to those organizations which are listed in Article 1.02.

1.02 STANDARD ORGANIZATIONS

A. Piping and Valves

ACPA	American Concrete Pipe Association
ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
AWWA	American Water Works Association
CISPI	Cast Iron Soil Pipe Institute
DIPRA	Ductile Iron Pipe Research Association
FCI	Fluid Controls Institute
MSS	Manufacturers Standardization Society
NCPI	National Clay Pipe Institute
NSF	National Sanitation Foundation
PPI	Plastic Pipe Institute

Uni-Bell PVC Pipe Association

B. Materials

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials

C. Painting and Surface Preparation

NACE	National Association of Corrosion Engineers
SSPC	Steel Structures Painting Council

D. Electrical and Instrumentation

AEIC	Association of Edison Illuminating Companies
AIEE	American Institute of Electrical Engineers
EIA	Electronic Industries Association
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IPC	Institute of Printed Circuits
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
TIA	Telecommunications Industries Association
UL	Underwriter's Laboratories
VRCI	Variable Resistive Components Institute

E. Aluminum

AA	Aluminum Association
AAMA	American Architectural Manufacturers Association

F. Steel and Concrete

ACI	American Concrete Institute
AISC	American Institute of Steel Construction, Inc.
AISI	American Iron and Steel Institute
CRSI	Concrete Reinforcing Steel Institute
NRMA	National Ready-Mix Association
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute

G. Welding

ASME	American Society of Mechanical Engineers
AWS	American Welding Society

H. Government and Technical Organizations

AIA	American Institute of Architects
APHA	American Public Health Association
APWA	American Public Works Association
ASA	American Standards Association
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASQC	American Society of Quality Control
ASSE	American Society of Sanitary Engineers
CFR	Code of Federal Regulations
CSI	Construction Specifications Institute
EDA	Economic Development Administration
EPA	Environmental Protection Agency
FCC	Federal Communications Commission
FS	Federal Specifications
IAI	International Association of Identification
ISEA	Industrial Safety Equipment Association
ISO	International Organization for Standardization
ITE	Institute of Traffic Engineers
NBFU	National Board of Fire Underwriters
(NFPA)	National Fluid Power Association
NBS	National Bureau of Standards
NISO	National Information Standards Organization
OSHA	Occupational Safety and Health Administration
SI	Salt Institute
SPI	The Society of the Plastics Industry, Inc.
USDC	United States Department of Commerce
WEF	Water Environment Federation

I. General Building Construction

AHA	American Hardboard Association
AHAM	Association of Home Appliance Manufacturers
AITC	American Institute of Timber Construction
APA	American Parquet Association, Inc.
APA	American Plywood Association
BHMA	Builders Hardware Manufacturers Association
BIFMA	Business and Institutional Furniture Manufacturers Association

	DHI	Door and Hardware Institute
	FM	Factory Mutual Fire Insurance Company
	HPMA	Hardwood Plywood Manufacturers Association
	HTI	Hand Tools Institute
	IME	Institute of Makers of Explosives
	ISANTA	International Staple, Nail and Tool Association
	ISDSI	Insulated Steel Door Systems Institute
	IWS	Insect Screening Weavers Association
	MBMA	Metal Building Manufacturers Association
	NAAMM	National Association of Architectural Metal Manufacturers
	NAGDM	National Association of Garage Door Manufacturers
	NCCLS	National Committee for Clinical Laboratory Standards
	NFPA	National Fire Protection Association
	NFSA	National Fertilizer Solutions Association
	NKCA	National Kitchen Cabinet Association
	NWMA	National Woodwork Manufacturers Association
	NWWDA	National Wood Window and Door Association
	RMA	Rubber Manufacturers Association
	SBC	SBCC Standard Building Code
	SDI	Steel Door Institute
	SIA	Scaffold Industry Association
	SMA	Screen Manufacturers Association
	SPRI	Single-Ply Roofing Institute
	TCA	Tile Council of America
	UBC	Uniform Building Code
J.	Roadways	
	AREA	American Railway Engineering Association
	DOT	Department of Transportation
	SSRBC	Standard Specifications for Construction of Transportation Systems, Georgia Department of Transportation
K.	Plumbing	
	AGA	American Gas Association
	NSF	National Sanitation Foundation
	PDI	Plumbing Drainage Institute
	SPC	SBCC Standard Plumbing Code
L.	Refrigeration, Heating, and Air Conditioning	
	AMCA	Air Movement and Control Association
	ARI	American Refrigeration Institute
	ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers

ASME	American Society of Mechanical Engineers
CGA	Compressed Gas Association
CTI	Cooling Tower Institute
HEI	Heat Exchange Institute
IIAR	International Institute of Ammonia Refrigeration
NB	National Board of Boilers and Pressure Vessel Inspectors
PFMA	Power Fan Manufacturers Association
SAE	Society of Automotive Engineers
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SMC	SBCC Standard Mechanical Code
TEMA	Tubular Exchangers Manufacturers Association

M. Equipment

AFBMA	Anti-Friction Bearing Manufacturers Association, Inc.
AGMA	American Gear Manufacturers Association
ALI	Automotive Lift Institute
CEMA	Conveyor Equipment Manufacturers Association
CMAA	Crane Manufacturers Association of America
DEMA	Diesel Engine Manufacturers Association
MMA	Monorail Manufacturers Association
OPEI	Outdoor Power Equipment Institute, Inc.
PTI	Power Tool Institute, Inc.
RIA	Robotic Industries Association
SAMA	Scientific Apparatus Makers Association

1.03 SYMBOLS

Symbols and material legends shall be as scheduled on the Drawings.

END OF SECTION

SECTION 01340
SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 GENERAL

1.01 SCOPE

- A. The work under this Section includes submittal to the Engineer of shop drawings, product data and samples required by the various sections of these Specifications.
- B. Submittal Contents: The submittal contents required are specified in each section.
- C. Definitions: Submittals are categorized as follows:
 - 1. Shop Drawings
 - a. Shop drawings shall include technical data, drawings, diagrams, procedure and methodology, performance curves, schedules, templates, patterns, test reports, calculations, instructions, measurements and similar information as applicable to the specific item for which the shop drawing is prepared.
 - b. Provide newly-prepared information, on reproducible sheets, with graphic information at accurate scale (except as otherwise indicated) or appropriate number of prints hereof, with name or preparer (firm name) indicated. The Contract Drawings shall not be traced or reproduced by any method for use as or in lieu of detail shop drawings. Show dimensions and note which are based on field measurement. Identify materials and products in the work shown. Indicate compliance with standards and special coordination requirements. Do not allow shop drawing copies without appropriate final "Action" markings by the Engineer to be used in connection with the Work.
Electronic drawings may be submitted in PDF format.
 - c. Drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to sheet and detail, specification section or schedule shown on the Contract Drawings.
 - d. Minimum assembly drawings sheet size shall be 24 x 36-inches.
 - e. Minimum detail sheet size shall be 8-1/2 x 11-inches.
 - f. Minimum Scale:
 - (1) Assembly Drawings Sheet, Scale: 1-inch = 30 feet.
 - (2) Detail Sheet, Scale: 1/4-inch = 1 foot.

2. Product Data
 - a. Product data includes standard printed information on materials, products and systems, not specially prepared for this Project, other than the designation of selections from among available choices printed therein.
 - b. Collect required data into one submittal for each unit of work or system, and mark each copy to show which choices and options are applicable to the Project. Include manufacturer's standard printed recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements which have been checked and special coordination requirements.
3. Samples
 - a. Samples include both fabricated and un-fabricated physical examples of materials, products and units of work, both as complete units and as smaller portions of units of work, either for limited visual inspection or, where indicated, for more detailed testing and analysis.
 - b. Provide units identical with final condition of proposed materials or products for the work. Include "range" samples, not less than three units, where unavoidable variations must be expected, and describe or identify variations between units of each set. Provide full set of optional samples where the Engineer's selection is required. Prepare samples to match the Engineer's sample where indicated. Include information with each sample to show generic description, source or product name and manufacturer, limitations and compliance with standards. Samples are submitted for review and confirmation of color, pattern, texture and "kind" by the Engineer. Engineer will note "test" samples, except as otherwise indicated, for other requirements, which are the exclusive responsibility of the Contractor.
4. Miscellaneous submittals related directly to the Work (non-administrative) include warranties, maintenance agreements, workmanship bonds, project photographs, survey data and reports, physical work records, statements of applicability, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, operating and maintenance materials, overrun stock, security/protection/safety keys and similar information, devices and materials applicable to the Work but not processed as shop drawings, product data or samples.

1.02 SPECIFIC CATEGORY REQUIREMENTS

- A. General: Except as otherwise indicated in the individual work sections, comply with general requirements specified herein for each indicated category of submittal. Submittals shall contain:
1. The date of submittal and the dates of any previous submittals.
 2. The Project title.
 3. Numerical submittal numbers, starting with 1.0, 2.0, etc. Revisions to be numbered 1.1, 1.2, etc.
 4. The Names of:
 - a. Contractor
 - b. Supplier
 - c. Manufacturer
 5. Identification of the product, with the Specification section number, permanent equipment tag numbers and applicable Drawing No.
 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 Specification numbers.
 9. Notification to the Engineer in writing, at time of submissions, of any deviations on the submittals from requirements of the Contract Documents.
 10. Identification of revisions on resubmittals.
 11. A 6 x 3-inch blank space for Contractor and Engineer stamps.
 12. Contractor's stamp, initialed or signed, certifying to 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.
 13. Submittal sheets or drawings showing more than the particular item under consideration shall have all but the pertinent description of the item for which review is requested crossed out.

1.03 ROUTING OF SUBMITTALS

- A. Submittals and routine correspondence shall be routed as follows:
 - 1. Supplier to Contractor (through representative, if applicable)
 - 2. Contractor to Engineer
 - 3. Engineer to Contractor and Owner
 - 4. Contractor to Supplier

PART 2 PRODUCTS

2.01 SHOP DRAWINGS

- A. Unless otherwise specifically directed by the Engineer, make all shop drawings accurately to a scale sufficiently large to show all pertinent features of the item and its method of connection to the Work.
- B. Submit all shop assembly drawings in the form of one reproducible electronic file.
- C. Submit all shop drawings as *Electronic drawings in PDF file format*.
- D. *One electronic file in PDF format will be returned to the Contractor and Owner when reviewed with no exception or Make Corrections Noted and Proceed.*

2.02 MANUFACTURER'S LITERATURE

- A. Where content of submitted literature from manufacturers includes data not pertinent to this submittal, clearly indicate which portion of the contents is being submitted for the Engineer's review.

2.03 SAMPLES

- A. Samples shall illustrate materials, equipment or workmanship and established standards by which completed work is judged.
- B. Unless otherwise specifically directed by the Engineer, all samples shall be of the precise article proposed to be furnished.
- C. Submit all samples in the quantity which is required to be returned to Contractor plus one sample which will be retained by the Owner.

2.04 COLORS

- A. Unless the precise color and pattern is specifically described in the Contract Documents, wherever a choice of color or pattern is available in a specified product, submit accurate color charts and pattern charts to the Engineer and Owner for review and selection.
- B. Unless all available colors and patterns have identical costs and identical wearing capabilities, and are identically suited to the installation, completely describe the relative costs and capabilities of each.

PART 3 EXECUTION

3.01 CONTRACTOR'S COORDINATION OF SUBMITTALS

- A. Prior to submittal for the Engineer's review, the Contractor shall use all means necessary to fully coordinate all material, including the following procedures:
 - 1. Determine and verify all field dimensions and conditions, catalog numbers and similar data.
 - 2. Coordinate as required with all trades and all public agencies involved.
 - 3. **Submit a written statement of review and compliance with the requirements of all applicable technical Specifications as well as the requirements of this Section.**
 - 4. **Clearly indicate in a letter or memorandum on the manufacturer's or fabricator's letterhead, all deviations from the Contract Documents.**
- B. Each and every shop drawing and related data shall bear the Contractor's stamp showing that they have been so checked. Shop drawings submitted to the Engineer without the Contractor's stamp will be returned to the Contractor for conformance with this requirement.
- C. The Owner may backcharge the Contractor for costs associated with having to review a particular shop drawing, product data or sample more than two times to receive a "No Exceptions Taken" mark.
- D. Grouping of Submittals
 - 1. Unless otherwise specifically permitted by the Engineer, make all submittals in groups containing all associated items.

2. No review will be given to partial submittals of shop drawings for items which interconnect and/or are interdependent. It is the Contractor's responsibility to assemble the shop drawings for all such interconnecting and/or interdependent items, check them and then make one submittal to the Engineer along with Contractor's comments as to compliance, non-compliance or features requiring special attention.

3.02 TIMING OF SUBMITTALS

- A. Make all submittals far enough in advance of scheduled dates for installation to provide all required time for reviews, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery.
- B. In scheduling, allow sufficient time for the Engineer's review following the receipt of the submittal.

3.03 REVIEWED SHOP DRAWINGS

- A. Engineer Review
 1. Allow a minimum of 10 days for the Engineer's initial processing of each submittal requiring review and response, except allow longer periods where processing must be delayed for coordination with subsequent submittals. The Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination. Allow a minimum of two weeks for reprocessing each submittal. Advise the Engineer on each submittal as to whether processing time is critical to progress of the Work, and therefore the Work would be expedited if processing time could be foreshortened.
 2. Acceptable submittals will be marked "**No Exceptions Taken**".
 3. Submittals requiring minor corrections before the product is acceptable will be marked "**Make Corrections Noted**". The Contractor may order, fabricate and ship the items included in the submittals, provided the indicated corrections are made. Drawings shall be resubmitted for review at Engineers discretion and noted on such Submittals.
 4. Submittals marked "**Amend and Resubmit**" must be revised to reflect required changes and the initial review procedure repeated.
 5. The "**Revise and Resubmit**" or "**Submit Specified Item**" notation is used to indicate products which are not acceptable. Upon return of a submittal so marked,

- the Contractor shall repeat the initial review procedure.
- B. No work or products shall be installed without a drawing or submittal bearing the "**No Exceptions Taken**" or "**Make Corrections Noted and Proceed**" notation. The Contractor shall maintain at the job site a complete set of shop drawings bearing the Engineer's stamp.
 - C. Substitutions: In the event the Contractor obtains the Engineer's approval for the use of products other than those which are listed first in the Contract Documents, the Contractor shall, at the Contractor's own expense and using methods approved by the Engineer, make any changes to structures, piping and electrical work that may be necessary to accommodate these products.
 - D. Use of the "**No Exceptions Taken**" or "**Make Corrections Noted and Proceed**" notation on shop drawings or other submittals is general and shall not relieve the Contractor of the responsibility of furnishing products of the proper dimension, size, quality, quantity, materials and all performance characteristics, to efficiently perform the requirements and intent of the Contract Documents. The Engineer's review shall not relieve the Contractor of responsibility for errors of any kind on the shop drawings. Review is intended only to assure conformance with the design concept of the Project and compliance with the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site. The Contractor is also responsible for information that pertains solely to the fabrication processes or to the technique of construction and for the coordination of the work of all trades.

3.04 RESUBMISSION REQUIREMENTS

- A. Project Data and Samples: Resubmit new data and samples as specified for initial submittal, with the resubmittal number shown.

END OF SECTION

**SECTION 01510
TEMPORARY FACILITIES**

PART 1 GENERAL

1.01 SCOPE

- A. Temporary facilities required for this work include, but are not necessarily limited to:
1. Temporary utilities such as water and electricity.
 2. First aid facilities.
 3. Sanitary facilities.
 4. Potable water.
 5. Temporary enclosures and construction facilities.

1.02 GENERAL

- A. First aid facilities, sanitary facilities and potable water shall be available on the Project site on the first day that any activities are conducted on site. The other facilities shall be provided as the schedule of the Project warrants.
- B. Maintenance: Use all means necessary to maintain temporary facilities in proper and safe condition throughout progress of the Work. In the event of loss or damage, immediately make all repairs and replacements necessary, at no additional cost to the Owner.
- C. Removal: Remove all such temporary facilities and controls as rapidly as progress of the Work will permit.

1.03 TEMPORARY UTILITIES

- A. General
1. Provide and pay all costs for all water, electricity and other utilities required for the performance of the Work.
 2. Pay all costs for temporary utilities until Project completion.
 3. Costs for temporary utilities shall include all power, water and the like necessary for testing equipment as required by the Contract Documents.
- B. Temporary Water: Provide all necessary temporary piping, and upon completion of the Work, remove all such temporary piping. Owner to provide and remove water meters.
- C. Temporary Electricity
1. Provide all necessary wiring for the Contractor's use.
 2. Furnish, locate and install area distribution boxes such that the individual trades may use, their own construction type extension cords to obtain adequate power, and artificial lighting at all points where required by inspectors and for safety.

1.04 FIRST AID FACILITIES

The Contractor shall provide a suitable first aid station, equipped with all facilities and medical supplies necessary to administer emergency first aid treatment. The Contractor shall have standing arrangements for the removal and hospital treatment of any injured person. All first aid facilities and emergency ambulance service shall be made available by the Contractor to the Owner and the Engineer's personnel.

1.05 SANITARY FACILITIES

Prior to starting the Work, the Contractor shall furnish, for use of Contractor's personnel on the job, all necessary toilet facilities which shall be secluded from public observation. These facilities shall be either chemical toilets or shall be connected to the Owner's sanitary sewer system. All facilities, regardless of type, shall be kept in a clean and sanitary condition and shall comply with the requirements and regulations of the area in which the Work is performed. Adequacy of these facilities will be subject to the Engineer's review and maintenance of same must be satisfactory to the Engineer at all times.

1.06 POTABLE WATER

The Contractor shall be responsible for furnishing a supply of potable drinking water for employees, subcontractors, inspectors, engineers and the Owner who are associated with the Work.

1.07 ENCLOSURES AND CONSTRUCTION FACILITIES

Furnish, install and maintain for the duration of construction, all required scaffolds, tarpaulins, canopies, steps, bridges, platforms and other temporary construction necessary for proper completion of the Work in compliance with all pertinent safety and other regulations.

1.08 PARKING FACILITIES

Parking facilities for the Contractor's and Contractor's subcontractors' personnel shall be the Contractor's responsibility.

END OF SECTION

**SECTION 01540
JOB SITE SECURITY**

PART 1 GENERAL

1.01 BARRICADES, LIGHTS AND SIGNALS

- A. The Contractor shall furnish and erect such barricades, fences, lights and danger signals and shall provide such other precautionary measures for the protection of persons or property and of the Work as necessary. Barricades shall be painted in a color that will be visible at night. From sunset to sunrise, the Contractor shall furnish and maintain at least one light at each barricade and sufficient numbers of barricades shall be erected to keep vehicles from being driven on or into any Work under construction.

- B. The Contractor will be held responsible for all damage to the Work due to failure of barricades, signs and lights and whenever evidence is found of such damage, the Contractor shall immediately remove the damaged portion and replace it at Contractor's cost and expense. The Contractor's responsibility for the maintenance of barricades, signs and lights shall not cease until the Project has been accepted by the Owner.

END OF SECTION

**SECTION 01610
TRANSPORTATION AND HANDLING**

PART 1 GENERAL

1.01 SCOPE

- A. The Contractor shall provide transportation of all equipment, materials and products furnished under these Contract Documents to the Work site. In addition, the Contractor shall provide preparation for shipment, loading, unloading, handling and preparation for installation and all other work and incidental items necessary or convenient to the Contractor for the satisfactory prosecution and completion of the Work.
- B. All equipment, materials and products damaged during transportation or handling shall be repaired or replaced by the Contractor at no additional cost to the Owner prior to being incorporated into the Work.

1.02 TRANSPORTATION

- A. All equipment shall be suitably boxed, crated or otherwise protected during transportation.
- B. Where equipment will be installed using existing cranes or hoisting equipment, the Contractor shall ensure that the weights of the assembled sections do not exceed the capacity of the cranes or hoisting equipment.
- C. Small items and appurtenances such as gauges, valves, switches, instruments and probes which could be damaged during shipment shall be removed from the equipment prior to shipment, packaged and shipped separately. All openings shall be plugged or sealed to prevent the entrance of water or dirt.

1.03 HANDLING

- A. All equipment, materials and products shall be carefully handled to prevent damage or excessive deflections during unloading or transportation.
- B. Lifting and handling drawings and instructions furnished by the manufacturer or supplier shall be strictly followed. Eyebolts or lifting lugs furnished on the equipment shall be used in handling. Shafts and operating mechanisms shall not be used as lifting points. Spreader bars or lifting beams shall be used when the distance between lifting points exceeds that permitted by standard industry practice.
- C. Under no circumstances shall equipment or products such as pipe, structural steel, castings, reinforcement, lumber, piles, poles, etc., be thrown or rolled off of trucks onto the ground.
- D. Slings and chains shall be padded as required to prevent damage to protective coatings and finishes.

END OF SECTION

**SECTION 01611
STORAGE AND PROTECTION**

PART 1 GENERAL

1.01 SCOPE

The work under this Section includes, but is not necessarily limited to, the furnishing of all labor, tools and materials necessary to properly store and protect all materials, equipment, products and the like, as necessary for the proper and complete performance of the Work.

1.02 STORAGE AND PROTECTION

A. Storage

1. Maintain ample way for foot traffic at all times.
2. All property damaged by reason of storing of material shall be properly replaced at no additional cost to the Owner.
3. Packaged materials shall be delivered in original unopened containers and so stored until ready for use.
4. All materials shall meet the requirements of these Specifications at the time that they are used in the Work.
5. Store products in accordance with manufacturer's instructions.

B. Protection

1. Use means necessary to protect the materials, equipment and products of every section before, during and after installation and to protect the installed work and materials of other trades.
2. Materials shall be delivered, stored and handled to prevent the inclusion of foreign materials and damage by water, breakage, vandalism or other causes.
3. Substantially constructed weather tight storage sheds, with raised floors, shall be provided and maintained as may be required to adequately protect those materials and products stored on the site which may require protection from damage by the elements.

C. Replacements: In the event of damage, immediately make replacements necessary for the approval of the Engineer and at no additional cost to the Owner.

D. Equipment and products stored outdoors shall be supported above the ground on suitable wooden blocks or braces arranged to prevent deflection or bending between supports. Items such as pipe, structural steel and sheet construction products shall be stored with one end elevated to facilitate drainage.

E. Unless otherwise permitted in writing by the Engineer, building products and materials

such as cement, grout, plaster, gypsum board, particleboard, resilient flooring, acoustical tile, paneling, finish lumber, insulation, wiring, etc., shall be stored indoors in a dry location. Building products such as rough lumber, plywood, concrete block and structural tile may be stored outdoors under a properly secured waterproof covering.

- F. Tarps and other coverings shall be supported above the stored equipment or materials on wooden strips to provide ventilation under the cover and minimize condensation. Tarps and covers shall be arranged to prevent ponding of water.

1.03 EXTENDED STORAGE

In the event that certain items of major equipment such as air compressors, pumps and mechanical aerators have to be stored for an extended period of time, the Contractor shall provide satisfactory long-term storage facilities which are acceptable to the Owner. The Contractor shall provide all special packaging, protective coverings, protective coatings, power, nitrogen purge, desiccants, lubricants and exercising necessary or recommended by the manufacturer to properly maintain and protect the equipment during the period of extended storage.

END OF SECTION

**SECTION 01710
CLEANING**

PART 1 GENERAL

1.01 SCOPE

This Section covers the general cleaning which the Contractor shall be required to perform both during construction and before final acceptance of the Project unless otherwise shown on the Drawings or specified elsewhere in these Specifications.

1.02 QUALITY ASSURANCE

- A. Daily, and more often if necessary, conduct inspections verifying that requirements of cleanliness are being met.
- B. In addition to the standards described in this Section, comply with all pertinent requirements of governmental agencies having jurisdiction.

1.03 HAZARDOUS MATERIAL AND WASTE

- A. The Contractor shall handle hazardous waste and materials in accordance with applicable local, state, and federal regulations. Waste shall also be disposed of in approved landfills as applicable.
- B. The Contractor shall prevent accumulation of wastes which create hazardous conditions.
- C. Burning or burying rubbish and waste materials on the site shall not be allowed.
- D. Disposal of hazardous wastes or materials into sanitary or storm sewers shall not be allowed.

1.04 DISPOSAL OF SURPLUS MATERIALS

Unless otherwise shown on the Drawings, specified or directed, the Contractor shall legally dispose off the site all surplus materials and equipment from demolition and shall provide suitable off-site disposal site, or utilize a site designated by the Owner.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

Provide all required personnel, equipment and materials needed to maintain the specified standard of cleanliness.

2.02 COMPATIBILITY

Use only the cleaning materials, methods and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material or as approved by the Owner and Engineer.

PART 3 EXECUTION

3.01 PROGRESS CLEANING

A. General

1. Do not allow the accumulation of scrap, debris, waste material and other items not required for construction of this Work.
2. At least each week, and more often if necessary, completely remove all scrap, debris and waste material from the job site.
3. Provide adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the environment.

B. Site

1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris and waste material. Remove all such items to the place designated for their storage.
2. Restack materials stored on site weekly.
3. At all times maintain the site in a neat and orderly condition which meets the approval of the Engineer.

3.02 FINAL CLEANING

- A. Definitions: Unless otherwise specifically specified, "clean" for the purpose of this Article shall be interpreted as the level of cleanliness generally provided by commercial building maintenance subcontractors using commercial quality building maintenance equipment and materials.
- B. General: Prior to completion of the Work, remove from the job site all tools, surplus materials, equipment, scrap, debris and waste. Conduct final progress cleaning as described in 3.01 above.
- C. Site: Unless otherwise specifically directed by the Owner, hose down all paved areas on the site and all public sidewalks directly adjacent to the site; rake clean other surfaces of the grounds. Completely remove all resultant debris.
- D. Post-Construction Cleanup: All evidence of temporary construction facilities, haul roads,

work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other evidence of construction, as directed by the Engineer.

- E. Restoration of Landscape Damage: Any landscape feature damaged by the Contractor shall be restored as nearly as possible to its original condition at the Contractor's expense. The Owner will decide what method of restoration shall be used.
- F. Timing: Schedule final cleaning as approved by the Engineer to enable the Owner to accept the Project.

3.03 CLEANING DURING OWNER'S OCCUPANCY

Should the Owner occupy the Work or any portion thereof prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning of the occupied spaces shall be as determined by the Engineer in accordance with the Special Conditions of the Contract Documents.

END OF SECTION

**SECTION 01720
RECORD DOCUMENTS**

PART 1 GENERAL

1.01 SCOPE

- A. The work under this Section includes, but is not necessarily limited to, the compiling, maintaining, recording and submitting of project record documents as herein specified.
- B. Record documents include, but are not limited to:
 - 1. Drawings;
 - 2. Specifications;
 - 3. Change orders and other modifications to the Contract;
 - 4. Engineer field orders or written instructions, including Requests for Information (RFI) and Clarification Memorandums;
 - 5. Reviewed shop drawings, product data and samples;
 - 6. Test records.
- C. The Contractor shall maintain on the Project site throughout the Contract Time an up to date set of Record Drawings.

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Storage
 - 1. Store documents and samples in the Contractor's field office, apart from documents used for construction.
 - 2. Provide files and racks for storage of documents.
 - 3. Provide locked cabinet or secure storage space for storage of samples.
- B. File documents and samples in accordance with format of these Specifications.
- C. Maintenance
 - 1. Maintain documents in a clean, dry, legible condition and in good order.
 - 2. Do not use record documents for construction purposes.
 - 3. Maintain at the site for the Owner one copy of all record documents.
- D. Make documents and samples available at all times for inspection by Engineer and Owner.
- E. Failure to maintain the Record Documents in a satisfactory manner may be cause for withholding of a certificate for payment.

1.03 QUALITY ASSURANCE

- A. Unless noted otherwise, Record Drawings shall provide dimensions, distances and coordinates to the nearest 0.1 foot.
- B. Unless noted otherwise, Record Drawings shall provide elevations to the nearest 0.01 foot for all pertinent items constructed by the Contractor.

1.04 RECORDING

- A. Label each document "PROJECT RECORD" in neat, large printed letters.
- B. Recording
 - 1. Record information concurrently with construction progress.
 - 2. Do not conceal any work until required information is recorded.

1.05 RECORD DRAWINGS

- A. Record Drawings shall be reproducible, shall have a title block indicating that the drawings are Record Drawings, the name of the company preparing the Record Drawings, and the date the Record Drawings were prepared. Reproducible shall be defined as being electronic copies in PDF and DWG file format.
- B. Legibly mark drawings to record actual construction, including:
 - 1. All Construction
 - a. Changes of dimension and detail.
 - b. Changes made by Requests for Information (RFI), field order, clarification memorandums or by change order.
 - c. Details not on original Drawings.
 - 2. Site Improvements, Including Underground Utilities
 - a. Horizontal and vertical locations of all exposed and underground utilities and appurtenances, both new facilities constructed and those utilities encountered, referenced to permanent surface improvements.
 - b. Location of and dimensions of roadways and parking areas, providing dimensions to back of curb when present.
 - c. The locations shall be referenced to at least two easily identifiable, permanent landmarks (e.g., power poles, valve markers, etc.) or benchmarks.

3. Structures
 - a. Depths of various elements of foundation in relation to finish first floor datum or top of wall.
 - b. Location of internal and buried utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.

1.06 SPECIFICATIONS

- A. Legibly mark each section to record:
 1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
 2. Changes made by Requests for Information (RFI), field order, clarification memorandums, or by change order.

1.07 SUBMITTAL

- A. At contract closeout, deliver Record Documents to the Engineer.
- B. Accompany submittal with transmittal letter, in duplicate, containing:
 1. Date
 2. Project title and number
 3. Contractor's name and address
 4. Title and number of each record document
 5. Signature of Contractor or Contractor's authorized representative

END OF SECTION

**SECTION 02010
SUBSURFACE CONDITIONS**

PART 1 GENERAL

1.01 SUMMARY

- A. Soil boring logs are shown in the Geotechnical Report entitled Report of Geotechnical Exploration Water Production Facilities – JWSC - Ridgewood dated May 19, 2014. This information is attached as Appendix A for information.
- B. This soil investigation information is offered as an aid in bidding only and is not a part of the Contract Documents. The boring logs are available for the Contractor's information, but are not a warranty of subsurface conditions. The Owner, Engineer and geotechnical engineer assume no responsibility for any variation between materials encountered during construction and those indicated on the boring logs nor for any variation between the location of the water table encountered and that indicated on the boring logs at the date borings were taken.
- C. Additional Investigation: The Contractor shall visit the site and become acquainted with site conditions. Prior to bidding, prospective Contractors may make their own site and subsurface investigations to satisfy themselves with site and subsurface conditions. The Contractor shall be responsible for obtaining rights of ingress and egress to private property for site and subsurface investigation and shall assume all responsibility for any damage to property caused as a result of the Contractor's investigation.

END OF SECTION

SECTION 02050 DEMOLITION

PART 1 GENERAL

1.01 SCOPE

A. The work covered under this Section includes furnishing all labor and equipment required to remove, handle, crush and legally dispose of all equipment, materials and piping as shown on the Drawings, and required for the completion of the Work, including all necessary, excavation and backfilling.

The work specified herein and shown on the Drawings is intended to give a general idea of the scope of this work but must not be construed as covering it entirely. The Contractor shall visit the site and judge the amount of work required and the problems anticipated in the performance of the work.

1.02 GENERAL REQUIREMENTS

The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and debris shall be removed from site daily, unless otherwise directed, to avoid accumulation at the demolition site. Material that cannot be removed daily shall be stored in areas specified by the Owner's representative. In the interest of conservations, salvage shall be pursued to the maximum extent possible; salvaged items and materials shall be disposed of as per local, state and federal regulation.

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Conditions of the Contract Documents. Prior to beginning work, a schedule of demolition and detail methods to be used on each facility to be demolished shall be submitted.

1.04 PROTECTION

A. Protection of Existing Property

Before beginning any demolition work, the Contractor shall carefully survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take all necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Owner, and any damaged items shall be repaired or replaced as approved by the Owner's Representative at no additional cost to the Owner. The Contractor shall carefully coordinate the work of this section with all other work and shall construct and maintain shoring, bracing and supports, as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new

supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.05 BURNING

The use of burning at the project site for the disposal of refuse and debris will be permitted only in accordance with state and local regulations. Burn permits must be secured prior to burning as required by local regulations.

1.06 USE OF EXPLOSIVES

Use of explosives of any type will not be permitted.

1.07 WORK AREAS AND LIMITS

Areas in which the work is to be accomplished will be as shown on the drawings.

PART 2 -PRODUCTS

2.01 EQUIPMENT

A. The Contractor shall furnish equipment of the type normally used in demolition including but not limited to tractors, trucks and loaders.

2.02 MATERIALS

A. All concrete, mortar, grout, and backfill used in patching, plugging or repairing shall comply in all respects with the applicable material requirements of these Specifications.

PART 3 -EXECUTION

3.01 GENERAL

A. All material shall be removed as necessary for construction, or in any event, to a minimum depth of three feet below finished grades.

B. PROTECTION

1. Take care to prevent the spread of dust and flying particles, Sprinkle rubbish and debris with water to keep dust to a minimum.

2. Maintain adequate fire protection, including extinguisher and operative water-hose lines during demolition,

C. PERSONNEL:

Perform work by personnel experienced in this type work and in such a manner as to eliminate hazards to persons and property without interference with new work and with use of adjacent areas, public rights-of-way, utilities and structures.

3.02 PROTECTION OF WORK AND EXISTING FACILITY

A. Perform the work in a manner that will not damage parts of the structure, facility, or system not intended to be removed. If, in the opinion of the Engineer, the method of demolition or cutting may endanger or damage parts of the structure(s) or affect the operation of the facilities, promptly change the method when so notified by the Engineer. Perform all cutting required regardless whether such cutting is specifically indicated. Examine the existing structures, evaluate conditions to be encountered in accomplishing the work, and accommodate such requirements accordingly in the Bid Proposal.

B. The Contractor shall exercise full care and shall use such methods and equipment during removal as will maintain the usefulness of the various materials and equipment removed.

3.03 UTILITIES

Existing utilities shall be removed as indicated. When utility lines are encountered that are not indicated on the drawings, the Owner's Representative shall be notified prior to further work in the area,

When pipes, conduits, sewers or other structures are removed from the trench leaving dead ends in the ground, such ends shall be fully plugged and sealed as indicated on the Drawings.

3.04 DISPOSAL

A. Disposal: All rubble and waste material shall be removed from each work area in order to provide a clean area for plant operations. Such removal and cleanup is to be completed upon conclusion of daily work, outage period, or specific work period. Removal of waste material from the work areas constitutes physical removal of the debris, rubble, or waste from the building proper or work site to a storage container or stockpile. If the material is stockpiled for later disposal, the stockpile location shall be as approved by the Engineer. Should stockpiling not be approved an appropriate container may be used, or the Contractor may dispose of the material directly. If stockpiling is approved, disposal of stockpiled materials shall be accomplished at a frequency no less other than weekly. Waste material is considered to be any item or material that is removed from an existing condition and is not intended for reinstallation or salvage to the Owner. The Contractor shall be fully responsible for proper and legal disposal of waste materials in accordance with all federal, state and local laws at no additional cost to the Owner.

B. Title to materials and equipment to be demolished, excepting salvageable items, is vested in the Contractor upon receipt of the notice to proceed.

C. Contractor shall salvage items and materials to the maximum extent possible.

1. Material Salvaged for the Contractor

- a. Material salvaged for the Contractor shall be stored where approved by the Owner's Representative and shall be removed from the site before completion of the contract. Material salvaged for the Contractor shall not be sold on the site.

2. The Contract Items Salvaged for the Owner

- a. Salvaged items remain the property of the Owner shall be removed in a manner to prevent damage and packed or crated to protect the items from damage while in storage or during shipment. Items damaged during removal or storage shall be repaired or replaced to match existing items. Containers shall be properly identified as to contents. The following items reserved as property of the Owner shall be delivered to the areas designated on the drawings. These include but are not limited to:

1. Electrical switchgear and panelboards
2. Piping and valves removed as part of well piping modifications
3. Chemical feed equipment
4. SCADA Equipment
5. Pressure Tank & Foundation

3. Unsalvageable Materials

1. Concrete, masonry, and other noncombustible materials, except concrete permitted to remain in place, shall be properly removed and legally disposed in a permitted landfill.

3.05 CLEAN-UP

Debris and rubbish shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

END OF SECTION

**SECTION 02100
SITE PREPARATION**

PART 1 GENERAL

1.01 SUMMARY

- A. This Section describes materials and equipment to be utilized and requirements for their use in clearing, grubbing, and preparing the work site for construction. The Contractor shall furnish all materials, equipment and labor necessary to complete the work.

1.02 REFERENCES

Georgia Manual for Erosion and Sedimentation Control, current edition.

1.03 QUALITY ASSURANCE

- A. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction.
- B. Layout work shall be done under supervision of a Registered Land Surveyor, registered in the State of Georgia.
- C. GPS, theodolites and measuring devices shall be calibrated to layout site and construction work.

1.04 SITE CONDITIONS

- A. The area to be cleared and grubbed is shown schematically on the Drawings.
- B. Construction site is an existing water production facility in operation. Coordinate and execute activities so as to not interfere with facility operation except as scheduled with Owner.

PART 2 PRODUCTS

2.01 EQUIPMENT

Furnish equipment of the type normally used in clearing and grubbing operations including but not limited to tractors, trucks, loaders, root rakes and etc.

2.02 MATERIALS

Provide stakes and batter boards to execute the work, Use wire to establish reference lines for site, paving, and building work.

PART 3 EXECUTION

3.01 PREPARATION

- A. Protect and maintain all benchmarks, monuments and reference points. Replace if disturbed or destroyed. If found at variance with the Drawings, notify the Engineer before proceeding with layout work.
- B. Install erosion and sedimentation control structures as shown on the Drawings.
- C. Protect all trees, vegetation, structures, utilities, and buildings not designated for removal for demolition.

3.02 CLEARING AND GRUBBING

- A. Within the limits shown on the Drawings, the site will be cleared and grubbed to prepare for construction.
- C. Materials to be cleared, grubbed and removed from the project site include, but are not limited to, all trees, stumps, roots, brush, trash, organic matter, paving, miscellaneous structures, debris, and abandoned utilities.
- D. Grubbing shall consist of completely removing stumps, trash and other debris from all graded areas to that topsoil is free from roots and debris. Topsoil is to be left sufficiently clean so that further picking and raking will not be required.
- E. All stumps, roots, foundations and planking embedded in the ground shall be removed and disposed of. Piling and butts of utility poles shall be removed to a minimum depth of two feet below the limits of excavation for structures, trenches and roadways or two feet below finish grade, whichever is lower.
- F. Surface rocks and boulders shall be grubbed from the soil and removed from the site.
- G. Grub raw water line construction areas with heavy tractors with root rakes unless construction is within an existing roadway. Raking shall proceed along the contours of the site rather than up and down slopes to inhibit soil erosion.
- H. Trees shall be taken down in sections.
- I. Any work pertaining to utility poles shall comply with the requirements of the appropriate utility.
- J. All fences adjoining any excavation or embankment that, in the Contractor's opinion, may be damaged or buried, shall be carefully removed, stored and replaced. Any fencing that, in the

Engineer's opinion, is significantly damaged shall be replaced with new fence material.

- K. Stumps and roots shall be grubbed and removed to a depth not less than two feet below grade. All holes or cavities which extend below the subgrade elevation of the proposed work shall be filled with crushed rock or other suitable material, compacted to same density as the surrounding material.
- L. The Contractor shall be responsible for all damages to existing improvements resulting from the Contractor's operation.

3.03 DISPOSAL OF DEBRIS

- A. The debris resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the Contractor and shall be disposed of in accordance with the requirements of federal, state, county and municipal regulations. No debris of any kind shall be deposited in any stream or body water, or in any street or alley. No debris shall be deposited upon any private property except with written consent of the property owner. In no case shall any material or debris be left on the Project, shoved onto abutting private properties or buried on the Project.
- B. When approved by the Engineer and authorized by the proper authorities, the Contractor may dispose of such debris by burning on the Project site provided all requirements set forth by the governing authorities are met. The authorization to burn shall not relieve the Contractor in any way from damages which result from the Contractor's operations. On easements through private property, the Contractor shall not burn on the site unless written consent is also secured from the property owner, in addition to authorization from the proper authorities.

END OF SECTION

SECTION 02125
EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 SUMMARY

- A. The work specified in this Section consists of providing and maintaining temporary and permanent erosion and sedimentation controls as shown on the Drawings. This Section also specifies the subsequent removal of temporary erosion and sedimentation controls.
- B. Temporary and permanent erosion and sedimentation controls include grassing and mulching of disturbed areas and structural barriers at those locations which will ensure that erosion during construction will be maintained within acceptable limits. Acceptable limits are as established by the Georgia Erosion and Sedimentation Control Act of 1975, latest edition, Section 402 of the Federal Clean Water Act, and applicable codes, ordinances, rules, regulations and laws of local and municipal authorities having jurisdiction.
- C. Land disturbance activity shall not commence until the Land Disturbance Permit has been issued if required by local or state authorities.
- D. Land disturbance permit, if required, shall be obtained and paid for by the **Contractor**.

1.02 REFERENCES

- A. Georgia Manual for Erosion and Sedimentation Control, current edition.
- B. Georgia Department of Transportation Standard Specifications, current edition.

1.03 SUBMITTALS

- A. Submit product data in accordance with the requirements of these Specifications.
- B. Prior to any construction activity, the Contractor shall submit, for the Engineer's approval, a schedule for the accomplishment of temporary and permanent erosion and sedimentation control work. No work shall be started until the erosion and sedimentation control schedule and methods of operation have been approved by the Engineer.

1.04 QUALITY ASSURANCE

- A. The temporary and permanent erosion and sedimentation control measures shown on the Drawings are minimum requirements. Any additional erosion and sedimentation control measures required by the Contractor's means, methods, techniques and sequence of operation will be installed by the Contractor at no additional cost to the Owner.

- B. Perform all work under this Section in accordance with all pertinent rules and regulations including, but not necessarily limited to, those stated in these Specifications, Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern.
- C. Provide all materials and promptly take all actions necessary to achieve effective erosion and sedimentation control in accordance with the Georgia Erosion and Sedimentation Control Act of 1975, as amended (OCGA 12-7-1, et.seq.) Local ordinances, other permits, local enforcing agency guidelines and these Specifications.
- D. Basic Principals
 - 1. Coordinate the land disturbance activities to fit the topography, soil types and conditions.
 - 2. Minimize the disturbed area and the duration of exposure to erosive elements.
 - 3. Provide temporary or permanent stabilization to disturbed areas immediately after rough grading is complete.
 - 4. Safely convey run-off from the site to a stable outlet to prevent flooding and damage to downstream facilities resulting from increased runoff from the site.
 - 5. Retain sediment on-site that was generated on-site.
 - 6. Minimize encroachment upon watercourses.
- E. Implementation
 - 1. The Contractor is solely responsible for the control of erosion within the Project site and the prevention of sedimentation from leaving the Project site or entering waterways.
 - 2. The Contractor shall install temporary and permanent erosion and sedimentation controls which will ensure that runoff from the disturbed area of the Project site shall pass through a filter system before exiting the Project site.
 - 3. The Contractor shall provide temporary and permanent erosion and sedimentation control measures to prevent silt and sediment from entering the waterways.
 - 4. The Contractor shall limit land disturbance activity to those areas shown on the Drawings.
 - 5. All fines imposed for improper erosion and sedimentation control shall be paid by the Contractor.

1.05 MAINTENANCE

- A. The Contractor shall maintain erosion and sedimentation control measures with disturbed areas on the entire site at no additional cost to the Owner until the acceptance of the Project. Maintenance shall include mulching, re-seeding, clean-out of sediment barriers and sediment ponds, replacement of washed-out or undermined rip rap and erosion control materials, to the satisfaction of the Owner and Engineer.

PART 2 PRODUCTS

2.01 SEDIMENT BARRIER

- A. Silt Fence
 - 1. Type A silt fence shall meet the requirements of Section 171 of the Georgia Department of Transportation Standard Specifications, latest edition.
 - 2. Silt fence fabric shall be an approved product on the Georgia DOT Qualified Product List No. 36, latest edition.
- B. Rock Check Dams: Stone shall conform to the requirements of Section 805.01 of the Georgia Department of Transportation Standard Specification, latest edition, for Stone Dumped Rip Rap except the stone shall be 8-inches or less at the greatest dimension.

2.02 CONSTRUCTION EXIT STONE

Use sound, tough, durable stone resistant to the action of air and water. Slabby or shaley pieces will not be acceptable. Aggregate size shall be in accordance with National Stone Association Size R-2 (1.5 to 3.5-inch stone) or Type 3 rip rap stone conforming to Section 805.01 of the Georgia Department of Transportation Standard Specifications.

2.03 CONCRETE

Concrete shall conform to the requirements specified in Section 03300 of these Specifications for Class AB concrete.

2.04 RIP RAP

- A. Stone Rip Rap: Use sound, tough durable stones resistant to the action of air and water. Slabby or shaley pieces will not be acceptable. Unless shown or specified otherwise, stone rip rap shall be Type 1.
 - 1. Type 1 Rip Rap: Rip rap size shall conform to Section 805.01 of the Georgia Department of Transportation Standard Specification for Type 1 Stone Dumped Rip Rap.
 - 2. Type 3 Rip Rap: Rip rap size shall conform to Section 805.01 of the Georgia Department of Transportation Standard Specifications for Type 3 Stone Dumped Rip Rap.

2.05 FILTER FABRIC

- A. Filter fabric shall conform to the Georgia Department of Transportation Standard Specifications, Section 881.06 for woven fabrics.
- B. Filter fabric shall be an approved product on the Georgia Department of Transportation Qualified Product List No. 28, latest edition.

2.06**GRASSING**

- A. Grassing materials shall meet the requirements of the following sections of the Georgia Department of Transportation Standard Specifications, latest edition:

Material	Section
Topsoil	893.01
Seed and Sod	890
Fertilizer	891.01
Agricultural Lime	882.02
Mulch	893.02
Inoculants	893.04

- B. Seed species shall be provided as shown on the ESC Drawings.
- C. Mulch Binder: Mulch on slopes exceeding 3 (horizontal) to 1 (vertical) shall be held in place by the use of a mulch binder, as approved by the Engineer. The mulch binder shall be non-toxic to plant and animal life and shall be approved by the Engineer.
- D. Water: Water shall be free of excess and harmful chemicals, organisms and substances which may be harmful to plant growth or obnoxious to traffic. Salt or brackish water shall not be used. Water shall be furnished by the Contractor.

PART 3 EXECUTION**3.01 GENERAL**

- A. Temporary and permanent erosion and sedimentation control measures shall prevent erosion and prevent sediment from exiting the site.
- B. All erosion and sedimentation control measures and devices shall be constructed and maintained as indicated on the Drawings or specified herein until adequate permanent disturbed area stabilization has been provided and accepted by the Engineer, all temporary erosion and sedimentation control structures and devices shall be removed.

3.02 INSTALLATION

A. Construction Exit

1. Construction exit(s) shall be placed as shown on the Drawings and as directed by the Engineer. A construction exit shall be located at any point traffic will be leaving a disturbed area to a public right-of-way, street, alley, sidewalk or parking area.
2. Placement of Construction Exit Material: The ground surface upon which the construction exit material is to be placed shall be prepared to a smooth condition free from obstructions, depressions or debris. The plastic filter fabric shall be placed to provide a minimum number of overlaps and a minimum width of one foot of overlap at each joint. The stone shall be placed with its top elevation conforming to the surrounding roadway elevations. The stone shall be dropped no more than three feet during construction.
3. Construction Exit Maintenance: The Contractor shall regularly maintain the exit with the top dressing of stone to prevent tracking or flow of soil onto public rights-of-way and paved surfaces as directed by the Engineer.
4. Construction Exit Removal: Construction exit(S) shall be removed and properly disposed of when the disturbed area has been properly stabilized, the tracking flow or soil onto public rights-of-way or paved surfaces has cease and as directed by the Engineer.

B. Sediment Barriers

1. Sediment barriers shall include, but are not necessarily limited to, silt fences, rock check dams, inlet sediment traps and any device which prevents sediment from exiting the disturbed area.
2. Silt fences, hay bales and rock check dams shall not be used in any flowing stream, creek or river.
3. Sediment barriers shall be installed as shown on the Drawings and as directed by the Engineer.
4. Sediment barriers shall be maintained to ensure the depth of impounded sediment is no more than one-half of the original height of the barrier or as directed by the Engineer. Torn, damaged, destroyed or washed-out shall be repaired, reinforced or replaced with new material and installed as shown on the Drawings and as directed by the Engineer.
5. Sediment Barrier Removal
 - a. Sediment barrier shall be removed once the disturbed area has been stabilized with a permanent vegetative cover and the sediment barrier is

no longer required as directed by the Engineer.

- b. Accumulated sediment shall be removed from the barrier and removed from the site.
- c. All non-biodegradable parts of the barrier shall be disposed of properly.
- d. The disturbed area created by barrier removal shall be permanently stabilized.

C. Rip Rap

- 1. Rip rap shall be placed as shown on the Drawings and as directed by the Engineer. Rip rap shall be placed at all points where natural vegetation is disturbed on the banks of streams or drainage ditches. Compact backfill and place rip rap to prevent subsequent settlement and erosion. This requirement applies equally to construction along side a stream or drainage ditch as well as crossing a stream or drainage ditch.
- 2. When trenching across a stream or drainage ditch rip rap is to be placed shall be brought to the correct lines and grades before placement is commenced. where filing of depressions is required, the new material shall be compacted with hand or mechanical tampers. Unless at creek banks or otherwise shown or specified, rip rap shall begin in a toe ditch constructed in original ground, and the side next to the fill or cut shall have that same slope. After the rip rap is placed, the toe ditch shall be backfilled and the excess dirt hauled off of the site and disposed of properly.
- 3. Placement of Filter Fabric
 - a. Filter fabric shall be placed under all rip rap unless shown or specified otherwise.
 - b. Filter fabric shall not be placed under rip rap on stream or drainage ditch crossings.
 - c. The surface to receive filter fabric shall be prepared to a smooth condition free from obstructions, depressions and debris. The filter fabric shall be installed with the long dimension running up the slope and shall be placed to provide a minimum number of overlaps. The fabric shall be placed to provide a minimum width of one foot of overlap at each joint. The fabric shall be anchored in place with securing pins of the type recommended by the fabric manufacturer. Pins shall be placed on or within 3-inches of the centerline of the overlap. The fabric shall be placed loosely to avoid stretching and tearing during the placement of the stone. The fabric shall be protected at all times during construction from clogging due to clay, silts, chemicals or other contaminants. Contaminated fabric or fabric damaged during installation or during placement or rip rap shall be

removed and replaced with uncontaminated and undamaged fabric at no additional cost to the Owner.

4. Placement of Rip Rap: Rip rap shall be placed on a 6-inch layer of soil, crushed stone or sand overlaying the filter fabric. Rip rap shall be placed with its top elevation conforming with the finished grade or the natural existing slope of the stream bank and stream bottom. The stone shall be dropped no more than three feet during construction.
 - a. Stone Rip Rap: Stone rip rap shall be placed to provide a uniform surface to the thickness specified on the Drawings, or a minimum of 18-inches thick if unspecified. The thickness tolerance for the course shall be -3-inches and +6-inches.

D. Grassing

1. Grassing shall meet the requirements of Section 700 of the Georgia Department of Transportation Standard Specifications, latest edition, unless specified otherwise.
2. Seed rate, fertilization and other requirements shall be provided as shown on the Drawings.
3. Temporary stabilization: Temporary stabilization shall be provided as shown on the Drawings and conforming to these Specifications to control erosion on the site. Temporary stabilization shall be provided to any area which will not receive permanent stabilization within the next 14 calendar days. Partial payment requests may be withheld for those portions of the Project not complying with this requirement.
4. Permanent Stabilization
 - a. Permanent stabilization shall be provided as shown on the Drawings and conforming to these Specifications to control erosion on the site. Permanent stabilization shall be provided to all areas of land disturbance within seven calendar days of the completion of land disturbance for any area greater than 0.25 acre. Partial payment requests may be withheld for those portions of the Project not complying with requirement.
 - b. Where permanent stabilization cannot be immediately established because of an inappropriate season, the Contractor shall provide temporary stabilization. The Contractor shall return to the site at the appropriate season to provide permanent stabilization in areas that received only temporary stabilization.

3.03 FIELD QUALITY CONTROL

All erosion and sedimentation control devices and structures shall be inspected by the Contractor at least once a week and immediately following each rainfall occurrence. Any device or structure found to be damaged will be repaired or replaced by the end of the day. Sediment ponds shall be cleaned out prior to the silt reaching the height or elevation shown on the Drawings.

3.04 CLEAN-UP

- A. Dispose of all excess erosion and sedimentation control materials in a manner satisfactory to the Engineer and Owner.
- B. Final clean-up shall be performed in accordance with the requirements of these Specifications.

END OF SECTION

SECTION 02140 DEWATERING

PART 1 GENERAL

1.01 SUMMARY

- A. This Section shall apply to all excavation, except trench excavation.
- B. Construct all permanent work in areas free from water. Design, construct and maintain all dikes, levees, cofferdams and diversion and drainage channels as necessary to maintain the areas free from water and to protect the areas to be occupied by permanent work from water damage. Remove temporary works after they have served their purpose.
- C. The Contractor shall be responsible for the stability of all temporary and permanent slopes, grades, foundations, materials and structures during the course of the Contract. Repair and replace all slopes, grades, foundations, materials and structures damaged by water, both surface and subsurface, to the lines, grades and conditions existing prior to the damage, at no additional cost to the Owner.

PART 2 PRODUCTS

Furnish well points, pumps, tile drains or other approved methods of the type normally used in dewatering operations. Furnish piezometer wells to monitor groundwater levels.

PART 3 EXECUTION

3.01 CARE OF WATER

- A. Except where the excavated materials are designated as materials for permanent work, material from required excavation may be used for dikes, levees, cofferdams and other temporary backfill.
- B. Furnish, install, maintain and operate necessary pumping and other equipment for dewatering the various parts of the work and for maintaining the foundation and other parts free from water as required for constructing each part of the work.
- C. Install all drainage ditches, sumps and pumps to control excessive seepage on excavated slopes, to drain isolated zones with perched water tables and to drain impervious surfaces at final excavation elevation.
- D. Dewater by means which will insure dry excavations, preserve final lines and grades, do not disturb or displace adjacent soil.
- E. All pumping and drainage shall be done with no damage to property or structures and without interference with the rights of the public, owners of private property.

- F. Do not overload or obstruct existing drainage facilities.
- G. After they have served their purpose, remove all temporary protective work at a satisfactory time and in a satisfactory manner. All diversion channels and other temporary excavations in areas where the compacted fill or other structures will be constructed shall be cleaned out, backfilled and processed under the same Specifications as those governing the compacted fill.
- H. When temporary works will not adversely affect any item of permanent work or the planned usage of the Project, the Contractor may be permitted to leave such temporary works in place. In such instances, breaching of dikes, levees and cofferdams may be required.

3.02 DEWATERING

- A. By the use of well points, pumps, tile drains or other approved methods, the Contractor shall prevent the accumulation of water in excavated areas. Should water accumulate, it shall be promptly removed.
- B. Excavations shall be continuously dewatered to maintain a ground water level no higher than three to four feet below the lowest point in the excavation. Dewatering shall be accomplished well enough in advance of excavation to ensure that groundwater is already lowered prior to completing the final excavation to finish subgrade.
- C. All destabilized subgrade conditions caused by inadequate or untimely dewatering operations shall be undercut and backfilled with suitable backfill material at no additional cost to the Owner.
- D. Piezometer wells are required to monitor the ground water level to insure proper dewatering prior to excavation below the static water table. The number of wells required will vary depending on the size and depth of structures.
- E. Where the presence of fine grained subsurface materials and a high groundwater table may cause the upward flow of water into the excavation with a resulting quick or unstable condition, the Contractor shall install and operate a well point system to prevent the upward flow of water during construction. Water pumped or drained from excavations, or any sewers, drains or water courses encountered in the work, shall be disposed of in a suitable manner without injury to adjacent property, the work under construction, or to pavements, roads, drives, and water courses. No water shall be discharged to sanitary sewers. Sanitary sewage shall be pumped to sanitary sewers or shall be disposed of by an approved method.

END OF SECTION

SECTION 02200 EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

Work in this section consists of all labor, materials, and equipment necessary for earthwork and related operations. This work includes, but is not limited to, excavating all classes of material encountered, handling, storage, transportation and disposal of all excavated and unsuitable material, construction of fills and embankments, backfilling around structures, backfilling trenches and pits, compacting, sheeting, shoring and bracing, preparation of subgrades, surfacing and grading, and any other similar, incidental, or appurtenant earthwork operations which may be necessary to properly complete the work.

1.02 RELATED SECTIONS

Section 2010, Subsurface Conditions
Section 2100, Site Preparation
Section 2125, Erosion and Sedimentation Control
Section 2140, Dewatering
Section 2221, Trenching, Backfilling, Compaction & Embedment
Section 2224, Trench Excavation & Backfill

1.03 GENERAL

- A. Benchmarks: Establish and maintain a permanent bench marks on the site for reference. All vertical dimensions shall be checked from this benchmark.
- B. Finish Grades: Finished grades, as used herein, mean the final grade elevations indicated on the drawings. Should finished grades shown on spot elevations conflict with those shown by the contours, the spot elevations shall govern.
- C. Preliminary Earthwork: Contractor shall remove soft organic type material from the wet areas within the construction areas. This material shall be used after reaching near optimum moisture content as topsoil for final dressing.
- D. Borrow Pits: Submit representative samples of all fill material requiring compaction to the Designated Testing Laboratory. Material and borrow pits shall be approved by the Engineer prior to filling operations. If the quantity available from site grading is not sufficient, purchasing, hauling, and blending of fill shall be done by the Contractor.

- E. Controlled Fill
1. Class I Fill is all structural fill to underside of slabs and to support foundations or footings.
 2. Class II Fill is all fill below finish grade immediately behind walls and in trenches and embankments under walks, drives, parking areas, and all areas to be paved. Top two-feet of this fill shall be Class I Fill.
 3. Class III Fill is all backfill used for filling trenches not under paved areas, slabs, foundations or footings.
- F. Insufficient Fill Material: If quantity of grading material is insufficient to provide finish grade elevations indicated on drawings, Contractor shall obtain additional fill material of specified quality at no additional cost to the Owner.
- G. Excess Cut Material: If quantity of grading material is in excess of quantities necessary to provide finish grade elevations indicated on drawings, any excess material shall be deposited and dressed on site as directed by the Engineer.
- H. Elevations shown on the Drawings as existing are taken from the best existing data and are intended to convey reasonably accurate information about existing elevations. The Contractor should satisfy himself as to exact quantities of excavation and fill materials required to complete the work.
- I. Safety: The Contractor shall perform all earthwork operations in a safe and proper manner. All applicable OSHA regulations shall be observed and practiced by the Contractor. Safety on the jobsite is the Contractor's responsibility. The contractor shall comply with all local regulations and with the Manual of Accident Prevention in Construction of the Associated General Contractors of America, Inc.
- J. Storage: Temporary stockpile locations shall be coordinated with the Owner. Stockpiles shall not block existing surface drainage or access to existing equipment, valves, hydrants, etc. Practice effective erosion control measures around all stockpiles.
- K. Sheeting, Shoring and Bracing: The Contractor shall furnish, place and maintain all sheeting, shoring, bracing and timbering required to properly support any excavation or trenching to prevent all movement of soil, pavement, structures or utilities outside of the excavation or trench. Sheeting, shoring and bracing shall be placed to allow the work to be constructed to the lines and grades shown on the drawings. All sheeting, shoring and bracing shall be removed from the excavation.
- L. Soils Report: The recommendations found in the Soils Investigation and Geotechnical Report shall be followed. This document is incorporated by reference as part of these specifications. See the Supplemental General Conditions for identification of the geotechnical report.

PART 2 PRODUCTS

2.01 FILL MATERIAL

- A. Sand Fill: Material shall consist of a clean sand with a fineness modulus of 1.6 to 3.1 and containing not more than 10 percent by weight finer than No. 200 U.S. Standard Sieve.
- B. Earth Fill: Material shall consist of inorganic material free of roots, cobbles and boulders and classified as GM, GC, SW, SP, SM, ML, SC, or CL by ASTM D2487-85 "Standard Methods for Classification of Soils for Engineering Purposes". Earth Fill shall also conform to the following:
 - 1. Liquid Limit = 50 maximum
 - 2. Plasticity Index = 25 maximum
 - 3. Dry Unit Weight= 100 pcf minimum maximum density
- C. Pervious Fill: Material shall consist of crushed stone or gravel. Size and gradation shall be #7 size as defined by ASTM C33-86, "Standard Specification for Concrete Aggregates" (Nominal size 2" to #4 Sieves).

2.02 UNSUITABLE SITE FILL MATERIAL

Material which does not conform to the above classifications (soil classification MH, OH, OL and PT) may be used as Site Fill material identified on the drawings as "spoil areas" and under topsoil to establish site grades.

2.03 TOPSOIL

Dark organic weed free loam which is free of muck.

PART 3 EXECUTION

3.01 SITE GRADING

- A. Remove all organic matter, stumps and other deleterious matter. Predensify the areas to be filled or upon which structures are to be placed. A loaded dump truck or other rubber tired equipment should be used for the predensification. Overlapping passes of the vehicle should be made across the site in one direction and then at right angles to the original direction of rolling.

Any yielding, pumping or soft areas should be cut out and replaced with fill compacted as described herein.
- B. Finish grading outside of building, where not shown otherwise, shall be given uniform slopes between points for which finished grades are shown, or between points and existing established grade.

- C. Provide drainage away from building walls, where not shown otherwise on the drawings, at a grade of at least 3-inches in 10-feet. Provide shallow swales where indicated on plans at a minimum width of 6-feet and minimum depth of 3-inches with a minimum flowline grade of not less than 1/8-inch per foot. Provide rounding at top and bottom of banks and at other breaks in grade.

3.02 RAINWATER, SURFACE WATER, AND BACKUP

Protect all work, including excavations and trenches, from rainwater, surface water, and back-up of drains and sewers. Furnish all labor, pumps, shoring, enclosures, and equipment necessary to protect and to keep work free of water.

3.03 UNDERCUTTING

- A. During construction, soils classified MH, OH, OL and PT shall be undercut to a depth as shown on the drawings and replaced with compacted structural fill.
- B. Stockpile material by Fill Material classification in on site locations where it will not interfere with construction operations. Materials stockpiled shall be placed in a manner to afford drainage. Protect against erosion.

3.04 PREDENSIFICATION

- A. After undercutting and prior to filling, the newly exposed subgrade enclosed by a line drawn 5'-0" outside the building area shall be scarified and predensified by rolling the surface with compaction equipment. This shall be performed in the presence of an Owner's representative.
- B. Rolling shall consist of a minimum of eight (8) overlapping coverages in each of two perpendicular directions and shall be continued until density tests at a depth of 6-inches below the surface indicate the attainment of 98% of the Standard Proctor Maximum Dry Density (ASTM D698).
- C. Subgrades where footings for structures and paving that will bear on expansive soils should not be allowed to dry or to become excessively wet prior to the placement of fill and final build out of the structure. The filling shall begin on the same day excavations are made.

3.05 INSPECTION OF SUBGRADE

- A. During predensification, the Designated Testing Laboratory shall inspect the newly exposed subgrade to detect soft, loose, or unstable zones.
- B. Replace soft, loose, or unstable zones with Class I Fill.

3.06 INSTALLATION OF CLASS I FILL

- A. Class I Fill shall be Earth Fill material.
- B. Compact within ± 3 percent of optimum moisture content in 4-inch to 8-inch loose layers not less than 98 percent of the Standard Proctor maximum density (ASTM D 698).

3.07 INSTALLATION OF CLASS II FILL:

- A. Class II Fill shall be Earth Fill materials except that fill immediately behind walls and under floor slabs shall be Sand Fill or Pervious Fill material as indicated on drawings.
- B. Compact within ± 3 percent of optimum moisture content in 4-inch to 8-inch loose layers to not less than 95 percent of the Standard Proctor maximum density (ASTM D698).

3.08 INSTALLATION OF CLASS III FILL

Compact fill in utility trenches not under buildings or paved areas to not less than 90 percent of the Standard Proctor maximum density (ASTM D698). See Sections 2221 and 2224 for additional information on trench backfilling procedures.

3.09 INSTALLATION OF BACKFILL

- A. Shore foundation walls which are to be tied into floor slabs prior to installation of Backfill and until slabs have been in place sufficient time to achieve strength and provide structural stability against overturning.
- B. Where Backfill is required on both sides of walls it shall be brought up in even lifts so as not to provide an unequal lateral load.
- C. Install Backfill against Foundation Walls only when directed by the Engineer, and elsewhere as construction progress permits.

3.10 EXCAVATION

Excavate to elevations and dimensions, plus space to permit erection of forms and for waterproofing and installation of drains. All bottoms shall be clean cut, true, level, and sound. Any water softened soils in foundation excavations shall be removed prior to steel and concrete placement.

3.11 GROUNDWATER CONTROL

- A. Maintain water table not less than 3-feet below subgrades during operations which require heavy wheeled or roller equipment and below excavation level during placement of structural fill or crushed aggregate subgrade stabilization as directed by the Engineer. See Section 2140, Dewatering.

- B. Provide temporary ditches as necessary during construction to control seepage from springs and direct the water away from the fill areas.
- C. Install storm sewers as shown on the drawings.

3.12 EXCAVATION STABILIZATION

- A. Where Groundwater Control cannot be accomplished, stabilize bottom of excavation with the installation of 1-foot of crushed aggregate Size #57 (1" to #4) prior to placement of compacted fill.
- B. After stabilization of excavation bottom, initial 1-foot "bridge-lift" of fill may be granular (SP, SW, GP OR GW) fill followed by placement of Controlled Fill.

3.13 COMPACTION TESTING

- A. Field density tests shall be made by a Designated Testing Laboratory selected and paid by the Owner.
- B. Class I Fills: One field density test for each 2000 SF of area after each one-foot lift or one test per 300 linear feet of trench or roadway per one and one half-foot lift.
- C. Class II Fills: One field density test for each 2000 SF of area after each two-foot lift or one test per 300 linear feet of trench or roadway per two-foot lift.
- D. Class III Fill: One field density test per 300 lineal feet of trench at a depth two feet below finish grade.
- E. Exact locations of tests shall be as directed by the Engineer. Two copies of all test results shall be submitted to the Engineer. The Contractor shall be responsible for maintaining a copy of all test results on file at the jobsite.
- F. The Contractor shall be responsible for:
 - 1. Notifying the laboratory on conditions requiring testing.
 - 2. Coordinating the laboratory for field testing.
 - 3. Providing representative fill soil samples to the laboratory for testing purposes. Provide 50 pound samples for each fill soil.

END OF SECTION

SECTION 02221
TRENCHING, BACKFILL, COMPACTION,
EMBEDMENT AND ENCASEMENT

PART I GENERAL

1.01 SUMMARY

- A. The work consists of furnishing all labor, equipment and materials, and performing all operations in connection with the excavation, trenching, backfill, embedment and concrete encasement required to install the pipelines shown on the Drawings and as specified.
- B. Excavation shall include the removal of any obstacles that may obstruct the line of work, and the excavation and removal of all earth, rock or other materials to the extent necessary to install the pipe and appurtenances in conformance with the lines and grades shown on the Drawings or as specified.
- C. Backfill shall include the refilling and consolidation of the fill in the trenches and excavations up to the surrounding ground surface.

1.02 QUALITY ASSURANCE

- A. Density

All references to "Maximum dry density" shall mean the maximum dry density defined by the "Standard Proctor Density," ASTM D 698, unless otherwise specified. Determination of the density of backfill in-place shall meet with the requirements of ASTM D 2922, "Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)".
- B. Sources and Evaluation Testing

Testing of materials to certify conformance with the specification requirements shall be performed by an independent testing laboratory paid by the Contractor. Owner's testing agency shall perform tests at the direction of the Engineer at sufficient intervals to determine conformance of all select material furnished for use on this project.
- C. Trench Width Dimension

The sides of all trenches shall be cut as nearly vertical as possible. The minimum and maximum widths of trenches, measured at an elevation twelve inches above the top of the pipe shall be as specified. If the maximum width is exceeded at any point, the Contractor shall use the next higher class (load factor) of embedment or encasement for the trench width as actually cut, at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 MATERIALS FOR EMBEDMENT OF NON-WRAPPED PIPE

A. Definition

Non-wrapped pipe applies to reinforced concrete cylinder pipe and reinforced concrete pipe.

B. Crushed Limestone

1. Material Description

The crushed limestone material for pipe embedment shall be of three gradations, standard, fine and coarse, and each shall be composed of sound and durable particles, reasonably well graded between the prescribed limits, and complying with the following requirements.

2. Crushed stone for embedment shall contain not more than 1 percent by weight of organic matter (other than native bitumen), clays, loam or pebbles coated therewith, and shall contain not more than 5 percent by weight of any one or combination of slate, shale, schist or soft particles of sandstone.

3. Gradation Limits. The sample of crushed stone for each gradation when tested in accordance with ASTM C 136, Sieve or Screen Analysis of Fine and Coarse Aggregates, shall comply with the following requirements.

a. Standard Crushed Rock

Sieve Size	% by Weight Passing
1 inch	100
7/8 inch	98 - 100
5/8 inch	55 - 85
3/8 inch	0 - 15
No. 4	0 - 5
No. 10	0 - 2

b. Fine Crushed Rock

Sieve Size	% by Weight Passing
1/2 inch	100
3/8 inch	98 - 100
No. 4	15 - 60
No. 10	0 - 2

- c. Coarse Crushed Rock. Coarse crushed rock embedment shall be graded from 3/4 inch to 1 1/2 inch, free of fines.

C. Gravel

Gravel shall consist of washed or screened gravel, 1/4 inch to 1/2 inch in size, pea gravel that is retained on 1/8 inch mesh but passes the 5/8 inch mesh, or similar sized crushed rock or slag, free of fines.

2.02 MATERIAL FOR EMBEDMENT OF WRAPPED PIPE

The embedment is applicable to steel, ductile iron pipe and all plastic pipes. Embedment for wrapped or coated pipe shall be well graded sand to a height of 12 inches over the top of the pipe. The material shall be free from binder, rocks, lumps, organic material, clay or other undesirable material.

2.03 CONCRETE FOR EMBEDMENT AND ENCASEMENT

Concrete embedment and encasement shall have a minimum compressive strength of 2,000 pounds per square inch at 28 days. Dry mix will not be permitted. The concrete cushion portion of the embedment or encasement shall be mixed moist or damp to give a slump of not more than one inch. Concrete for the sides and top, if specified, shall be mixed to obtain a slump of not less than one inch nor more than three inches, and shall be placed after the concrete used for cushion portion of the embedment or encasement sets up.

PART 3 EXECUTION

3.01 TRENCH EXCAVATION

A. Topsoil

Topsoil and grass shall be stripped a minimum of six inches over the trench excavation site and stockpiled separately for replacement over finished grading areas.

B. Excavation

1. Trenches shall be excavated to the lines and grades shown on the Drawings with the centerlines of the trenches on the centerlines of the pipes.
2. The sides of all trenches shall be vertical to a minimum of one foot above the top of the pipe. Unless otherwise indicated on the Drawings, the trench width shall be equal to the sum of the outside diameter of the pipe plus 2 feet plus or minus 3 inches.
3. Wherever the prescribed maximum trench width is exceeded, the Contractor shall use the next higher class (load factor) embedment or encasement for the full trench width as actual at no additional cost to the Owner.

4. The trenches shall be excavated to the required depth allowing the placement of pipe bedding to the thickness shown on the Drawings.
5. Should the bottom of the trench become an unstable foundation for the pipe through the failure of the Contractor to adequately perform, the Contractor shall remove the unstable material and fill the trench to the proper subgrade with crushed rock. No extra compensation will be allowed for this material or work. Should the trench be inadvertently excavated to a greater depth than necessary, crushed rock fill to the proper subgrade shall be provided at no additional cost to the Owner.
6. Should the undisturbed material encountered at the grade depth constitute, in the opinion of the Engineer, an unstable foundation for the pipe, the Contractor shall be required to remove such unstable material and fill the trench to the proper subgrade with crushed rock.
7. Control drainage in the vicinity of excavation so the ground surface is properly pitched to prevent water running into the excavation.

3.02 SHEETING AND SHORING

- A. In caving ground or in wet, saturated or flowing or otherwise unstable materials, the sides of all trenches and excavations shall be adequately sheeted and braced, to maintain the excavation from slides or cave-ins and to provide safety for workmen.
- B. In all cases, excavation protection shall strictly conform to the requirements of the Occupational Safety and Health Act of 1970.
- C. Sheet piling and shoring shall not be left in place unless its removal is determined impractical by the Engineer.

3.03 DEWATERING EXCAVATIONS

- A. There shall be sufficient pumping equipment available at all times to remove any water that accumulates in excavations. Where the pipe line crosses natural drainage channels, the Work shall be conducted in such a manner that unnecessary damage or delays in the prosecution of the Work will be prevented. Provision shall be made for the satisfactory disposal of surface water pumped to prevent damage to public or private property.
- B. In all cases, accumulated water in the trench shall be removed before laying pipe, placing concrete or backfilling.

3.04 EXCAVATED MATERIALS

Excavated materials shall be placed adjacent to the work to be used for backfilling as required. Top soil shall be stockpiled to be used for backfilling as required. Top soil shall be carefully placed in its original location.

3.05 EMBEDMENT OF NONWRAPPED PIPE

- A. The embedment shall be crushed limestone, gravel, or select material, or as specified or indicated on the Drawings. The initial layer of embedment placed to receive the pipe shall be brought to grade and dimensions indicated on the Drawings, and the pipe shall be placed thereon and brought to grade by tamping, or by removal of the slight excess amount of embedment under the pipe. Adjustment to grade line shall be made by scraping away or filling with embedment material. Each pipe section shall have a uniform bearing on the embedment for the length of the pipe.
- B. After embedment has been placed, joints made and inspected, and sufficient time has passed to prevent damage to the embedment or joints, select backfill shall be placed to a depth of 12 inches over the top of the pipe or as shown on the Drawings.
- C. If approved by a Soils Engineer, good, sound earth may be used as select material for backfill. Good, sound earth is defined as gravel, sandy loam or loam, free from excessive clay. Good, sound earth will be allowed as select material only if sand or rock cuttings are not present on the project site.
- D. Select material shall be brought up in hand or mechanically tamped layers not exceeding 8 inches in thickness of loose fill approximately equal on each side of the pipe. The first layer shall not extend above the spring line of the pipe. When necessary, backfill materials shall be moistened to facilitate compaction by tamping. Compaction shall be 95 percent of maximum dry density as determined by ASTM D698.
- E. Final backfilling shall be as specified in Paragraph 3.09.

3.06 WRAPPED PIPE

- A. Pipe shall be backfilled with well graded sand to a height of 12 inches over the top of the pipe. The sand shall be brought up in hand or mechanically tamped lifts not exceeding 8 inches in thickness of loose fill, approximately equal on each side of the pipe. All backfill to 12 inches above the pipe shall be compacted to 90 percent of maximum dry density or as shown on the Drawings.
- B. Final backfilling shall be as specified in paragraph 3.09.

3.07 CONCRETE EMBEDMENT AND ENCASEMENT

- A. After pipe joints are completed, the voids at the joints in the embedments shall be brought to proper grade. Where concrete is placed over or along the pipe, it shall be placed in such manner as not to injure the joints or displace the pipe.
- B. While placing concrete embedment and until the concrete sets up, each pipe shall be properly braced and held to grade so as to prevent any possible shifting or floating of the pipe.
- C. No cleavage line between the base concrete and the side or top concrete will be allowed. Backfilling shall be done in a careful manner and at such a time after concrete embedment or encasement has been placed as not to damage the concrete in any way.
- D. Backfill placed over concrete embedment, encasement, cradle, or block shall not be placed until the concrete has set up to such an extent that backfill operations will not damage the concrete.
- E. Encasements and embedment shall end only at a flexible pipe joint.

3.08 CONCRETE THRUST BLOCKING FOR FLEXIBLE-JOINT BURIED PIPING

- A. Thrust blocking of concrete shall be provided at all changes of direction, tees and crosses on all buried piping having flexible joints. Thrust blocking shall be placed against undisturbed trench walls and the pipe in such a manner that the blocking will prevent the pipe from moving when subjected to require test pressure.
- B. Thrust blocking for large diameter pipes and higher working pressure shall require formed construction to provide adequate bearing area.
- C. Concrete thrust blocking shall be in place four (4) days prior to testing the pipeline.
- D. The minimum bearing areas for thrust blocks shall be determined for each pipe based on pipe size and bend and internal fluid test pressure on the pipe.
- E. The method of computing bearing area for some cases indicated on standard detail sheets on Plans. In all cases the Contractor shall compute the thrust block requirements.

3.09 FINAL BACKFILL PLACEMENT

- A. From 12 inches above the top of the pipe, or as shown on the Drawings, the trench or excavation shall be backfilled with select material from the excavation placed in a manner approved by the Owner. No excessively large rocks or debris of any sort are to be put into the backfill, and appreciable weight of any sort, other than backfill, shall not be allowed on the pipe until it has been covered to such a depth that damage to the pipe or joints will

not occur. Except under roadways, the top six (6) inches shall be topsoil obtained as specified in Paragraph 3.01 of this Section.

B. Excavated material which is unsuitable for backfilling and excess material shall be disposed of in a lawful manner. Remove surplus rock from the trenching operations from the site.

C. Method of Consolidation

1. The remaining backfill outside of structures shall be accomplished either by mechanical compaction in layers not to exceed 8" loose thickness to 90% Standard Proctor Density or by jetting and flooding until no additional settlement occurs.

2. Backfill under road, concrete slabs, and related items shall be cement stabilized sand made of granular material and two sacks per cubic yards of Type 1 Portland cement. The stabilized sand shall be tamped in place.

3. Backfill in Structural Excavation Zone

The backfill for pipeline trenches located in the zone of excavation for structures shall be well graded sand, free from binders, rocks, lumps, organic or clay material. The backfill shall be consolidated to provide a density of compaction of at least 95 percent of the maximum dry density as determined by ASTM D 698.

END OF SECTION

SECTION 02224
TRENCH EXCAVATION AND BACKFILL

PART 1 GENERAL

1.01 SUMMARY

- A. The work under this Section consists of furnishing all labor, equipment and materials and performing all operations in connection with the trench excavation and backfill required to install the site utilities, including all pipelines, electrical conduits and duct banks shown on the Drawings and as specified.
- B. Excavations shall include the removal of any trees, stumps, brush, debris or other obstacles which remain after the clearing and grubbing operations, which may obstruct the work, and the excavation and removal of all earth, rock or other materials to the extent necessary to install the utility and appurtenances in conformance with the lines and grades shown on the Drawings and as specified.
- C. Backfill shall include the refilling and compaction of the fill in the trenches and excavations up to the surrounding ground surface or road grade at crossing.

1.02 DEFINITIONS

The trench is divided into five specific areas:

- A. Foundation: The area beneath the bedding, sometimes also referenced to as trench stabilization.
- B. Bedding: The area above the trench bottom (or foundation) and below the bottom of the utility.
- C. Haunching: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.
- D. Initial Backfill: The area above the haunching material and below a plane 12-inches above the top of the barrel of the pipe or the top of duct bank.
- E. Final Backfill: The area above a plane 12-inches above the top of the utility.

1.02 REFERENCES

- A. Perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596), as amended. The Contractor shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P AExcavation, Trenching & Shoring as described in OSHA publication 2226.

- B. ASTM D 698.
- C. ASTM D 4253, Maximum Index Density of Soils Using a Vibratory Table.
- D. ASTM D1556, Density of Soil in Place by the Sand Care Method.
- E. ASTM D 2837, Density of Soil in Place by the Drive-Cylinder Method.
- F. ASTM D 2922, Density of Soil and Soil Aggregate In Place by Nuclear Methods (Shallow Depth).

1.03 QUALITY ASSURANCE

- A. Density: Tests for compaction and density shall be conducted by and independent testing laboratory selected in accordance with Section 02200 of these Specifications.
 - 1. The soils testing laboratory is responsible for the following:
 - a. Field compaction testing shall be based on using the maximum dry density determined by the Standard Proctor Compaction Test in accordance with ASTM D 698.
 - b. Maximum dry density for non-cohesive materials shall mean the maximum index density as determined by ASTM D 4253.
 - c. Determination of in-place backfill density shall be done in accordance with ASTM D 1556, ASTM D 2937, or ASTM D 2922.
 - d. Field density tests for each two feet of lift; one test for each 5,000 square feet of fill.
 - e. Inspecting and testing stripped site, subgrades and proposed fill materials.
 - 2. Contractor's duties relative to testing include:
 - a. Notifying laboratory of conditions requiring testing.
 - b. Coordinating with laboratory for field testing.
 - c. Providing representative fill soil samples to the laboratory for test purposes. Provide 50 pound samples of each fill soil.
- B. Sources and Evaluation Testing: Testing of materials to certify conformance with the Specifications shall be performed in accordance with Section 02200 of these Specifications.
- C. Field density tests for each two feet of lift, one test for each 2,000 feet of pipe installed or more frequently if ordered by the Engineer.

PART 2 PRODUCTS

2.01 TRENCH FOUNDATION MATERIALS

- A. Crushed stone shall be utilized for trench foundation (trench stabilization).
- B. Crushed stone shall conform to Georgia DOT Standard Specifications for Construction, 800.01, size No. 57.

2.02 BEDDING AND HAUNCHING MATERIALS

- A. Unless specified otherwise, bedding and haunching materials shall be crushed stone as specified above.
- B. Earth materials utilized for bedding and haunching shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, earth bedding and haunching materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as bedding or haunching material, provide select material conforming to the requirements of this Section at no additional cost to the Owner.

2.03 INITIAL BACKFILL

- A. Initial backfill material shall be crushed stone or earth materials as specified for bedding and haunching materials.
- B. Earth materials utilized for initial backfill shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock for at least one foot above the top of the pipe, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. No stone larger than eight (8) inches in its greatest dimension shall be used for backfill. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, initial backfill materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as initial backfill material, provide select material conforming to the requirements of this Section.

2.04 FINAL BACKFILL

Final backfill material shall be general excavated earth materials, shall not contain rock larger than 8-inches at its greatest diameter, cinders, stumps, limbs, man-made wastes and

other unsuitable materials. If materials excavated from the trench are not suitable for use as final backfill material, provide select material conforming to the requirements of this Section.

2.05 SELECT BACKFILL

Select backfill shall be materials which meet the requirements as specified for bedding, haunching, initial backfill or final backfill materials, including compaction requirements.

2.06 CONCRETE

Concrete for bedding, haunching, initial backfill or encasement shall be Class AC concrete in accordance with Section 03300 of these Specifications.

2.07 DETECTION TAPE

Furnish a metalized tape, ATerra Tape Type D for water as manufactured by Griffolyn Co., Inc. Or approved equal where shown.

PART 3 EXECUTION

3.01 PREPARATION

Topsoil and grass shall be removed.

3.02 TRENCH EXCAVATION

- A. Description: The trench shall be dug to the alignment and grade required. The trench shall be braced if necessary and drained in order that workmen therein may work safely and efficiently. It is essential that the discharge from any pumps be led to natural drainage channels or to drains.
- B. Width: Minimum width of trench shall be six (6) inches from the outside of barrel of pipe on each side of pipe. Maximum width of trench shall be nine (9) inches from the outside of barrel of pipe on each side of pipe. Sides of trench shall be dug and maintained substantially vertical except Contractor shall adhere to all applicable requirements of OSHA for trench safety.
- C. Correcting Faulty Grade: Any part of the trench excavated below grade shall be corrected with approved material thoroughly compacted.
- D. Bell Holes, Required: Bell holes of ample dimensions shall be dug in trenches at each joint to permit the joint to be made properly.
- E. Braced and Sheeted Trenches: Wherever necessary to prevent caving, excavations shall be adequately sheeted and braced. Where sheeting and bracing are used, the trench width

shall be increased accordingly. Trench sheeting shall remain in place until the pipe has been laid, tested for defects, and repaired if necessary, and the earth around it compacted to a depth of two feet over the top of the pipe.

- F. Trench Stabilization: Wherever the material at the bottom of the trench is unsuitable for the proper installation of the pipe, the Engineer or his representative will direct the removal and replacement of the unsuitable material.

When so directed, undercut the trench and backfill with No. 57 stone meeting the requirements of GA D.O.T. Specification 800.01. Place and compact this material to bring the trench to the required grade.

- G. Pipe Alignment and Grade: The pipe shall be laid in the trench so that the interior surface of pipe shall conform accurately to the grades and alignments fixed and shown on the plans.

- H. Rock Excavation:

1. Definition of Rock: Any material which cannot be excavated with a backhoe having a bucket curling force rated at not less than 18,300 pounds (Caterpillar Model 215 or equal), and occupying an original volume of at least one-half cubic yard.
2. Excavation: Where rock is encountered in trenches, excavate to the minimum depth which will provide clearance below the pipe barrel of 4 inches plus required bedding depth for pipe and manholes. Remove boulders and stones to provide a minimum of 6 inches clearance between the rock and any part of the pipe or manhole.
3. Blasting: Provide experienced workmen to perform blasting. Conduct blasting operations in accordance with all existing ordinance and regulations. Protect all structures from the effects of the blast. Repair any resulting damage.

If the Contractor persistently used excessive blasting charges or blasts in an unsafe or improper manner, the Engineer or his representative may direct the Contractor to employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge.

4. Removal of Rock: Do not use excavated rock as backfill material. Dispose of rock which is surplus or not suitable for use as rip rap.
- I. Haunching of Sewer: Haunch pipelines in accordance with detail drawing and the following specifications. Haunching will be required for all gravity sewers. Haunching material shall be No. 57 stone.
- J. Bedding of Sewer: Bed pipelines in accordance with the following specifications.

1. Bedding Materials:
 - a. PVC Sewer: All bedding materials shall be crushed stone unless shown or specified otherwise. Crushed stone bedding materials shall meet the requirements of Georgia Department of Transportation Specification 800.01 for No. 57 stone.
 - b. Sewer Laterals: The bedding requirement for the laterals from the main sewer to the edge of the road right-of-way or easement shall be the same as applicable to the main sewer.
 - c. Manholes: All bedding materials shall be crushed stone unless shown or specified otherwise. Crushed stone bedding materials shall meet the requirements of Georgia Department of Transportation Specification 800.01 for No 57 stone.
2. General: Compact stone bedding material by tamping or slicing with a flatblade shovel. Prepare the trench bottom to support the pipe uniformly throughout its length. Provide bell holes to relieve pipe bells of all load. If the trench is excavated to excessive width or depth, provide the next better class of bedding. In rock trenches, bed pipe in at least six inches of bedding material.
3. Bedding Classifications: All gravity sewer installations shall conform to the following bedding classifications in accordance with ASTM C12.
 - A. Gravity Sewers and Accessories: Lay PVC pipe with minimum Class AB bedding, unless shown or specified otherwise.
 1. Class AA (Bedding Factor - 2.8): Excavate the bottom of the trench flat a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Lay pipe to line and grade on concrete block. Place concrete to the full width of the trench and to a height of one-fourth of the outside diameter of the pipe above the invert.
 2. Class AB (Bedding Factor - 1.9): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to the centerline of the pipe.
 3. Class AC (Bedding Factor - 1.5): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding materials to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to a height of one-fourth the outside diameter of the pipe above the bottom of the pipe barrel.

4. Manholes: Excavate to a minimum of 12 inches below the planned elevation of the base of the manhole. Place and compact stone bedding material to the required grade before constructing the manhole
 5. Compaction: Bedding under pipe and manholes shall be compacted to a minimum of 90 percent of the maximum dry density as determined by the Standard Proctor Compaction Test, ASTM D 698.
- J. Care of Surface material for Reuse: If local conditions permit their reuse, all surface materials suitable for reuse in restoring the surface shall be kept separate from the general excavation material.
- L. Manner of Piling Excavated Materials: All excavated materials shall be piled so that it will not endanger the work and so that it will avoid obstructing roads and driveways. Drainage channels shall be kept clear or other satisfactory provisions made for drainage.
- M. Trenching by Machine or by Hand: The use of trench digging machinery will be permitted except in places where operation of same will cause damage to existing structures above or below the ground; in which case, hand methods shall be employed.

3.03 INITIAL BACKFILL

- A. As soon as practicable after the completion of laying and jointing of the pipe, the trench shall be backfilled, and at no time shall the completed backfilled trench be more than 200 feet behind the pipe laying. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill and ensure the uniform distribution of the loads over the top of the pipe.
- B. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least 18-inches above the pipe or duct bank. Layer depths shall be a maximum of 6-inches for pipe 18-inches in diameter and smaller and a maximum of 12-inches for pipe larger than 18-inches in diameter.
- C. Backfill on both sides of the pipe simultaneously to prevent side pressures.
- D. Compact each layer thoroughly with suitable hand tools or tamping equipment.
- E. Initial backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless shown or specified otherwise.
- F. For PVC gravity sewer, crushed stone shall be used for initial backfill up to 6-inches above the pipe barrel.
- G. For electrical duct banks, place the first 12-inches of initial backfill materials as specified in this Section. Place in 6-inch layers, compact with suitable hand tools or tamping equipment.

- H. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.

3.04 CONCRETE ENCASEMENT FOR PIPELINES

Where concrete encasement is shown on the Drawings for pipelines, excavate the trench to provide a minimum of 6-inches clearance from the bell of the pipe. Lay the pipe to line and grade on concrete blocks. In lieu of bedding, haunching and initial backfill, place concrete to the full width of the trench and to a height of not less than 6-inches above the pipe bell. Do not backfill the trench for a period of at least 24 hours after concrete is placed.

3.05 FINAL BACKFILL

- A. After initial backfill materials has been placed and compacted, backfill with final backfill material. Place backfill material in uniform layers, compacting each layer thoroughly as follows:
 - 1. In 6-inch layers, if using light power tamping equipment, such as a jumping jack.
 - 2. In 12-inch layers, if using heavy tamping equipment, such as hammer with tamping feet.
- B. Final backfill shall be compacted to a minimum 85 percent of the maximum dry density, unless specified otherwise.
- C. Backfill carefully to provide a finished grade at the elevations shown on the Drawings.
- D. The top 6-inches shall be topsoil obtained as specified in Section 02200 of these Specifications.
- E. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.
- F. Settlement: If trench settles, re-fill and grade the surface to conform to the adjacent surfaces.
- G. Remove and dispose of excess or unsuitable materials in accordance with the requirements of Section 02200 of these Specifications.

3.06 ADDITIONAL MATERIAL

Where final grades above the pre-construction grades are required to maintain minimum cover, additional fill material will be as shown on the Drawings. Utilize excess material excavated from the trench, if the material is suitable. If excess excavated materials are not suitable, or if the quantity available is not sufficient, provide additional suitable fill material.

3.07 BACKFILL UNDER ROADS

Compact backfill underlying pavement and sidewalks, and backfill under dirt and gravel roads to a minimum 95 percent of the maximum dry density. The top 12-inches shall be compacted to a minimum of 98 percent of the maximum dry density.

3.08 BACKFILL ALONG RESTRAINED JOINT PIPE

Backfill along restrained joint pipe shall be compacted to a minimum 90 percent of the maximum dry density.

3.09 DETECTION TAPE

Where required, detection tape shall be buried 4 to 10-inches beneath the ground surface directly over the top of the utility. Should detection tape need to be installed deeper, the Contractor shall provide 3-inch wide tape. In no case shall detection tape be buried greater than 20-inches from the finished grade surface.

END OF SECTION

SECTION 02226
SUBGRADE CONSTRUCTION AND PREPARATION

PART 1 GENERAL

1.01 SUMMARY

The work described in this section includes furnishing all labor and equipment necessary for the construction and preparation of part or all of the road bed to receive the immediate construction of a base or pavement thereon.

1.02 INSPECTION AND TESTING

- A. Subgrade testing will be performed by an independent testing laboratory.
- B. The testing agency shall test in-place subgrade for compliance with specified compaction requirements.
- C. Compaction
 - 1. Subgrade: Minimum acceptable density shall be 95 percent of maximum dry density in accordance with AASHTO T-99. Conduct one test for each 2,500 square yards of in-place material, but in no case less than one daily.
- D. Contractor's Duties Relative to Testing
 - 1. Notifying laboratory of conditions requiring testing.
 - 2. Coordinating with laboratory for field testing.
 - 3. Paying costs for performing testing and for retesting where initial test reveal non-conformance with specified requirements.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EQUIPMENT

All equipment necessary and required for the construction of the subgrade must be on the Project and proven to be first-class working order before construction will be permitted to begin.

3.02 SUBGRADE PREPARATION

- A. Road and drainage excavation and embankment construction shall be performed in accordance with the provisions of Section 02200 of these Specifications.

- B. The subgrade shall be prepared to the lines and grades staked by a GA Registered Land Surveyor.
- C. Where excavation is necessary to prepare the subgrade, the material removed shall be carefully stored. Unsuitable material shall be wasted.
- D. All rock shall be removed to a depth of not less than 6-inches below the surface of the subgrade and all holes or depressions, caused by the removal of rock, or otherwise, shall be backfilled with satisfactory material and thoroughly compacted.
- E. Where the roadbed is below grade, the Contractor shall prepare the subgrade by hauling and spreading satisfactory material excavated in channeling, or otherwise. The material shall be spread in layers not to exceed 6-inches in thickness and thoroughly compacted by rolling, using water if directed. Each layer shall have been completed before the succeeding layer is started.
- F. Where it is intended or required to use steel forms in the construction of the base of pavement, the subgrade shall be constructed at least 12-inches wider, on each side, than the net width of the base of pavement. For bases or pavements using wooden forms, the subgrade shall be constructed at least 6-inches wider, on each side, than the width of the base of pavement, as indicated on the Drawings or as directed.
- G. Where sub-bases are to be constructed on the subgrade, the limits of the subgrade preparation shall extend across the entire section upon which any sub-base course is to be applied, including the shoulders.

3.03 SUBGRADE COMPACTION

- A. After the subgrade has been appropriately prepared and shaped, it shall be loosened in its entirety by disking, harrowing or other approved methods to a depth of not less than 6-inches prior to its being compacted to the approved density. The subgrade shall then be thoroughly compacted with the 10 ton roller or pneumatic tired roller. The density shall be 98 percent of AASHTO density when tested by the standard Specifications for Compaction and Density of Soils, AASHTO Serial Designation T 99 (latest revision). The limits of the subgrade compaction shall extend across the entire section upon which any base or sub-base course is to be applied, including the shoulders. Prior to reworking and compacting the subgrade, all vegetation within the limits as set out above shall be removed and properly disposed of as directed by the Engineer.
- B. All soft, yielding material, which will not compact readily under the roller, shall be removed as directed. All holes or depression caused by the removal of material, as described above, shall be backfilled with satisfactory material and the entire surface thoroughly compacted with the roller where possible, or otherwise when directed by the Engineer.

- C. The subgrade shall be checked after rolling and adjusted so as to conform to the grade and cross section, as indicated or directed.

3.04 SCOPE OF SUBGRADE

The subgrade shall be true to lines, grades and cross sections, must be free from dust or other loose material, must have a uniform bearing power, and shall be prepared and maintained at least 50 feet in advance of the placing of any materials thereon.

3.05 DRAINAGE

- A. Grading of the subgrade shall be performed in such a manner that there will not remain on the roadbed, at anytime, berms of earth or other material which will interfere with the immediate drainage of water from the subgrade of the side ditches. All side ditches and drains shall be maintained to provide for proper drainage during the construction.
- B. All ditches and drains shall be completed so as to drain the roadbed effectively before the placing of any construction materials will be permitted.

3.06 PROTECTION OF SUBGRADE

- A. In handling materials, equipment, tools, etc., the Contractor shall take all precaution necessary to protect the subgrade from damage. Only hauling necessary for the purpose of construction will be permitted on the subgrade after it has been completed.
- B. If ruts of 2-inches or more in depth are formed in the subgrade, all construction materials, whether stored or in place, within the range of such ruts, shall be removed and the subgrade shall be reshaped and rolled. All ruts or rough places developing in a completed subgrade shall be smoothed and the subgrade rerolled.

END OF SECTION

**SECTION 02228
WASTE MATERIAL DISPOSAL**

PART 1 GENERAL

1.01 SUMMARY

Dispose of waste soils, cleared and grubbed materials which are in excess of or are unsuitable for use in the permanent Work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 WASTE DISPOSAL

- A. Disposal of the cleared and grubbed materials shall not be allowed by burning. Burying of materials on the site shall not be allowed. Disposal of materials in streams is not acceptable; do not pile materials in stream channels or along the banks subject to flooding. Timber within the areas cleared shall become the property of the Contractor. The contractor may cut, trim, hew, saw or otherwise dress felled timber within the limits of the Work area, provided all timber and all waste materials are disposed of as specified. All fence material removed within the areas to be cleared shall become the property of the Contractor and shall be removed from the job site.
- B. Dispose of excavated materials not meeting specifications for use as compacted fill or other required fills in a designated waste disposal area, as approved by engineer. That material from stripping which is suitable for use as topsoil shall be stockpiled in sufficient quantity to provide not less than 4-inches of topsoil on slopes of the compacted fill, on the cut slopes and embankment slopes of road construction, and in other areas requiring sprigging and seeding. The topsoil so placed shall be uniformly spread and graded but shall not be compacted.

END OF SECTION

**SECTION 02523
CONCRETE SIDEWALK AND DRIVEWAY**

PART 1 GENERAL

1.01 SUMMARY

- A. Concrete sidewalk shall be constructed of Portland cement concrete, at the locations and to the dimensions, lines, grades and cross section indicated on the Drawings or as directed by the Engineer and in conformity with the provisions and requirements set out in these Specifications.
- B. Concrete driveways shall be constructed of Portland Cement concrete, at the locations and to the dimensions, lines, grades and cross section indicated on the Drawings or as directed by the Engineer, and in conformity with the provisions and requirements set out in these Specifications.
- C. Concrete sidewalk and driveway shall include all the necessary excavation, unless otherwise indicated, subgrade and subbase preparation, backfilling, final clearing up and completing all incidentals.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Materials used in the construction of sidewalks and driveways, in addition to the general requirements of these Specifications, shall conform, unless otherwise stipulated, to the following:
 - 1. Concrete shall be manufactured of the materials meeting the requirements of and in accordance with the provisions and requirements for Class A concrete as set out in Section 03300 of these Specifications.
 - 2. Crushed stone for base shall meet the gradation requirements for Size 7 or 8 as specified in ASTM D 448 or AASHTO M43.

2.02 FORM MATERIAL

- A. Forms may be constructed of wood or metal.
- B. The lumber to be used in the construction of wood forms shall be free of bulge or warp, of uniform width, not less than 1 ½ -inches (commercial) in thickness and shall be sound and free from loose knots. Stakes shall be not less than 2 x 4-inch lumber of sufficient length that, when driven they will hold the forms rigidly in place.

PART 3 EXECUTION

3.01 LABOR

For finishing, competent and skilled finishers shall be provided.

3.02 EQUIPMENT

- A. All equipment necessary and required for the construction of concrete sidewalks and driveways, must be on the Project and proven to be in first class working condition before construction begins.
- B. A one bag mixer will be permitted when the total output of concrete, per 10 hour day does not exceed 25 cubic yards.
- C. Satisfactory floats, edgers, spades and tamps shall be furnished. Tamps of not over 8-inch diameter and weighing not less than 25 pounds shall be provided for tamping subgrade. A 10 foot longitudinal float of the inverted T-type with plough handles attached for manipulation, and a rigid float not less than 18-inches longer than the width of the walk being constructed, shall be provided.

3.03 CLEARING AND GRUBBING

Clearing and grubbing shall be performed in accordance with the requirements of Section 02100 of these Specifications.

3.04 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

Unless otherwise indicated or stipulated, the removal of structure, obstructions, etc., will be performed in accordance with the requirements of these Specifications.

3.05 ROAD AND DRAINAGE EXCAVATION

Road and drainage excavation, as indicated on the Drawings, shall be performed in accordance with the requirements of Section 02200 of these Specifications.

3.06 EMBANKMENT CONSTRUCTION

Embankment construction, as indicated on the Drawings or as directed by the Engineer, shall be performed in accordance with the provisions of Section 02200 of these Specifications.

3.07 SUBGRADE PREPARATION

- A. The subgrade for sidewalks and driveways shall be formed by excavation to a depth equal to the thickness of the concrete +2-inches.
- B. All subgrade shall be of such width as to permit the proper installation and bracing of the forms.
- C. Yielding, or unsuitable material shall be removed and backfilled with satisfactory material. Place 6-inches of graded aggregate base under commercial/industrial driveways, compacted thoroughly and finished to a smooth, unyielding surface and proper line, grade and cross section of the proposed construction.

3.08 FORMS

- A. All forms shall be set upon the prepared subgrade, true to lines and grade, and held rigidly in place so as to not to be disturbed or displaced during the placing of the concrete. The top of the form shall be set to exact grade and the height shall be equal to not less than the thickness of the proposed concrete.
- B. All forms shall be so constructed as to form the cross section, contour, etc., of the proposed construction.
- C. Immediately before placing the concrete, the forms shall be given a coat of light oil and where being removed and used again, the forms shall be thoroughly cleaned and oiled each time.
- D. Forms shall be removed within 24 hours after placing concrete and no pressure shall be exerted upon the concrete in removing forms.
- E. When the sidewalk is to be joined to an existing sidewalk, the existing sidewalk, if not in proper condition for the junction, shall be cut to a neat line perpendicular to both the centerline and the surface, or as indicated by the Engineer.

3.09 EXPANSION JOINTS

- A. Unless otherwise indicated on the Drawings, premoulded expansion joint filler, 2-inch in thickness, shall be placed at the locations and in line with expansion joints in the adjoining pavement, gutter, and not otherwise indicated on the Drawings, a 2-inch premoulded expansion joint filler shall be placed at intervals of not over 50 feet apart. All premoulded expansion joint filler must be cut to full width or length of the proposed construction and shall extend to within 2-inch of the top or finished surface. All longitudinal expansion joints shall be placed as indicated on the Drawings or as directed by the Engineer.

- B. All expansion joints shall be true, even and present a satisfactory appearance.
- C. All expansion joint material protruding after the concrete has been finished shall be trimmed.

3.10 MANUFACTURING AND PLACING CONCRETE

- A. Immediately before placing concrete, the depth of the proposed concrete shall be checked by means of a templet cut true to the cross section of the proposed construction and any irregularities shall be corrected.
- B. Immediately before placing concrete, all subgrade shall be thoroughly sprinkled or wetted.
- C. Concrete shall not be placed upon a frozen subgrade or subbase.
- D. Construction joints will be permitted only at grooves or at expansion joints.
- E. The concrete shall be manufactured and placed in accordance with the requirements of Section 03300 of these Specifications.

3.11 FINISHING

- A. The concrete shall be stuck-off with a transverse template resting upon the side forms and then shall be floated with a longitudinal float working the float transversely across the concrete with a sawing motion, always maintaining it parallel to the edges of the sidewalk, or driveway, where practicable, and in such a manner that all surplus water, laitance and inert material shall be removed from the surface. This operation shall be continued until the surface of the concrete shows no variation from 10 foot straightedge. If necessary, additional concrete shall be added to fill depressions, and the longitudinal float used again. The longitudinal float shall not be moved ahead more than one-half its length at any time.
- B. When the surface of the concrete is free from water and just before the concrete obtains its initial set, it shall be gone over and finished with a wooden float so as to produce a sandy texture. The longitudinal surface variations shall be not more than 1/4-inch under a 12 foot straightedge, nor more than 1/8-inch on a five foot transverse section. The surface of the concrete must be finished so as to drain completely at all times.
- C. The edges of the sidewalks or driveways shall be carefully finished and rounded with an edging tool having a radius of 2-inch.
- D. The surface of sidewalks shall be divided into blocks by use of a grooving tool. Grooves shall be placed so as to cause contraction joints to be placed at a groove line, where practical. The grooves shall be spaced approximately five feet apart and the blocks shall be rectangular. The grooves shall be cut to a depth of not less than 1-inch. The edges of the grooves shall be edged with an edging tool having a radius of 1/4-inch, and any marks caused by edging or otherwise shall be removed with a wetted brush or wooden float so as to give the surface a uniform texture and finish.

- E. The edges of the concrete at contraction joints shall be rounded with an edging tool having a radius of 1/4-inch. The top and ends, where practicable, of expansion joint material shall be cleaned of all concrete and the expansion joint material shall be trimmed so as to be slightly below the surface of the concrete. All marks caused by edging shall be removed with a wetted brush or wooden float.

3.12 PROTECTION AND CURING

- A. Immediately after finishing the concrete, it shall be covered and cured in accordance with the requirements of Section 03300 of these Specifications. If the temperature falls to below freezing, satisfactory heating devices shall be placed under suitable covers to keep the temperature around the concrete at above 45 degrees F.
- B. Pedestrians will not be allowed upon concrete sidewalks or driveways until 12 hours after finishing concrete, and no vehicles or loads shall be permitted upon any sidewalk or driveway until the concrete has attained sufficient strength for such traffic.
- C. The Contractor shall construct such barricades and protection devices as are necessary to keep pedestrians and traffic off the sidewalks or driveways.
- D. If any sidewalk or driveway is damaged at any time previous to final acceptance of the project, it shall be repaired by removing all concrete within the limits of the grooves, and be replaced, at the Contractor's expense, with concrete of the type, kind and finish in the original construction.

3.13 BACKFILLING

Immediately after the concrete has set sufficiently, the spaces along the sides or edges of the sidewalk or driveway shall be refilled with suitable material, this material shall be in compacted layer of not over 4-inches each, until firm and solid.

3.14 CLEANING

- A. All excess or unsuitable material shall be removed and disposed of in accordance with requirements of Section 02228 of these Specifications.
- B. Final clean-up shall be performed in accordance with the requirement of Section 01710 of these Specifications.
- C. All material becoming the property of the Owner shall be stored in a manner and at locations near or on the Project as directed by the Engineer.

END OF SECTION

**SECTION 02610
PIPING**

PART 1 GENERAL

1.01 SUMMARY

- A. Provide all labor, material, equipment, and incidentals necessary to construct all piping and appurtenances located inside and outside of buildings and structures and test as specified.
- B. This section includes piping in utility vaults and manholes.
- C. This section includes all above-ground piping.

1.02 SUBMITTALS

- A. Complete shop drawings and product data on all piping and accessories shall be submitted to the Engineer in accordance with the requirements of these Specifications.
- B. Shop drawings shall indicate piping layout in plan and/or elevations and shall include a complete schedule of all pipe, fittings, specials, hangers and supports. Special castings shall be clearly detailed showing all pertinent dimensions. Special coatings shall be clearly identified.
- C. The Contractor shall submit written evidence to the Engineer that the products furnished under this Section will conform with the material and mechanical requirements specified herein. Certified copies of independent laboratory test results or mill test results from the pipe supplier may be considered evidence of compliance provided such tests are performed in accordance with the appropriate testing standards by experienced, competent personnel.

PART 2 PRODUCTS

2.01 DUCTILE IRON PIPE (DIP)

- A. Ductile Iron Pipe
 - 1. Ductile Iron Pipe shall be utilized for all piping, unless otherwise noted.
 - 2. Ductile iron pipe shall be manufactured in accordance with AWWA C151. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipe shall have a minimum pressure rating as indicated in the following table, and corresponding minimum wall thickness, unless otherwise specified or shown on the Drawings:

Pipe Sizes (inches)	Pressure Class (psi)
4 - 12	350
14 - 18	350
20	300
24	250
30 - 64	200

3. Flanged pipe minimum wall thickness shall be equal to Special Class 53 for pipe sizes 4 - 54". Flanges shall be furnished by the pipe manufacturer.
4. Restrained joint pipe on supports shall have bolted joints and shall be specifically designed for clear spans of 36 feet, minimum.

B. Fittings and Accessories

1. Fittings shall be ductile iron and shall conform to either AWWA C110 or AWWA C153 for sizes 3" through 24", AWWA C110/ANSI A21.10 for sizes 30" through 48", or manufacturer's standard for 54 inches and larger. The minimum rated working pressure for fittings less than 54" shall be 250 psi and 150 psi for fittings 54" and larger.
2. Flanged elbow fittings shall be ANSI pattern using short radius elbows except where noted differently on the Drawings. Special fittings, ductile iron wall pipes and sleeves shall conform to the dimensions and details as shown on the Drawings.
3. All grooved-end fittings shall conform to the laying length requirements of AWWA C110/ANSI A21.10, end preparation requirements of AWWA C606, and wall thickness requirements of AWWA C110/ANSI A21.10.
4. Thrust Collars: Thrust collars shall be welded-on ductile iron body type capable of withstanding a thrust due to 250 psi internal pressure on a dead end from either direction on that pipe size. Weld-on collars shall be continuously welded to the pipe by the pipe manufacturer.
5. Bosses: Bosses shall be welded-on ductile iron body type and shall be faced and tapped for AWWA C110/ANSI A21.10 flange connection. All welding, fabrication and outlet hole drilling shall be performed by the manufacturer. Outlets shall be free of burrs. Sizes shall be as indicated on the Drawings. The bosses shall be welded on minimum Class 51 ductile iron pipe greater than 12-inches and Class 52 for smaller pipe. Bosses shall be equal to ACIPCO A-96945

for mechanical joint or A-96946 for flanged joints.

6. Solid Sleeves: Solid sleeves shall permit the connection of plain end ductile iron pipe and plain end PVC pipe. Solid sleeves shall meet the requirements of ANSI/AWWA C110 for long pattern and have a minimum pressure rating of 250 psi. Solid sleeves shall have a mechanical or restrained joint as specified in this Section and as shown on the Drawings. Solid sleeves shall be provided with gaskets suitable for the type of pipe to be connected. Solid sleeves shall be used only in locations shown on the Drawings. Solid sleeves shall be manufactured by ACIPCO, U.S. Pipe or McWane (Clow).

C. Joints for Ductile Iron Pipe and Fittings

1. General

- a. Joints for ductile iron pipe and fittings shall be mechanical joint, flanged joint, restrained joint, push-on joint or grooved-end joint as shown on the Drawings or specified herein.
- b. Unless otherwise shown on the Drawings, specified or directed, all ductile iron pipe laid underground shall be joined using mechanical joints or push-on type joints.
- c. In all cases, gaskets shall be made of material that will not be damaged by the fluid being transported nor by the environment in which the pipe is installed.
- d. Provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A.

2. Mechanical Joints

- a. Joints shall conform to AWWA C111/ANSI A21.11.
- b. Bolts and nuts shall be Tee Head Bolts and nuts of high strength low-alloy steel in accordance with ASTM A 242 to the dimensions shown in AWWA C111/ANSI A21.11.
- c. Gaskets shall be in accordance with AWWA C111/ANSI A21.11 and shall be constructed of non-reinforced rubber
- d. Mechanical joint glands shall be ductile iron.

3. Push-On Joints: Push-on joints and gaskets shall conform to AWWA C111/ANSI A21.11. Details of the joint design shall be in accordance with the manufacturer standard practice such as ACIPCO Fastite, McWane (Clow) Bell-Tite, or U.S. Pipe Tyton joints.

4. Flanged Joints

- a. Flanged joints shall conform to AWWA C115/ANSI A21.12. Flanges shall be ductile iron and shall be furnished by the pipe manufacturer.
- b. Gaskets shall be made of 1/8-inch thick, Buna-N. Gaskets may be ring type or full face type. Gaskets for all flanged piping 24-inches and larger shall be equal to ACIPCO Toruseal gaskets.
- c. Flanged ductile iron pipe 3 through 12-inches or less in length shall have flanges cast solidly to the pipe barrel. Flanges on ductile iron pipe longer than 12-inches may be of the threaded type. Pipe threads shall be of such length that with flanges screwed home, the end of the pipe shall project beyond the face line of the flange. Flange and pipe shall then be machined to give a flush finish to the pipe and the flange and surface shall be normal to the axis of the pipe. Ductile iron flanges shall be of such design that the flange neck completely covers the threaded portion of the pipe to protect same against corrosion. All pipe with threaded type flanges shall be assembled, faced, and drilled at the point of manufacture, unless otherwise approved by the Engineer.
- d. Flange filler shall conform to AWWA C110/ANSI A21.10. Joint bolt length shall be increased by the thickness of the flange filler.
- e. Where tap or stud bolts are required, flanges shall be drilled and tapped accordingly.
- f. Bolt length and diameter shall conform to ANSI/AWWA C115 for Class 125 flanges shown in ANSI/ASME B16.1.
- g. Bolts for exposed service shall be zinc plated, cold pressed, steel machine bolts conforming to ASTM A 307, Grade B. Nuts for exposed service shall be zinc plated, heavy hex conforming to ASTM A563. Zinc plating shall conform to ASTM B 633, Type II.
- h. Bolts for submerged service shall be stainless steel machine bolts conforming to ASTM A 193, Grade B8. Nuts shall be heavy hex, stainless steel conforming to ASTM A 194, Grade 8.

5. Restrained Joints

- a. Restrained joints shall be ACIPCO LOK-RING, McWane (Clow) SUPER-LOCK or U.S. TR-FLEX or LOK-TYTE.
- b. Restraining gaskets shall be ACIPCO Fast-Grip or U.S. Pipe Field-Lok Gasket.
- c. Bolts and nuts shall be in accordance with the manufacturer's recommendations.
- d. Gaskets shall be in accordance with the manufacturer's recommendations.

6. Flexible (Ball) Joints

- a. Joints shall be ball and socket type, providing leaktight connections for up to 15 degrees of joint deflection. Pipe shall be American FLEX-LOK, U.S. Pipe USIFLEX or McWane (Clow) F-141.
- b. All nuts and bolts shall be Type 304 stainless steel.

- c. Gaskets shall be manufacturer's standard.
- 7. Grooved End Joints
 - a. Split type couplings shall be manufactured from ductile iron conforming to ASTM A 536, Grade 65-45-12.
 - b. Gaskets shall be of the center leg design, specifically for uses with ductile iron pipe and shall be compounded of either a halogenated butyl or nitrile material as determined by service application.
 - c. Bolts shall be of the track head type with hexagonal heavy nuts conforming to ASTM A 183 and A 194.
 - d. To insure joint integrity, couplings and fittings shall be by the same manufacturer. Couplings shall be suitable for both rigid and flexible joint grooves and shall be equal to Style 31 coupling as manufactured by the Victaulic Company of America.
- D. Cement Linings: Pipe and fittings shall be cement lined in accordance with AWWA C104/ANSI/AWWA C104/A21.4.
- E. Polyethylene Encasement: Ductile iron pipe shall be encased with polyethylene film where shown on the Drawings. Polyethylene film shall have a minimum thickness of 8 mils.
- F. Mechanical Pipe Couplings
 - 1. Pipe couplings shall be installed where shown on the Drawings or as directed by the Engineer.
- G. Wall Sleeves and Wall Pipes
 - 1. Where piping passes through concrete structures, furnish and install wall sleeves unless wall pipes or other provisions are specifically shown on the Drawings. Wall sleeves shall be accurately located and securely fastened into position before concrete is poured.
 - 2. Wall Sleeves
 - a. For pipe sizes smaller than 3-inches, wall sleeves shall be steel oversize sleeves furnished with a full circle, integral, or continuously welded waterstop collar. The sleeve seal shall be the mechanically expanded, synthetic rubber type. Provide all associated bolts, seals and seal fittings, pressure clamps, or plates necessary to achieve a watertight installation. Sleeves shall extend the full thickness of the concrete. Sleeves and seal shall be Link Seal.
 - b. For larger pipe sizes, wall sleeves shall be statically cast ductile iron mechanical joint wall sleeves. Unless specified or shown otherwise for a specific situation, wall sleeves shall be mechanical joint bell-plain end

type with waterstop/thrust collar. The collar shall be capable of withstanding a thrust force caused by a 250 psi dead end load from either direction on that size pipe. Sleeves shall be constructed with studs and mechanical joint retainer gland on the air side of the concrete structure. Provide retainer gland where shown on the Drawings. Where the concrete structure is exposed to dirt on one side and is wet on the other side, construct with studs and glands on the dirt side. Wall sleeves shall be equal to ACIPCO A-10771.

3. Wall pipes

- a. Wall pipes shall be either statically cast ductile iron with integral waterstop/thrust collar or centrifugally cast ductile iron with a continuously welded waterstop/thrust collar. The welded on collar shall be attached to the pipe by the manufacturer. The collar shall be capable of withstanding a thrust force caused by a 250 psi dead end load from either direction on that size pipe. Wall pipes shall be furnished uncoated on the outside and cement lined on the inside. Unless specified or shown otherwise, wall pipes shall be flange end type.
- b. Wall pipes shall be cast and/or fabricated and lined in one manufacturer's facilities and delivered to the job site ready for use.

- H. Hydrant Tees: Hydrant tees shall be equal to ACIPCO A-10180 or U.S. Pipe U-592.
- I. Tapping Saddles: Tapping saddles shall be ductile iron body type with O-ring gasket and alloy steel straps. Connection shall be flanged or mechanical joint as detailed on the Drawings. Tapping saddles shall be equal to ACIPCO A-30920.
- J. Tapping Sleeves and Valves (TS&V): Tapping sleeves shall be cast or ductile iron of the split-sleeve, mechanical joint type. The contractor shall be responsible for determining the outside diameter of the pipe to be connected to prior to ordering the sleeve. Valves shall be gate valves furnished in accordance with Section 02665 of these Specifications, with flanged connection to the tapping sleeve and mechanical joint connection to the branch pipe. The tapping sleeve and valve shall be supplied by the valve manufacturer. Tapping sleeves shall be American-Darling, Mueller or M & H Valve.
- K. Flange Adapters: Flange adapters shall permit the connection of unthreaded, ungrooved, open-ended, ductile iron pipe to ANSI/ASME B16.1, Class 125 flanges. Flange adapters shall meet the test requirements of ANSI/ASME B16.1 for Class 125 flanges. The adaptor shall be a ductile iron casting incorporating a flange with extended throat, set screws and gasket. The gasket shall provide a compression seal between the adaptor, the pipe and the adjacent flange. Flange adapters are to be used only in locations specifically shown on the Drawings and in accordance with the manufacturer's recommendations. Flange adapters shall be manufactured by McWane, Uni-Flange (Series 400) or EBAA Iron.

2.02 REINFORCED CONCRETE PIPE (RCP)

A. Reinforced Concrete Pipe

1. Pipe

- a. Pipe shall be bell and spigot reinforced concrete conforming to ASTM C 76 for Class III pipe. Wall thickness design shall correspond to Wall C.
- b. In addition, the pipe and materials shall meet the following requirements:
 1. Concrete shall have a minimum compressive strength of 5,000 psi for Class III and IV.
 2. Cement shall meet the requirements of ASTM C 150, Type II.
 3. Absorption shall not exceed 6 percent when tested in accordance with ASTM C 497.
- c. Reinforced concrete pipe shall be supplied in lengths of at least six feet.

2. Joints: Pipe shall have concrete and rubber O-ring gasket type joints conforming to ASTM C 361. A rectangular groove shall be supplied in the spigot end to receive the rubber O-ring gasket, and it shall be supplied in the spigot end to receive the rubber O-ring gasket will be deformed to a rectangular shape and confined on all four sides. Bell and spigot surfaces shall be accurately formed and smooth to provide a close sliding fit with a nominal clearance of 1/16-inch.

3. Fittings and Specials: Reinforced concrete pipe fittings and specials shall meet all requirements for reinforced concrete pipe, including materials of construction, structural strength, linings, and joints. Provide special adapters or transition pieces for connection to pipe of different materials where shown on the Drawings.

4. Acceptance

- a. Acceptance of pipe shall be on the basis of plant load-bearing tests for the load to produce 0.01-inch crack and the ultimate strength of the pipe, material tests, and inspection of manufactured pipe for visual defects and imperfections as described in Paragraph 5.1.1 of ASTM C 76.
- b. Provide results of tests on pipe, pipe materials, joint material, and made-up joints performed by an independent testing laboratory approved by the Engineer. Include materials, absorption, crushing, and hydrostatic leakage tests on pipe of each size in accordance with applicable specifications.
- c. Each length of pipe shall be stamped by a regular employee of the approved testing laboratory.
- d. Inspect pipe after delivery for laboratory stamp, shape, cracks, uniformity, blisters and imperfect surfaces, hammer test, damaged ends, and gasket grooves. Do not accept or use pipe with repaired or patched gasket grooves. Do not accept or use pipe with repaired or patched gasket grooves or shoulders. Any pipe repaired or patched is subject to rejection

if such repairs or patches, in the opinion of the Engineer or Owner, are not sound and properly finished.

- e. The Owner shall, at its own discretion, select another independent testing laboratory to confirm those tests performed by the manufacturer's testing laboratory. This testing laboratory shall observe the tests conducted by the laboratory selected by the manufacturer, or, as necessary, conduct its own tests. The manufacturer shall provide the necessary facilities for the performance of these tests at the plant site. These test specimens shall be provided in accordance with paragraph 11 of ASTM C 76.
- f. All pipe for this Project shall be stored at a designated place on the yard of the manufacturer. No pipe shall be used except from this designated place. Each length of pipe, which is deemed satisfactory, shall be stamped by an employee of the laboratory selected by the Owner. No pipe shall be installed without this stamp
- g. No pipe shall be shipped before it has been cured for a minimum of 14 days.

B. Reinforced Concrete Pipe (Storm Drains)

- 1. Pipe: Pipe shall be bell and spigot reinforced concrete conforming to ASTM C 76 for Class III pipe. Wall thickness design shall correspond to Wall B. Reinforced concrete pipe shall be supplied in lengths of at least six feet.
- 2. Joints: Pipe shall have rubber gasket type joints conforming to ASTM C 443 or ASTM C 361. A rectangular groove shall be supplied in the spigot end to receive the rubber gasket, and it shall be so formed that when the joint is complete the gasket will be deformed to a rectangular shape and confined on all four sides. Bell and spigot surfaces shall be accurately formed and smooth to provide a close sliding fit with a nominal clearance of 1/16-inch.
- 3. Acceptance
 - a. Acceptance for pipe shall be on the basis of plant load-bearing tests, material tests, and inspection of manufactured pipe for visual defects and imperfections as described in Paragraph 5.1.1 of ASTM C 76.
 - b. Provide results of tests on pipe and joint material performed by an independent testing laboratory approved by the Engineer. Include materials and crushing loads for pipe of each size in accordance with applicable specifications.
 - c. Each length of pipe shall be stamped by a regular employee of the approved testing laboratory.
 - d. Inspect pipe after delivery for laboratory stamp, shape, cracks, uniformity, blisters and imperfect surfaces, hammer test, damaged ends, and gasket grooves.

2.03 STEEL PIPE

A. Steel Pipe

Steel pipe in sizes 2-1/2-inches and smaller shall be seamless carbon steel pipe conforming to the requirements of ASTM A 120. Steel pipe in sizes 3 to 6-inches shall be seamless carbon steel pipe conforming to the requirements of ASTM A 53, Grade B.

1. Steel pipe for process piping in sizes 3 through 6-inches shall be Schedule 40 with flanged joints.
2. Flanged Joints
 - a. Flanges, where required, shall be forged steel conforming to ASTM A181, Class 60, and ANSI B16.5, Class 150.
 - b. Flanged joints for exposed service shall be bolted with through stud or tap bolts of required size as directed. Nuts shall be hexagonal. Bolts and nuts shall be zinc plated, cold pressed, steel machine bolts, conforming to ASTM A 307, Grade B. Zinc plating shall conform to ASTM B 633, Type II.
 - c. Gaskets shall be neoprene, 1/16-inch thick, conforming to ANSI/ASME B16.5. Gaskets for air piping operating at temperatures between 120 and 300 degrees F shall be viton.
3. Unless otherwise shown or specified, steel pipe and fittings 6-inches and smaller in size shall be hot dip galvanized in accordance with the requirements of ASTM A 153.

2.04 STAINLESS STEEL PIPE

- A. Stainless steel pipe in sizes 10-inches and smaller shall conform to the requirements of ASTM A-778, Type 304.
- B. Unless otherwise specified or shown, stainless steel pipe 1-1/2 inches and smaller shall be Schedule 40S with threaded joints. Stainless steel pipe in sizes 2 through 10-inches shall be scheduled 10S with welded joints, unless otherwise shown on the Drawings.
- C. Threaded fittings and unions 1-1/2-inches and smaller shall be 3,000 pound forged stainless steel conforming to ASTM A 182, Grade F304 and ANSI B16.11.
- D. Welded fittings shall be of the butt-welded type of wrought stainless steel conforming to ASTM A 403, Grade WP304 and ANSI/ASME B16.9. Reducing branch connections shall be made using threadolets or weldolets.
- E. Flanges shall be forged stainless steel conforming to ASTM A 182, Grade 304 and ANSI/ASME B16.5, Class 150. Bolts shall be heavy hex conforming to ASTM A 193, Grade B8. Nuts shall be heavy hex conforming to ASTM A 194, Grade 8. Gaskets shall

be Buna N, 1/16-inch thick, conforming to ANSI/ASME B16.5.

2.05 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE AND FLEXIBLE HOSE

- A. Schedule PVC Pipe, Less Than 4-Inch Diameter
 - 1. Schedule 80, ASTM D 1785
 - 2. Fittings: Solvent weld socket type, same schedule as piping, ASTM D 2466 or D 2467
 - 3. Current Cement: ASTM D 2564
- B. Flexible hose: Provide flexible Teflon tube chemical hose capable of transferring lime slurry.

2.06 COPPER TUBING

- A. Exposed copper tubing for water or air shall be seamless hard drawn copper tube conforming to the requirements of ASTM B 88, Type L. Buried copper tubing shall be seamless, annealed copper tube conforming to the requirements of ASTM B 88, Type K. Annealed copper tube may be furnished in straight lengths or coils.
- B. Fittings for copper tube shall be wrought copper conforming to ASTM b 75 and ANSI B 16.22 for silver brazed joints.
- C. Copper tubing for instrument air service in sizes 5/8-inch outside diameter and smaller shall be coated, seamless, bright annealed copper tube conforming to ASTM B 68, Type DHP. Wall thickness of copper tube shall be as follows:

Tube Outside Diameter, Inches	Wall Thickness, Inches
1/4	0.030
3/8	0.032
1/2	0.035
5/8	0.040

- D. Fittings for annealed copper tube in instrument air service shall be of the flareless, compression type, Hoke Gyrolok, Crawford Swagelok or Parker Trible-Lok, conforming to ASTM B 16 or B 124.

- E. Instrument air tubing shall be factory coated with a layer of black PVC meeting the requirements of ASTM D 1047, IPCEA S-61-402, and applicable UL standards. Minimum coating thickness shall be 0.032-inch. Unless otherwise shown, minimum size of instrument air tubing shall be 3/8-inch outside diameter.

2.07 MISCELLANEOUS ACCESSORIES

A. Flexible Adaptor Couplings

1. Couplings for pipe sizes 15-inches diameter and less shall be elastomeric plastic sleeves designed to connect pipes of dissimilar materials. Adapters shall provide a positive seal against infiltration and exfiltration and remain leakproof and root proof up to 4.3 psi. The adaptor manufacturer shall provide all stainless steel clamps and required accessories.
2. Couplings shall be products of Fernco and shall be installed in accordance with the manufacturer's recommendations.

B. Flexible Adaptor Donuts

1. Adaptor donuts shall be elastomeric PVC, compressible seals designed for sealing joints between sewer pipes of different sizes and/or dissimilar materials. Adapters shall provide a positive seal against infiltration and exfiltration and remain leakproof and root proof up to 4.3 psi.
2. Donuts shall be products of Fernco and shall be installed in accordance with the manufacturer's recommendations.

- C. Detection Tape: Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the text describing pipe and material. Tape lettering shall be permanently printed with no surface printing allowed. Tape width shall be minimum 2-inches when buried less than 10-inches below the surface. Tape width shall be minimum 3-inches when buried greater than 10-inches and less than 20-inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape.

- D. Retainer Glands: Retainer glands shall be Megalug, Series 1100, as manufactured by EBAA Iron.

E. Harness Rods

1. Harness rods shall be manufactured in accordance with ASTM A 449. Harness rods shall be field coated with bitumastic before backfilling.
2. Eye bolts shall be of the same diameter as specified in AWWA C111 for that pipe

size. The eye shall be welded closed. Where eye bolts are used in conjunction with harness rods, an appropriate size washer shall be utilized with a nut on each end of the harness rod. Eye bolts shall be of the same material and coating as the harness rods.

- F. Service Clamps: Service clamps shall be ductile iron, double strap clamps equal to Mueller.
- G. Accessories:
 - 1. Gasketed Mechanical Couplings - Gasketed mechanical couplings (GMC) shall conform to ASTM F 147-93 for Type II - Class 3, Plain End Mechanical Couplings, Flexible and Unrestrained. GMC shall be Type II TEEKAY couplings with 304 stainless steel sleeves and fasteners.
 - 2. Push Joints - Manufactured from ductile iron as specified in AWWA C110 and C153 with pressure rating of 350 psi (8-inch and smaller) and 250 psi (20-inches and larger).
 - 3. Mechanical Joints - Manufactured from ductile iron in conformance with ANSI/AWWA C110/A21.10 with pressure rating of 350 psi (8-inches and smaller) and 250 psi (20-inches and larger).

2.08 COMBINATION AIR RELEASE VALVES

- A. The combination air valve(s) shall be installed as shown on the drawings. This will permit discharging the surge of air from an empty line when filling and relieve the vacuum when draining, and also release an accumulation of air when the system is under pressure.
- B. The body of the valve shall be one integral casting or two valve bodies flange bolted together containing an air and vacuum valve and a separate pressure valve mechanism.
- C. The air and vacuum valve shall operate by sealing the BUNA-N rubber outlet seat with a peripherally guided float as the liquid enters the valve chamber to raise the float. The air and vacuum valve shall satisfactorily withstand hydrostatic pressures of 300 psig.
- D. The pressure air release valve shall operate through simple or compound levers to permit air to be released under operating conditions. The valve shall have a 5/16-inch orifice with valve sealing faces of an adjustable BUNA-N valve and stainless steel or PVC and shall operate at 0 - 100 psig and be capable of passing 10 scfm of air.
- E. The valve(s) shall be 6-inch NPT screwed inlet connection with stainless steel floats with bronze and brass or stainless steel trim.
- F. The valve(s) shall be Combination Air Valve Type P stainless steel seat and BUNA-N rubber valve.

- G. Valve shall be Crispin, APCO, or approved equal.

2.09 PRESSURE AIR RELEASE VALVES

The Pressure Air Release Valve(s) shall be installed in the filter building to vent the accumulation of air and other gases with the line under pressure.

The valve(s) shall operate through a compound lever system and shall have a 5/16-inch orifice with valve sealing faces of an adjustable BUNA-N rubber valve and stainless steel seat.

The valve(s) shall be one inch NPT screwed inlet connection and shall be cast iron body, top and inlet flange (where required), stainless steel float and trim.

Valves which use a needle valve to seal the orifice will not be acceptable.

The valve(s) shall be Crispin, Apco, or approved equal.

2.10 DEEP WELL AIR RELEASE VALVES

Deep Well Air Release Valves shall be installed on the discharge side of the pump so that the volume of air exiting the system can be easily vented and controlled without hampering the operation of the air release valve. This shall be accomplished by means of a throttling device on the discharge side of the valve.

The valves shall operate by sealing the BUNA-N rubber orifice with a peripheral guided ball float as the air exits the valve at an adjustable and controlled rate and the liquid enters the chamber to raise the float. The valves shall satisfactorily withstand a hydrostatic pressure of 300 psig.

The valves shall be Crispin, Apco, or approved equal. The valves shall be sized as shown on the drawings with NPT screwed inlet and outlet with cast iron body and top, bronze and brass, or stainless steel trim.

PART 3 EXECUTION

3.01 EXISTING UNDERGROUND UTILITIES AND OBSTRUCTIONS

- A. The Drawings indicate utilities or obstructions that are known to exist according to the best information available to the Owner. The Contractor shall call the Utilities Protection Center (UPC) (325-5000 or 1-800-282-7411) as required by Georgia law (Code Section 25-9-1 through 25-9-13) and all utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site at least 72 hours (three business days) prior to construction to verify the

location of the existing utilities.

- B. Existing Utility Location: The following steps shall be exercised to avoid interruption of existing utility service.
1. Provide the required notice to the utility owners and allow them to locate their facilities according to Georgia law. Field utility locations are valid for only 10 days after original notice. The Contractor shall ensure, at the time of any excavation, that a valid utility location exists at the point of excavation.
 2. Expose the facility, for a distance of at least 200 feet in advance of pipeline construction, to verify its true location and grade. Repair, or have repaired, any damage to utilities resulting from locating or exposing their true location.
 3. Avoid utility damage and interruption by protection with means or methods recommended by the utility owner.
 4. Maintain a log identifying when phone calls were made, who was called, area for which utility relocation was requested and work order number issued, if any. The Contractor shall provide the Engineer an updated copy of the log bi-weekly, or more frequently if required.

C. Conflict with Existing Utilities

1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed piping does not permit safe installation of the piping by the use of sheeting, shoring, tying-back, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the piping to avoid horizontal conflicts if the new alignment remains within the available right-of-way or easement, complies with regulatory agency requirements and after a written request to and subsequent approval by the Engineer. Where such relocation of the piping is denied by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.
2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed piping does not permit the crossing without immediate or potential future damage to the utility, main, service, or the piping. The Contractor may change the proposed grade of the piping to avoid regulatory agencies requirements after written request to and subsequent approval by the Engineer. Where such relocation of the piping is denied by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.

- D. Electronic Locator: Have available at all times an electronic pipe locator and a magnetic

locator, in good working order, to aid in locating existing pipe lines or other obstructions.

3.02 LOCATION AND GRADE

- A. The Drawings show the alignment and grade of the piping and the location of other appurtenances.
- B. Prior to clearing and grubbing, construction staking shall conform to the requirements of Section 01055 of these Specifications.

3.03 LAYING AND PIPE ASSEMBLY

- A. Installation
 - 1. Proper implements, tools and facilities shall be provided for the safe performance of the work. All pipe, fittings, valves and hydrants shall be lowered carefully into the trench by means of slings, ropes or other suitable tools or equipment in such a manner as to prevent damage to piping materials and protective coatings and linings. Under no circumstances shall piping materials be dropped or dumped into the trench.
 - 2. All pipe, fittings, valves, hydrants, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Engineer, who may prescribe corrective repairs or reject the materials.
 - 3. All lumps, blisters and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit or any foreign materials before the pipe is laid. No pipe containing dirt shall be laid.
 - 4. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing or other materials shall be placed in the pipe at any time.
 - 5. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.
 - 6. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade, shall not be permitted.

7. Provide detection tape for all non-metallic pipe. Detection tape shall be buried 4 to 10-inches deep. Should detection tape need to be installed deeper, the Contractor shall provide 3-inch wide tape. In no case shall detection tape be buried greater than 20-inches from the finish grade surface.

B. Alignment and Gradient

1. Lay pipe straight in alignment and gradient or follow true curves as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.
2. Maintain a transit, level and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.
3. The Contractor shall check the invert elevation for gravity sewer and storm drains at each manhole at least three times daily, start, mid-day and end of day. Elevations shall be checked more frequently if more than 100 feet of pipe is installed in a day or if the pipe is being constructed at minimum slope.
4. The Contractor shall check the horizontal alignment of the sewer at the same schedule as for invert elevations.

- C. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint or as approved by the Engineer.

D. Joint Assembly

1. Push-on, mechanical, flange and restrained type joints shall be assembled in accordance with the manufacturer's recommendations.
2. Each restrained joint shall be inspected by the Contractor to ensure that it has been homed 100 percent.
3. The Contractor shall internally inspect each pipe joint to insure proper assembly for pipe 24-inches in diameter and larger after the pipe has been brought to final alignment.
4. Field welding of steel pipe joints shall conform to the requirements of AWWA C206. All welding shall be performed by persons meeting the qualification requirements of ANSI/AWS D1.1.

- E. Cutting Pipe: Cut ductile iron pipe using an abrasive wheel saw. Cut PVC pipe using a

suitable saw; remove all burrs and smooth the end before jointing. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, accessories and closure pieces in the correct location. Only push-on or mechanical joint pipe shall be cut.

- F. Lining Repair: Repair polyethylene or polyurethane linings and recoat spigot ends of cut pipe with a product equal to Protecto 101 or Madewell 1104 coal tar epoxy in accordance with the manufacturer's recommendations and as specified below:
1. Remove all burrs and areas of loose lining materials by sanding or scraping to bare metal.
 2. Remove oil and lubricants used during field cutting.
 3. Lining shall be stripped back a minimum of 1-inch from the spigot end into well adhered lined areas.
 4. Roughen 1 to 2-inches of good lining with a rough grade (40 grit) emery paper, rasp or small chisel, to allow an overlap between new and existing lining.
 5. Apply lining repair material in the number of coats required to match the thickness requirements as specified in Part 2 of this Section and in accordance with the manufacturer's recommendations.
- G. Polyethylene Encasement: Installation shall be in accordance with AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired to the satisfaction of the Engineer.

3.04 CONNECTIONS TO EXISTING PIPING

- A. Make connections to existing pipe lines as shown on the Drawings.
- B. Location: Before laying pipe, locate the points of connection to existing piping and uncover as necessary for the Engineer to confirm the nature of the connection to be made.
- C. Interruption of Services: Make connections to existing piping only when system operations permit. Operate existing valves only with the specific authorization and direct supervision of the Owner.
- D. Tapping Saddles and Tapping Sleeves
1. Holes in the new pipe shall be machine cut, either in the field or at the factory. No torch cutting of holes shall be permitted.
 2. Prior to attaching the saddle or sleeve, the pipe shall be thoroughly cleaned, utilizing a brush and rag, as required.

3. Before performing field machine cut, the watertightness of the saddle or sleeve assembly shall be pressure tested. The interior of the assembly shall be filled with water. An air compressor shall be attached, which will induce a test pressure as specified in this Sectn. No leakage shall be permitted for a period of five minutes.
 4. After attaching the saddle or sleeve to existing piping, but prior to making the tap, the interior of the assembly shall be disinfected. All surfaces to be exposed to potable water shall be swabbed or sprayed with one percent hypochlorite solution.
- E. Connections Using Solid Sleeves: Where solid sleeves are shown on the Drawings, the Contractor shall furnish materials and labor necessary to make the connection using a solid sleeve to the existing pipe line.
- F. Connections Using Flange Filler: Flange filler shall be used only where shown on the Drawings or approved by the Engineer to make up minor differences in pipe length less than 3-inches. Joint bolt length shall be increased by the thickness of the flange filler.
- G. Connections Using Mechanical Pipe Couplings: Where pipe couplings are shown on the Drawings, the contractor shall furnish materials and labor necessary to make the connection using a pipe coupling to the existing pipe line, including all necessary cutting, plugging and backfill.
- H. Connections to Pressure Mains
1. Connections to ductile iron pipe pressure mains shall be by the direct tap method or service clamp, as detailed on the Drawings in full accordance with AWWA requirements.
 2. Connections to polyvinyl chloride pipe shall be made using a full body service clamp.
 3. Pressure ratings for connections shall be the same as the pressure rating for the pipe.
- I. Hydrants: Hydrants shall be attached to the water main by the following method:
1. For mains 12-inches and smaller, the isolation valve shall be attached to the main by connecting the valve to the hydrant tee.
 2. For mains larger than 12-inches, the isolation valve shall be attached to the main by providing an anchor coupling between the valve and tapping saddle.
 3. The isolation valve shall be attached to the hydrant by providing an anchor coupling between the valve and hydrant.

3.05 THRUST RESTRAINT

- A. Provide restraint at all points where hydraulic thrust may develop.
- B. Retainer Glands: Provide retainer glands where shown on the Drawings and all associated fittings, valves and related piping. Retainer glands shall be installed in accordance with the manufacturer's recommendations, particularly, the required torque of the set screws. The contractor shall furnish a torque wrench to verify the torque on all set screws which do not have inherent torque indicators.
- C. Harnessing
 - 1. Provide harness rods only where specifically shown on the Drawings or directed by the Engineer.
 - 2. Where possible, harness rods shall be installed through the mechanical joint bolt holes. Where it is not possible, provide 90 degree bend eye bolts.
- D. Concrete Thrust Collars: Collars shall be constructed as shown on the Drawings. Concrete shall be as shown on the Drawings. Reinforcing steel shall be as shown on the Drawings and as specified in Section 03200 of these Specifications. The thrust collar shall be a weld on collar as specified in this Section. Weld-on collar shall be continuously welded to the pipe by the pipe manufacturer.
- E. Concrete Blocking
 - 1. Provide concrete blocking for all bends, tees, valves, and other points where thrust may develop, except where other exclusive means of thrust restraint are specifically shown on the Drawings.
 - 2. Concrete shall be Class B as specified in Section 03300 of these Specifications.
 - 3. Form and pour concrete blocking at fittings as shown on the Drawings and as directed by the Engineer. Pour blocking against undisturbed earth. Increase dimensions where required excavation.

3.05 CONSTRUCTION WITHIN STRUCTURES

- A. Proper and suitable tools and appliances for safe and convenient handling and laying of pipe and fittings shall be used. Care shall be taken to prevent the pipe coating from being damaged, particularly cement linings on the inside of the pipes and fittings. Any damage shall be remedied as directed by the Engineer.
- B. All pipe and fittings shall be carefully examined by the Contractor for defects just before installing and no pipe or fitting shall be installed if it is defective. If any defective pipe or fitting is discovered after having been installed, it shall be removed and replaced in a satisfactory manner with a sound pipe or fitting by the Contractor at Contractor's own expense.

- C. All pipes and fittings shall be thoroughly cleaned before they are installed and shall be kept clean until they are used in the completed work. Open ends of pipe shall be kept plugged with a bulkhead during construction.
- D. All elbows, tees, brackets, crosses and reducers in pressure piping systems shall be adequately restrained against thrust. Underground pressure piping containing unrestrained push-on or mechanical joints or expansion joints shall be restrained by thrust blocks. Thrust blocks shall consist of Class B concrete conforming to the requirements of Section 03300 of these Specifications and shall be of the size and shape as shown on the Drawings. The Contractor may use forms or undisturbed earth walls to mold the thrust blocks. When earth walls are used, they shall be conducted so that no loose earth will become mixed with the concrete. At the end of 24 hours, damp earth may be placed over the concrete to retain moisture.
- E. All pipes entering structures shall be adequately supported between the structure and undisturbed earth to prevent damage resulting from settlement of backfill around the structure.
- F. All pipe installed under structures shall be encased in Class C concrete as specified in Section 03300 of these Specifications. The size of the encasement concrete shall be a minimum of 6-inches larger than the outside diameter of the pipe and shall include the area between the top of the pipe and the bottom of the structure.
- G. Wall pipe and wall sleeves shall be accurately located and securely fastened in place before concrete is poured. All wall pipe and sleeves shall have wall collars properly located to be in the center of the wall where the respective pipes are to be installed.
- H. Wall pipe and wall sleeves shall be installed when the wall or slab is constructed. Blocking out or breaking of the wall for later installation shall not be permitted.
- I. Cutting or weakening of structural members to facilitate pipe installation will not be permitted. All piping shall be installed in place without springing or forcing.
- J. Exposed piping shall be supported as shown on the Drawings and specified in Section 15094 of these Specifications.

3.06 INSPECTION AND TESTING

All pressure and leakage shall be performed in accordance with the requirements of Section 02666 of these Specifications.

3.07 INSULATION AND HEAT TRACING

Provide insulation and heat tracing in accordance with Section 15835 of these Specifications.

3.08**DISINFECTION**

All potable water lines shall be disinfected in accordance with Section 02675 of these Specifications.

STEEL PIPE DATA TABLE

ASTM Standard	Description	Class Sizes Available	Tensile/Yield Strength(ksi)	Other
ASTM A 53	Welded Black and Hot Dipped Galvanized	1/8-26" B (60/35) Welded Type S Wrought Steel, Seamless	A (48/30) Resistance	Type E Electrical
ASTM A 139	Electric-Fusion (Arc) Welded Pipe Straight or Spiral Seam	4-92"	A (48/30) B (60/35) C (60/42) D (60/46) E (66/52)	
ASTM A 570	Steel, Sheet & Strip, Carbon, Hot Rolled Structural Quality		30 (49/30) 33 (52/33) 36 (53/36) 40 (55/40) 45 (60/45) 50 (65/50)	
ASTM A 36	Structural Steel		(58-80/36)	
ASTM A 572	High Strength, Low Alloy Columbium-Vanadium Steel or Structural Quality		42 (60/42) 50 (65/50) 60 (75/60)	
ASTM A 283	Low & Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars		C (50-70/30) D (60-75/33)	

END OF SECTION

SECTION 02611
SITE PIPING MANHOLES AND APPURTENANCES

PART 1 GENERAL

1.01 SUMMARY

The work covered by this Section includes furnishing all labor, equipment and materials required to install cast-in-place and precast concrete manholes; storm drain inlets; and piping appurtenances as described herein and/or shown on the Drawings.

1.02 DESIGN REQUIREMENTS

- A. Manholes shall be constructed of specified materials to the sizes, shapes and dimensions and at the locations shown on the Drawings or as otherwise directed by the Engineer. The height of depth of the manhole will vary with the location. Unless shown otherwise on the Drawings, the top of the manhole will vary with the location. Unless shown on the Drawings, the top of manhole frame will be at the finished grade of the pavement or ground surface and inverts will be at the elevations shown on the Drawings.
- B. Where the difference in the invert elevation of a sewer 18-inches in diameter or smaller and any other sewer intersecting in one manhole is two feet or more, a drop manhole shall be constructed as shown on the Drawings. They shall be similar in construction to the standard manhole except that a drip connection of pipe and fittings of the proper size and material shall be constructed outside the manhole and supported by Class AA concrete.

1.03 SUBMITTALS

- A. Complete product data on all precast manhole bottoms, riser sections, transition slabs and tops shall be submitted in accordance with these Specifications.
- B. Complete product data on frames, covers and steps shall be submitted to the Engineer for approval.
- C. Complete product data on all piping appurtenances shall be submitted to the Engineer for approval.

1.04 QUALITY ASSURANCE

- A. Prior to delivery, all basic materials specified herein shall be tested and inspected by an approved independent commercial testing laboratory or, if approved by the Engineer, certified copies of test reports prepared by the manufacturer's testing laboratory will be acceptable. All materials which fail to conform to these Specifications shall be rejected.
- B. After delivery to the site, any materials which have been damaged in transit or are

otherwise unsuitable for use in the Work shall be rejected and removed from the site.

PART 2 PRODUCTS

2.01 MANHOLES

A. Concrete and Reinforcement

1. Concrete used in construction shall be Class AA concrete conforming to the requirements of Section 03300 of these specifications.
2. Steel reinforcement shall conform to the requirements of Section 03200 of these Specifications.

B. Brick: Brick used in manhole construction shall be either solid or cored, medium hard or better, Grade MS brick conforming to the requirements of ASTM C 32 for sewer and manhole brick.

C. Mortar: Mortar shall be made of one part Portland cement and two parts clean sharp sand. Cement shall be Type 1 and shall conform to STM C 150. Sand shall meet the requirements of ASTM C 144.

D. Round Precast Concrete Manholes: Provide manholes and other precast concrete products in accordance with the following:

1. Precast concrete sections shall meet the requirements of ASTM C 478. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi.
2. The minimum wall thickness shall be one-twelfth of the inside diameter of the base, riser or the largest cone diameter. Additionally, the wall thickness shall be sufficient for the proper installation of the rubber boots.
3. Transition slabs which convert bases larger than four feet in diameter to four foot diameter risers shall be designed by the manhole manufacturer to carry the live and dead loads exerted on the slab.
4. Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant.

E. Square and Rectangular Precast Manholes and Vaults

1. Precast concrete sections shall meet the requirements of ASTM C 913. The minimum 28 day compressive strength of the concrete in precast sections shall be 4,000 psi.
2. The design of each structure shall be the responsibility of the manufacturer and shall conform to ACI-318 and the minimum structural design loading requirements as defined in ASTM C 890. The minimum design dead load shall be based on the depth shown on the Drawings or in Table 1 of this Section. The minimum design live load shall be A-16.

3. Transition slabs which connect rectangular or square sections to round riser sections shall be designed by the manufacturer to support the live and dead loads on the slab.
4. Precast sections shall be manufactured such that the spigot end is at the top of each section.
5. Dimensions for square and rectangular manholes are shown on the Drawings.

F. Manhole Frames and Covers

1. Cast iron frames and covers shall meet the requirements of ASTM A 48 for Class 30 gray iron and all applicable local standards. All castings shall be tough, close grained, smooth and free from blow holes, blisters, shrinkage, strains, cracks, cold shots and other imperfections. No casting will be accepted which weighs less than 95 percent of the design weight. Shop drawings must indicate the design weight and provide sufficient dimensions to permit checking. All castings shall be thoroughly cleaned in the shop and given two coats of approved bituminous paint before rusting begins.
2. Manhole frames and covers shall be equal to the following: JWSC Construction Standards, latest edition.
3. All frames and covers shall have machined horizontal bearing surfaces.
4. All manholes shall have standard frames and covers except where specifically shown otherwise on the Drawings.
5. Watertight covers shall be bolt-down type and shall be equipped with four 2-inch stainless steel bolts and a 1/8-inch red rubber or rubber O-ring gasket. Covers shall be rotatable and interchangeable. Bolt holes shall be bored through so that debris entering the bolt hole will fall into the manhole. Bolt holes shall have the full 360 degree circle within the cover's radius when bored through the cover.

G. Storm Drain Inlets

1. Frames and gratings shall be of the type shown on the Drawings. Iron castings shall conform to ASTM A 48, Class 30. All castings shall be true to pattern in form and dimensions, free from faults, sponginess, cracks, blowholes and other defects affecting their strength. Bearing surfaces between cast frames and gratings shall be machined, fitted together and match marked to prevent rocking.
2. Inlets, grates and frames in paved and roadway areas shall be rated for HS-20 loading.
3. Inlets, grates and frames in non-paved and non-roadway areas shall be rated for a minimum of 2,000 pound wheel load unless shown otherwise of the Drawings.
4. Minimum clear opening areas shall be as shown on the Drawings.

- H. Joint Sealants: Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant. Butyl rubber sealants shall meet the requirements of

AASHTO M-198. Sealant shall be pre-formed type with a minimum nominal diameter of 1-inch. Butyl rubber sealant shall be equal to Kent Seal No.2 or concrete Sealants CS202.

- I. Steps: Manhole steps are required.
- J. Rubber Boots: Provide preformed rubber boots and fasteners equal to those manufactured by Kor-N-Seal or Press Seal Gasket Corporation.
- K. Floor Doors.
 - 1. Door shall be a single or double leaf type as shown on the Drawings built to withstand 150 pounds per square foot.
 - 2. The frame shall be 1/5-inch extruded aluminum with built-in neoprene cushion and with strap anchors bolted to the exterior. Door leaf shall be 1/4-inch aluminum diamond plate reinforced with aluminum stiffeners as required. Stainless steel hinges shall be bolted to the underside and pivot on torsion bars that counterbalance the door for easy operation. The door shall open to 90 degrees and lock automatically in that position. A vinyl grip handle shall be provided to release the cover for closing. Doors shall be equipped with a snap lock and removable handle. Door shall also be equipped with hasp and padlock in addition to built-in locking mechanisms. Padlocks for all doors shall be keyed alike. Bituminous coating shall be applied to the exterior of the frame by the manufacturer. All parts shall be aluminum or stainless steel.
 - 3. Door shall be Type JD for double leaf doors and Type J for single leaf doors by The Bilco Company or The Halliday Company.

2.02 MISCELLANEOUS APPURTENANCES

- A. Meter Boxes
 - 1. Cast iron meter boxes shall be oval or rectangular shaped. Cover shall have lifting loop cast into the top.
 - 2. Cast iron meter boxes shall be equal to Vulcan, Russell or Griffin Foundry.
- B. FRP Meter Boxes
 - 1. Meter boxes shall be plastic. Material shall meet or exceed the following:
 - a. Tensile Strength: 3,400 psi (ASTM D 638).
 - b. Flexural Modulus: 191,000 psi (ASTM D 790).
 - c. Impact Strength, Izod: 0.6 feet 16-inch (ASTM D 256).
 - d. Deflection Temperatures: 200 degrees F (ASTM D 648).
 - 2. Meter box shall be fitted with cast iron cover.
 - 3. Minimum dimensions shall be 10-3/4 x 16-inches top and 18-1/2 c 13-1/4-inches at bottom and 12-inches deep.

4. Plastic meter boxes shall be equal to Ametek, Plymouth Products Division or Brooks Products, Inc.
- C. Corporation Cocks and Curb Stops
1. Corporation cocks and curb stops shall be ground key type, shall be made of bronze conforming to ASTM B61 or B62 and shall be suitable for the working pressure of the system. Ends shall be suitable for compression type joint. Threaded ends for inlet and outlet of corporation cocks shall conform to AWWA C800; coupling nut for connection to flared copper tubing shall conform to ANSI B16.26.
 2. Corporation cocks and curb stops shall be equal to Mueller.
- D. Service Clamps
1. Service clamps shall be ductile iron, double strap clamps.
 2. Service clamps shall be equal to Mueller.

PART 3 EXECUTION

3.01 GENERAL

- A. Excavation for backfilling for all manholes covered under this Section shall conform to the requirements of Section 02200 of these Specifications.
- B. Top Elevations: Build manholes outside of paved areas to 18-inches above finished grade unless otherwise shown on the Drawings or directed by the Engineer. Build manholes in paved areas to existing grades.
- C. Drop Connections: Manholes requiring drop connections are shown on the Drawings. Construct drop connections of the same materials as the upstream sewer and in accordance with the details shown on the Drawings.
- D. Inlet and Outlet Pipe
1. Inlet and outlet pipes shall be supported outside the manhole in accordance with the requirements of Section 02224 of these Specifications.
 2. Where required, inlet and outlet pipes shall be cut-off flush with the interior surface of the manhole walls.
- E. Inverts: All inverts shall be Class A concrete meeting the requirements of Section 03300 of these Specifications, and shall conform to the shape indicated on the Drawings or as directed by the Engineer. The invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in directions of flow through

the inlet shall be made to a true curve with as large a radius as the size of the inlet will permit.

- F. Invert Elevations: The invert elevations shown on the Drawings shall be for the invert at the centerline of the manhole or for the invert of the precast concrete fitting associated with the pipe tee manhole. Prior to setting the laser or other vertical alignment control system for the sewer upstream of the manhole, the Contractor shall verify the elevation of the sewer installed at the manhole. Should the elevation differ from that shown on the Drawings, the Contractor shall take the following corrective action:
1. If the sewer is laid at negative grade, the Contractor shall remove and reinstall the sewer at the correct grade at no additional cost the Owner.
 2. If the sewer is laid at a grade less than that shown on the Drawings, thus reducing the sewer's capacity, the Owner may require the sewer to be removed and relaid at the correct grade at no additional cost to the Owner. As a minimum, the grade to the next upstream manhole shall be adjusted such that the next upstream manhole shall be set at the correct elevation.
 3. If the sewer is laid at a grade greater than that shown on the Drawings, and if the Contractor can show that there are no conflicts with upstream existing utilities or obstruction, the Contractor shall adjust the grade of the next upstream manhole such that the next upstream manhole shall be set at the correct elevation. If such an adjustment, in the Engineer's opinion, is substantial, the grade adjustment shall be spread over multiple sections of the sewer. If such an adjustment, in the Owner's opinion, significantly reduces the sewer's capacity, the Owner may require the Contractor to remove and relay that portion of the sewer laid at the improper grade.
- G. Manholes shall be constructed such that their walls are plumb.
- H. Manhole Markers: Install manhole markers adjacent to manhole directly over upstream pipe.
- I. The cast iron frame for the manhole cover shall be set at the required elevation and properly anchored to the masonry. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be tilted to conform to the exact slope, crown and grade of the existing adjacent pavement.
- J. Masonry work shall be allowed to set for a period of not less than 24 hours. Outside forms, if any, then shall be removed and the manhole backfilled and compacted. All loose or waste material shall be removed from the interior of the manhole. The manhole cover then shall be placed and the surface in the vicinity of the work cleaned off and left in a neat and orderly condition.
- K. After backfilling has been completed, the excavated area, if located in a street, alley or sidewalk, shall be provided with a temporary surface.

- L. Floor Doors: Floor doors shall be integrally cast into the top of the manhole at the location shown on the Drawings. The Contractor shall verify the location with the Engineer and any equipment manufacturers prior to installation of the floor door. Floor doors shall be cast into concrete in accordance with the manufacturer's recommendations.

3.02 CONSTRUCTION OF CAST-IN-PLACE CONCRETE MANHOLES

- A. Cast-in-place manholes shall be constructed in place as shown on the Drawings and in accordance with the requirements of Section 03300 of these Specifications.
- B. The base shall be concentric with the manhole and have a minimum diameter of 16-inches greater than the outside diameter of the manhole, and 10-inch minimum thickness under the lowest pipe. Minimum wall thickness shall be 6-inches.
- C. Adjustment rings shall be provided between the conical section and the manhole frame. The rings shall be cast-in-place using building felt between pours to create a weakened joint or as directed by the Engineer. If adjustment of the lid elevation is called for, concrete donut sections or brick shall be used.
- D. Should circumstances make a joint necessary, a formed groove or reinforcing dowels shall be required in the top of the first placement for shear protection. Immediately before the second placement is made, the surface of the cold joint shall be thoroughly cleaned and wetted with a layer of mortar being deposited on the surface.

3.03 PRECAST MANHOLE CONSTRUCTION

- A. Construct manholes as shown on the Drawings and in accordance with the requirements of ASTM C 891.
- B. Precast Concrete: Handle sections carefully to prevent cracking or chipping. Provide uniform bedding of the bottom section to prevent uneven loading. Install gaskets and joint sealants in accordance with manufacturer's recommendations to produce a watertight structure.
- C. Brick: Where bricks are used to adjust the frame and cover to grade, bed the bottom and sides of every brick in mortar. Apply a smooth coat of mortar, 3/4-inch thick, on the inside and outside.
- D. Pipe Connections for HDPE Pipe: Install the manhole entry pieces as follows:
 - 1. Do not cut the smooth wall manhole entry piece. Instead, cut the spigot end off of standard quarter, half or full length pipe so that the manhole entry piece is properly positioned in the manhole wall.
 - 2. Prepare the field cut end so that a standard sealing ring can be installed for watertight joint in accordance with manufacturer's recommendations.
 - 3. Connect rubber boot to the manhole entry piece and to the manhole wall using

fasteners recommended by the boot manufacturer.

- E. Pipe Connections: Seal the void between the pipe and the manhole with brick and mortar on both the inside and outside.
 - 1. Pipe 36-inch Diameter and Less: Connect pipe to manhole utilizing rubber boots.
 - 2. Pipe 42-inch Diameter and Larger: Construct manhole collars as shown on the Drawings after the pipe has been sealed into the manhole. Forms may be used in lieu of brick sidewalls upon written approval of the Engineer.
 - 3. If preformed opening must be enlarged or altered, or if new openings must be made in the field, minimize the amount of material removed to provide closely matched surfaces for grouting.
- F. Frames and Covers: Unless frame and cover is at grade, the frame shall be cast into the cone section.
- G. Seal all manhole joints and lift holes, both inside and out, with grout. Between precast sections, this is in addition to joint sealant.

3.04 SURFACE PREPARATION AND SHOP PAINTING

Frames, covers and steps shall be cleaned, shop primed and shop painted with a bituminous paint in accordance with the requirements of Section 09900 of these Specifications.

3.05 INSPECTION AND TESTING

All manholes shall be tested in accordance with the requirements of Section 02666 of these Specifications.

END OF SECTION

**SECTION 02665
WATER MAINS AND ACCESSORIES**

PART 1 GENERAL

1.01 SUMMARY

- A. This Section describes products to be incorporated into the water mains and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications. ***Should there be a conflict between these specifications and the Owner's Construction Standards, the Owner's standards shall be used and govern. The Owner's Construction Standards are hereby incorporated into these specifications by reference.***
- B. General: Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards are applicable.

1.02 QUALIFICATIONS

If requested by the Engineer, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

1.03 SUBMITTALS

- A. Complete product data and engineering data for all products shall be submitted to the Engineer in accordance with the requirements of these Specifications.

1.04 TRANSPORTATION AND HANDLING

- A. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification. Pipe handled on skids shall not be rolled or skidded against the pipe on the ground.
- B. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front end loader. Do not use material damaged in handling. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior coatings or internal lining of the pipe.

1.05 STORAGE AND PROTECTION

- A. Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.
- B. Stored materials shall be kept safe from damage. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt or foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.
- C. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tier shall be kept off the ground on timbers, rails or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. At least two rows of timbers shall be placed between tiers and chocks, affixed to each other in order to prevent movement. The timbers shall be large enough to prevent contact between the pipe in adjacent tiers.
- D. Stored mechanical and push-on joint gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.
- E. Mechanical-joint bolts shall be handled and stored in such manner that will ensure proper use with respect to types and sizes.

1.07 QUALITY ASSURANCE

The manufacturer shall provide written certification to the Engineer that all products furnished comply with all applicable requirements of these Specifications.

PART 2 PRODUCTS

2.01 PIPING MATERIALS AND ACCESSORIES

- A. Ductile Iron Pipe (DIP)
 - 1. Ductile iron pipe shall be manufactured in accordance with AWWA C151. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipe shall have a minimum pressure rating as indicated in the following table, and corresponding minimum wall thickness, unless otherwise specified or shown on the Drawings:

Pipe Sizes (inches)	Pressure Class (psi)
4 - 12	350

14 - 20	350
24	250
30 - 64	250

2. Flanged pipe minimum wall thickness shall be equal to Special Class 53. Flanges shall be furnished by the pipe manufacturer.
3. Pipe and fittings shall be cement lined in accordance with AWWA C104. Pipe and fittings shall be furnished with a bituminous outside coating and interior lining.
4. Fittings shall be ductile iron and shall conform to AWWA C110 or AWWA C153 with a minimum rated working pressure of 250 psi.
5. Joints
 - a. Unless shown or specified otherwise, joints shall be push-on or restrained joint type for pipe and standard mechanical, push-on or restrained joints for fittings. Push-on and mechanical joints shall conform to AWWA C111. Restrained joints shall be American "LOK-FAST" or "FLEX-RING" with gaskets. No field welding of restrained joint pipe will be permitted.
 - b. Flanged joints shall meet the requirements of ANSI B16.1, Class 125.
6. Provide the appropriate gaskets for mechanical and flange joints. Gaskets for flange joints shall be made of 1/8-inch thick, cloth reinforced rubber; gaskets may be ring type or full face type.
7. Bolts and Nuts
 - a. Provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A.
 - b. Bolts and nuts for mechanical joints shall be Tee Head Bolts and nuts of high strength low-alloy steel in accordance with ASTM A 242 to the dimensions shown in AWWA C111/ANSI A21.11.
 - c. Flanged joints shall be bolted with through stud or tap bolts of required size as directed. Bolt length and diameter shall conform to ANSI/AWWA C115 for Class 125 flanges shown in ANSI/ASME B16.1.
 - d. Bolts for exposed service shall be zinc plated, cold pressed, steel machine bolts conforming to ASTM A 307, Grade B. Nuts for exposed service shall be zinc plated, heavy hex conforming to ASTM A 563. Zinc plating shall conform to ASTM B 633, Type II.
 - e. Bolts for submerged service shall be stainless steel machine bolts conforming to ASTM A 193, Grade B8. Nuts shall be heavy hex, stainless steel conforming to ASTM A 194, Grade 8.
8. Mechanical joint glands shall be ductile iron.
9. Ductile iron pipe shall be encased with polyethylene film where shown on the

- Drawings. Polyethylene film shall have a minimum thickness of 8 mils.
10. Thrust collars shall be welded-on ductile iron body type designed to withstand thrust due to 250 psi internal pressure on a dead end.
 11. Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

- B. Detection Tape: Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Water Systems, Safety Precaution Blue, A Caution Water Line Buried Below. Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be a minimum of 2-inches when buried less than 10-inches below the surface. Tape width shall be a minimum of 3-inches when buried greater than 10-inches and less than 20-inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape.

2.02 VALVES

A. Gate Valves (GV)

1. 3-Inches in Diameter and Smaller: Gate valves shall be bronze, heavy duty, rising stem, wedge type with screwed or union bonnet. Valve ends shall be threaded or solder type as appropriate. Valves shall have a minimum 200 psi working pressure for water (125 psi working pressure for steam). Valves shall be made in the U.S.A. Gate valves shall be Mueller.
2. 4-Inches Through 12-Inches in Diameter: Gate valves 4-inches through 12-inches shall be resilient wedge type conforming to the requirements of AWWA C509 rated for 200 psi working pressure.
 - a. Valves shall be provided with two O-ring stem seals with one O-ring located above and one O-ring below the stem collar. The area between the O-rings shall be filled with lubricant to provide lubrication to the thrust collar bearing surfaces each time the valve is operated. At least one anti-friction washer shall be utilized to further minimize operating torque. All seals between valve parts, such as body and bonnet, bonnet and bonnet cover, shall be flat gaskets or O-rings.
 - b. The valve gate shall be made of cast iron having a vulcanized, synthetic rubber coating, or a seat ring attached to the disc with retaining screws. Sliding of the rubber on the seating surfaces to compress the rubber will not be allowed. The design shall be such that compression-set of the rubber shall not affect the ability of the valve to seal when pressure is applied to either side of the gate. The sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.
 - c. All internal ferrous surfaces shall be coated with epoxy to a minimum

thickness of 4 mils. The epoxy shall be non-toxic, impart no taste to the water and shall conform to AWWA C550, latest revision.

d. Gate valves 4 through 12-inches shall be manufactured by Mueller.

3. 16-Inches in Diameter and Larger: Valves shall be double-disc type conforming to the requirements of AWWA C500. Valves shall be designed for horizontal installation with tracks and rollers, bypass valves, and bevel gear type operator. Valves shall be rated for 150 psi working pressure.

a. Valve ends shall be mechanical joint type except where flanged or restrained joint ends are shown. Flanged joints shall meet the requirements of ANSI B16.1, Class 125.

b. Buried valves shall be equipped with valve boxes unless access to the operator is provided by a manhole.

c. Manually operated valves, including geared valves, shall be non-rising stem type having O-ring seals.

d. Gate valves 16-inches in diameter and larger shall be manufactured by Mueller.

B. Butterfly Valves (BV)

1. Butterfly valves shall be resilient seated, short body design, and shall be designed, manufactured, and tested in accordance with all requirements of AWWA C504. Valves shall be designed for a rated working pressure of 150 psi, unless shown otherwise on the drawings. AWWA C504 Section 5.2 testing requirements are modified as follows for valves designed for a rated pressure of 250 psi: the leakage test shall be performed at a pressure of 250 psi; proof of design tests shall be performed and certification of such proof of design test shall be provided to the Engineer.

2. Valve bodies shall be ductile iron conforming to ASTM A 536, Grade 65-45-12 or ASTM A 126, Grade B cast iron. Shafts shall be 18-8, Type 304 stainless steel, machined and polished. Valve discs shall be ductile iron, ASTM A 536, Grade 65-45-12 or ASTM A 126, Grade B cast iron. The resilient valve seat shall be located either on the valve disc or in the valve body and shall be fully field replaceable for valves 30" and larger.

3. Actuators

a. Valves shall be equipped with traveling nut, self-locking type actuators designed, manufactured and tested in accordance with AWWA C504. Actuators shall be capable of holding the disc in any position between full open and full closed without any movement or fluttering of the disc.

b. Actuators shall be furnished with fully adjustable mechanical stop-limiting devices. Actuators that utilize the sides of the actuator housing to limit disc travel are unacceptable.

c. Valve actuators shall be capable of withstanding a minimum of 450 foot pounds of input torque in either the open or closed position without damage.

4. Operators: Valves for buried service shall have a nut type operator and shall be equipped with a valve box and stem extension, as required.
5. Valves shall be installed with the valve shafts horizontal. Valves and actuators shall have seals on all shafts and gaskets on valve actuator covers to prevent the entry of water. Actuator mounting brackets shall be totally enclosed and shall have gasket seals.
6. Valve ends shall be mechanical joint type, except where flanged or restrained joint ends are shown. Flange joints shall meet the requirements of ANSI B16.1, Class 125.
7. Butterfly valves shall be manufactured by M&H.

C. Plug Valves

1. Valves shall be 90 degree turn, non-lubricated, eccentric type with resilient faced plugs. Design of the valve shall provide that contact between the seat and the plug shall only occur in the final degrees of plug movement. Valves shall be suitable for throttling service where valve operation is infrequent.
2. Valves shall provide drip-tight shut-off up to the full pressure rating with pressure in either direction. Pressure ratings shall be established by hydrostatic tests conducted in accordance with ANSI B16.1. Valves shall be rated at a minimum of 150 psi.
3. Valves shall have a port area equal to at least 80 percent of the full pipe area.
4. Bodies shall be cast-iron, conforming to ASTM A 126, Class B (carbon steel for 2-inch valves).
5. Valve ends shall be a mechanical joint type, except where flanged or restrained joint ends are shown on the Drawings. Mechanical joint valves shall have bell ends conforming to applicable requirements of ANSI B16.1, Class 125. Flanged valves with flange-to-MJ adapters shall not be acceptable in lieu of MJ valves.
6. Valve seats shall be a raised, welded-in overlay of not less than 90 percent pure nickel, machined to mate with the resilient faced plug. Overlay shall be minimum of 1/8-inch thick.
7. The plug shall be of semi-steel, conforming to ASTM A 126, Class B. The plug facing shall be a synthetic rubber compound of approximately 70 durometer hardness bonded to the plug. Facing material shall be abrasion resistant and suitable for service in sewage and sludge applications.
8. Valves shall be furnished with replaceable, sleeve-type bearings in the upper and lower journals. Bearings shall comply with applicable requirements of AWWA C507. Bearing materials shall have a proven record of service of not less than five years.
9. The valve body shall be fitted with a bolted bonnet incorporating a stuffing box and pull-down packing gland. Packing shall be the split chevron type. Design of exposed valves shall allow visible inspection of the shaft seal, adjustment of the packing, and replacement of the packing, all without disturbing the bonnet or valve operator. The shaft seal shall comply with the requirements of AWWA C504.
10. Actuators

- a. Valves for exposed service, 3 through 8-inches in diameter, shall be lever operated. Hand levers shall be steel with a non-metallic grip.
 - b. Actuators for buried service and valves 10-inches and larger, shall be equipped with manual operated geared actuators. Geared actuators shall be totally enclosed, oil lubricated, worm and gear type. Shaft seals shall be provided to prevent entry of dirt and water into the actuator. All shaft bearings shall be permanently lubricated bronze bushings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. Construction of actuator housing shall be semi-steel. Gear actuators shall comply with requirements of AWWA C504.
 - c. Gear actuators for buried valves 10-inches and larger in diameter shall be mounted above ground on an extended bonnet.
 - d. Motorized actuators shall be provided where shown on the Drawings and as specified in this Section.
 - e. Valves and operators for submerged or buried services shall have seals on all shafts and gaskets on valve operator covers to prevent the entry of water. Operator mounting brackets for submerged service shall be totally enclosed and shall have gasket seals.
11. Operators
- a. Valves for non-buried service, six feet or more above the operating floor shall be furnished with a chain wheel operator and chain for operation from floor level. All other valves shall be equipped with a handwheel operator.
 - b. Valves, 3 through 8-inches, for buried service shall have a nut type operator and shall be equipped with a valve box and stem extension required to bring the operation nut within 6-inches of finished grade. Valve boxes and extension stems shall be as specified in this Section.
 - c. Valves shall be equipped with pedestal type operators where shown on the Drawings.
12. All exposed bolts, nuts, and washers for buried or submerged valves shall be stainless steel. All exposed nuts, bolts, springs, washers, and miscellaneous hardware shall be zinc coated in accordance with ASTM A 153 unless specified otherwise.
13. The exterior of all buried valves shall have a factory applied, two coat coal tar epoxy coating system. The coat tar epoxy shall be Tnemac Tneme-Tar 46-413, Indurall Ruffstuff 2100 Coal Tar Epoxy or Kop-Coat Bitumastic No. 300-M. Each coating shall have a minimum dry film thickness of 8-10 mils.
14. All ferrous metal interior surfaces of plug valves shall be provided with a factory applied epoxy interior coating conforming to the requirements of AWWA C550. The coating shall be either TNEMEC Series 20 Pota Pox, Valspar Series 78 or Kopcoat Hi Gard Epoxy. Each coating shall have a minimum dry film thickness of 4 to 6 mils.
15. Acceptable Manufacturers: All plug valves shall be products of a single manufacturer who must submit evidence of five years satisfactory service in sewage applications of the same design and of the sizes required. Valves shall be

manufactured by DeZurik or Val-Matic.

2.03 MUD VALVES

- A. Mud valves shall be of the iron body, bronze mounted type with non-rising stems, flanged ends, extension stem, 2-inch square operating nut, and open by turning left.
- B. The frame, yoke, and gate shall be sturdily proportioned for strength and rigidity and be of cast iron conforming to ASTM specifications A 126 Class B.
- C. The stem, stem nut, and seats shall be bronze. The stem shall be machined with accurately cut acme threads.
- D. The gate seat shall be rolled into a dovetailed groove under pressure to make one inseparable unit. The body (frame) seat ring shall be threaded and screwed into place in the frame.
- E. Both gate and body seat ring faces shall be machined to a smooth finish.
- F. Mud valves shall be manufactured by Clow, M&H or approved equal by owner.

2.04 FIRE HYDRANTS (FH)

- A. All fire hydrants shall conform to the requirements of AWWA C502 for 150 psi working pressure. Hydrants shall be the compressive type, closing with line pressure. The valve opening shall not be less than 5-1/4-inches. Hydrants shall open left.
- B. In the event of a traffic accident, the hydrant barrel shall break away from the standpipe at a point above grade and in a manner which will prevent damage to the barrel and stem, preclude opening of the valve, and permit rapid and inexpensive restoration without digging or cutting off the water.
- C. The means for attaching the barrel to the standpipe shall permit facing the hydrant a minimum of eight different directions.
- D. Hydrants shall be fully bronze mounted with all working parts of bronze. Valve seat ring shall be bronze and shall screw into a bronze retainer.
- E. All working parts, including the seat ring shall be removable through the top without disturbing the barrel of the hydrant.
- F. The operating nut shall match those on the existing hydrants. The operating threads shall be totally enclosed in an operating chamber, separated from the hydrant barrel by a rubber

O-ring stem seal and lubricated by grease or an oil reservoir. A stop nut shall be positioned in the top operating mechanism so that the valve cannot contact the bottom of the shoe when fully open.

- G. Hydrant shall be a non-freezing design and be provided with a simple, positive , and automatic drain which shall be fully closed whenever the main valve is opened.
- H. Hose and pumper connections shall be breech-locked, pinned, or threaded and pinned to seal them into the hydrant barrel. Each hydrant shall have two 2-1/2-inch hose connections and on 4-1/2-inch pumper connection, all with National Standard threads and each equipped with cap and non-kinking chain.
- I. Hydrants shall be furnished with a mechanical joint connection to the spigot of the 6-inch hydrant lead.
- J. Minimum depth of bury shall be 4.5 feet. Provide extension section where necessary for proper vertical installation and in accordance with manufacturer's recommendations.
- K. All outside surfaces of the barrel above grade shall be painted with enamel in a color to be selected by the Owner.
- L. Hydrants shall be traffic model and shall be Mueller Super Centurion or manufactured by American-Darling or M & H.

2.05 PRESSURE REDUCING VALVES (2 TO 2-INCH SIZE)

- A. Provide bronze body, spring controlled, adjustable pressure reducing valve with threaded connections.
- B. Provide valves with high temperature diaphragm and renewable nickel alloy seat.
- C. Provide with thermal expansion bypass.
- D. Provide with separate bronze strainer with 20 mesh stainless steel basket. Attach to valve with threaded connections.
- E. Rated for 300 psig maximum inlet water pressure with adjustable 25-75 psig outlet water pressure. Nominal outlet pressure shall be set to 75 psig.
- F. Tested and certified under ASSE 1003 and the Standard Plumbing Code.
- G. Acceptable Manufacturers: Watts 223SB, Wilkins, Mueller.

2.06 PRESSURE REDUCING CONTROL VALVES (1-1/4 inch to 6-inch size)

- A. Provide fluid actuated automatic control valves where indicated to regulate downstream

water pressure.

- B. Provide valves with cast iron valve body and cover. Exposed internal and external surfaces shall be coated with an FDA approved fused epoxy finish coat.
- C. Provide with flexible, non-wicking, FDA approved, reinforced synthetic elastomer diaphragm integral with the valve assembly. Support the diaphragm with an actuation stem utilizing upper and lower bearings.
- D. Provide flow sealing in the closed position with a separate elastomer sealing ring and smooth metal seat surface. Seat design shall be removable and shall not promote seal cutting or wear at low flow rates.
- E. Unless otherwise noted, valves shall be rated for a minimum of 150 psig inlet pressure with an adjustable outlet pressure range of 30 to 90 psig. Nominal outlet pressure shall be adjusted to 65 psig.
- F. Provide with inlet strainer per manufacturer's standard arrangement.
- G. Provide valves with flanged end connections.
- H. Acceptable Manufacturers: Watts Series 115, Cla-Val, OCV.

2.07 BACKFLOW PREVENTERS, REDUCED PRESSURE ZONE TYPE (RPZ) (2-1/2 TO 10-Inch Size)

- A. Provide reduced pressure zone backflow preventers where noted on the Drawings. Backflow preventers shall be rated for operation with inlet water pressures up to 175 psig and water temperatures up to 110-1/2 degrees F. Backflow preventers shall be tested and certified in accordance with ASSE 1013 and AWWA C506 and C511.
- B. Provide with FDA approved epoxy coated cast iron check valve bodies, removable bronze seats, stainless steel internal parts, and FDA approved epoxy coated cast iron relief valve with stainless steel trim.
- C. Valves shall be accessible with top or side access for maintenance without requiring removal from the line.
- D. Provide isolation valves on the inlet and outlet of each backflow preventer. These valves shall be non-rising stem resilient wedge gate valves or full port, resilient seated, quarter turn ball valves.
- E. Provide bronze body ball valve test cocks.
- F. Provide FDA approved epoxy coated cast iron body strainer on the inlet of each backflow preventer or as otherwise noted.

- G. Acceptable Manufacturers: Watts Series 909, Wilkins, Hersey.

2.08 STAINLESS STEEL BALL VALVES (3-INCHES AND SMALLER)

- A. Ball valves two inches in diameter and smaller shall be three piece, full port and stainless steel body construction. Ball valves 2-1/2-inches in diameter shall have reduced port with three piece stainless steel body construction. Valve shall have threaded ends and a lever operator or motorized operator as shown on drawings. Ball shall be 316 stainless steel with TFE seats and packing. Valve shall be pressure rated for 1,000 psi.
- B. Ball valve shall be manufactured by Watts Series S, Apollo Series 85 and 86, or Neles-Jamesbury Series 4000.

2.09 CHECK VALVES (CV)

- A. Check valves shall be swing disc type, oil cushioned valve constructed in accordance with AWWA C508.
- B. Check valves shall be hinged disc type with cast iron body and bronze or bronze-fitted disc with replaceable resilient seat. Valves shall be designed for the operating head indicated and shall not slam shut on pump shutdown. The valve shall be set to close at the differential pressure of 2.0 psi. Valves shall be equipped with a 2-inch stop cock at the high point of the valve for bleeding air from the line.
- C. Valves shall be outside weight and lever cushioned type. The cushion chamber shall be rigidly attached to the side of the valve body externally and constructed with a piston operating in a chamber that will effectively prevent water hammer at the pump discharge heads specified. The cushioning shall be by vegetable grade oil, and the cushion dashpot assembly shall be so arranged that the closing speed will be adjustable to meet the service requirements.
- D. Valve ends shall be flanged, meeting the requirements of ANSI B16.1, Class 125.
- E. Valves shall be manufactured by APCO (Model 6100), or GA Industries (Model 25-DXH).

2.10 PVC BALL VALVES (BLV)

Chemical feed ball valves shall be non-shock thermoplastic of Type 1, Grade 1 PVC with O-ring stem seal and Teflon ball seat. Valves shall withstand 150 psi pressure. Valves shall have union connections at each end. Valves shall be Hayward "Safe Block" or Chemtrol TU Series.

2.11 PVC BALL CHECK VALVES (CV)

Chemical feed ball check valves shall be non-shock thermoplastic type of Type 1, Grade 1 PVC

with O-ring ball seal. The valve shall have a true union connection for easy removal. The valve shall operate in the vertical or horizontal position. Valve shall be Hayward "True Check" or Chemtrol BC Series.

2.12 MOTORIZED ACTUATORS

Not Used

2.13 VALVE OPERATOR ACCESSORIES

A. Pedestal Operators for Valves (PO)

1. Non-gearped pedestal type operators shall be provided and installed as shown on the drawings. Operators shall be high strength cast iron. Non-gearped operators shall be equipped with indicators to show valve position and shall have handwheel operator. Operators shall be non-rising stem or rising stem valves. The operator shall be sized by the valve manufacturer to provide a minimum of two times the force and torque required to operate the valve with a maximum 40 pound force applied to the handwheel. Operators shall be manufactured by Clow, Troy, or shall be an accessory product of the valve manufacturer.
2. Geared pedestal operators shall be provided and installed as shown on the drawings. Geared operators shall have ball thrust bearings sized by the valve manufacturer and shall be equipped with valve position indicators and crank type handle. The operator shall be sized by the valve manufacturer to provide two times the maximum load or torque required to operate the valve with a maximum 40 pound force applied to the crank. The operators shall be manufactured by Clow or shall be a product of the valve manufacturer.

B. Stem Guides (SG): Fully adjustable stem guides with bronze bushings, shall be furnished by the manufacturer of the associated valve and shall be installed as shown on the drawings and wherever necessary to conform to the extension stem guide spacing requirements of AWWA C501.

C. Extension Stems: Extension stem shall be stainless steel and shall be furnished by the manufacturer of the associated valve. Extension stems shall be sized by the valve manufacturer to withstand the maximum valve operator output. Extension stems shall be provided with operating nuts located within six inches of finished grade.

D. Valve Boxes (VB)

1. All valves shall be equipped with valve boxes. The valve boxes shall be cast iron two piece screw type with drop covers. Valve boxes shall have a 5.25-inch inside diameter. Valve box covers shall weigh a minimum of thirteen pounds. The valve boxes shall be adjustable to six inches up or down from the nominal required cover over the pipe. Valve boxes shall be of sufficient length that bottom

flange of the lower belled portion of the box is below the valve operating nut. Ductile or cast iron extensions shall be provided as necessary. Covers shall have "WATER VALVE" cast into them. Valve boxes shall be manufactured in the United States.

2. Valve boxes shall be manufactured by Mueller (A-26441), M&H Valve (Style 3801), Tyler, or Opelika.
- E. Floor Boxes: Valve floor boxes shall be provided where shown on the drawings. Floor boxes shall be manufactured by Vulcan Industries, Troy, Clow F-5695, U.S. Foundry, American-Darling, Neenah, or M&H Valve.

2.14 VALVE BOXES (VB) AND EXTENSION STEMS

- A. All valves shall be equipped with valve boxes. The valve boxes shall be cast iron two-piece screw type with drop covers. Valve boxes shall have a 5.25-inch inside diameter. Valve box covers shall weigh a minimum of 13 pounds. The valve boxes shall be adjustable to 6-inches up or down from the nominal required cover over the pipe. Valve boxes shall be of sufficient length that bottom flange of the lower belled portion of the box is below the valve operating nut. Ductile or cast iron extensions shall be provided as necessary. Covers shall be WATER VALVE or WATER cast into them. Valve boxes shall be manufactured in the United States.
- B. All valves shall be furnished with extension stems, as necessary, to bring the operating nut to within 30-inches of the top of the valve box. Connection to the valve shall be with a wrench nut coupling and a set screw to secure the coupling to valves operating nut. The coupling and square wrench nut shall be welded to the extension stem. Extension stems shall be equal to Mueller A-2641, M & H Valve Style 3801, or manufactured by Tyler and Opelika.

2.15 VALVE MARKERS (VM)

The Contractor shall provide a concrete valve marker as detailed on the Drawings for each valve installed. Valve markers shall be stamped Water.

2.16 TAPPING SLEEVES AND VALVES (TS&V)

Tapping sleeves shall be cast or ductile iron of the split-sleeve, mechanical joint type. The Contractor shall be responsible for determining the outside diameter of the pipe to be connected to prior to ordering the sleeve. Valves shall be gate valves furnished in accordance with the specifications shown above, with flanged connection to the tapping sleeve and valve shall be supplied by the valve manufacturer. Tapping sleeves shall be equal to American-Darling, Mueller or M & H Valve.

2.17 TAPPING SADDLES

Tapping saddles shall be ductile iron body type with O-ring gasket and alloy steel straps. Connections shall be flanged or mechanical joint as detailed on the Drawings. Tapping saddles shall be equal to ACIPCO A-30920.

2.18 CORPORATION COCKS AND CURB STOPS

Corporation cocks and curb stops shall be ball type, shall be made of bronze conforming to ASTM B 61 or B 62, and shall be rated at 150 psi. Ends shall be suitable for flared tube compression type joint. Threaded ends for inlet and outlet of corporation cocks shall conform to AWWA C800; coupling nut for connection to flared copper tubing shall conform to ANSI B16.26. Corporation cocks and curb stops shall be manufactured by Mueller, McDonald or Ford. Curb stops for 2-inch blow-off assemblies or other main line locations shall have inside IPT on both ends. They shall be Mueller Catalog No. B-20283 or Ford Catalog No. B11-777. Provide valve boxes, specified elsewhere in these Specifications, with all main line curb stops. Corporation cocks and curb stops will be furnished by the Contractor.

2.19 AIR VALVES

- A. Air Release Valves: Air release valves shall be one of the following types:
 - 1. The air release valve shall automatically release air accumulations from the pipeline due to the action of the float. When the air valve body fills with air, the float falls freely from the orifice to allow the air to escape to the atmosphere. When all the air has been exhausted from the valve body, the float will be buoyed up to seat against the orifice and prevent water from being exhausted from the valve. The valve body and cover shall be constructed of cast iron (ASTM A 126-B). A synthetic orifice button shall be affixed to the valve cover to provide a non-corrosive seat for the float. The float shall be valve constructed of stainless steel. A resilient, Buna-N seat shall be attached to the float for drop-tight closure. The float shall be free floating within the valve body. Valve orifice size shall be as shown on the drawing.
- B. Air/Vacuum Valve: The air/vacuum valve shall discharge large amounts of air as the pipeline fills and allow air to enter the pipeline as it drains or in the event of vacuum conditions. The valve shall operate by means of a non-collapsible stainless steel float which seals an orifice. As air enters the valve the float shall drop from the orifice and allow the air to escape. As water rises in the valve, the float will again seal the orifice. The valve will be of such design that the float cannot blow shut at any air velocity. All working parts shall be of stainless steel. The inside of the valve body shall be epoxy coated. Valve inlet size shall be as shown on the detail drawing schedule.
- C. Combination Air Valves: Combination air valves shall combine the features of an air release valve and an air/vacuum valve and shall be of one of the following types:
 - 1. Valve shall consist of air/vacuum valve described in paragraph B, above, with an air release valve described in A, above tapped into its body. The valve shall be of

two-piece body design with an isolation gate valve separating the two valves.

2. Valve shall be single body, double orifice, allowing large volumes of air to escape out the larger diameter air and vacuum orifice when filling a pipeline and closes watertight when the liquid enters the valve. During large orifice closure, the smaller diameter air release orifice will open to allow small pockets of air to escape automatically and independently of the large orifice. The large air/vacuum orifice shall also allow large volumes of air to enter through the orifice during pipeline drainage to break the vacuum. The Buna-N seats must be fastened to the valve, without distortion, for drop-tight shut-off. The float shall be stainless steel. Valve sizes shall be as shown on the detail drawing schedule.
- D. Surge Check Valve: Where shown on the Drawings or specified, provide a surge check valve on the inlet of the air/vacuum valve. The surge check valve shall be normally open, spring loaded valve consisting of a body, seat and plug bolted to the inlet of the air/vacuum valve. The surge check shall operate on the interphase between the kinetic energy and relative velocity flows of air and water, allowing air to pass through but water shall close the surge check, reducing the rate of water flow by means of throttling orifices in the plug to prevent shock closure of the air/vacuum valve. The surge check orifices must be an adjustable type to suit operating conditions in the field.
- E. All air valves and accessories shall be supplied by a single manufacturer and shall be G.A. Industries, APCO, Crispin or Val-Matic.

2.20 MANHOLES AND PRECAST CONCRETE PRODUCTS

- A. Provide precast concrete products in accordance with the following:
 1. Precast Concrete Sections
 - a. Precast concrete sections shall meet the requirements of ASTM C 478. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi. The minimum wall thickness shall be one-twelfth of the inside diameter of the base, riser or the largest cone diameter.
 - b. Transition slabs which convert bases larger than four feet in diameter to four foot diameter risers shall be designed by the precast concrete manufacturer to carry the live and dead loads exerted on the slab.
 - c. Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant. Butyl rubber sealants shall meet the requirements of AASHTO M-198., sealant shall be pre-formed type with a minimum nominal diameter of 1-inch.
 - d. Butyl rubber sealant shall be equal to Kent Seal No. 2 or Concrete Sealants CS 202.
 2. Brick and Mortar: Brick shall be whole and hardburned, conforming to ASTM C 32, Grade MS. Mortar shall be made of one part Portland cement and two parts clean sharp sand. Cement shall be Type 1 and shall conform to ASTM C 150.

Sand shall meet ASTM C 53.

3. Iron Castings

- a. Cast iron manhole frames, covers and steps shall meet the requirements of ASTM A 48 for Class 30 gray iron and all applicable local standards. All castings shall be tough, close grained, smooth and free from blow holes, blisters, shrinkage, strains, cracks, cold shots and other imperfections. No casting will be accepted which weighs less than 95 percent of the design weight. Shop drawings must indicate the design weight and provide sufficient dimensions to permit checking. All castings shall be thoroughly cleaned in the shop and given two coats of bituminous paint before rusting begins.
- b. Manhole frames and covers shall be Macon Water authority standard.
- c. All frames and covers shall have machined horizontal bearing surfaces.
- d. Bolt-down covers shall be equipped with four 2-inch stainless steel bolts and a 1/8-inch red rubber or rubber O-ring gasket. Covers shall be rotatable and interchangeable. Bolt holes shall be bored through so that debris entering the bolt hole will fall into the manhole. Bolt holes shall have the full 360 degree circle within the covers radius when bored through the cover.

4. Plastic Steps: Manhole steps of polypropylene, molded around a steel rod, equal to products of M.A. Industries may be used.

5. Floor Door

- a. Door shall be single or double leaf type as shown on the Drawings.
- b. The frame shall be 1/4-inch extruded aluminum alloy 6063-T6, with built-in neoprene cushion and with strap anchors bolted to the exterior. Door leaf shall be 1/4-inch aluminum diamond plate, alloy 6061-T6, reinforced with aluminum stiffeners as required. Stainless steel hinges shall be bolted to the underside and pivot on torsion bars that counterbalance the door for easy operation. The door shall open to 90 degrees and lock automatically in that position. A vinyl grip handle shall be provided to release the cover for closing. The door shall be built to withstand an H-20 Highway Traffic Loading, and shall be equipped with a snap lock and removable handle. Bituminous coating shall be applied to exterior of frame by the manufacturers. The door shall also be provided with a hasp and padlock in addition to the built-in locking mechanism. Padlocks for all door shall be keyed alike.
- c. The floor door shall be equal to Series H2W as manufactured by Halliday Products.

6. Where vent pipes are shown on the Drawings, vents shall be of one-piece, welded stainless steel construction. Vent pipes shall equal air valve size, but no less than

4-inches. The vent pipe shall be grouted into a precast hole in the vault. This discharge of the vent pipe shall be provided with a 3/16-inch PVC coated mesh screen..

7. Where vent pipes are not shown on the Drawings, the frame and cover or floor door shall be provided with 1-inch holes to provide the equivalent opening as in air valve, but not less than two. The quantity for each valve size is as follows: 2-inch, 4; 3-inch, 9; 4-inch, 16; 6-inch, 36; 8-inch, 64.

2.21 RETAINER GLANDS

Retainer glands shall be Megalug Series 100, as manufactured by EBAA Iron, or Uni-Flange Series 1400, as manufactured by Ford Meter Box Company.

2.22 HYDRANT TEES

Hydrant tees shall be equal to ACIPCO A10180 or U.S. Pipe U-592.

2.23 ANCHOR COUPLINGS

Lengths and sizes shall be as shown on the Drawings. Anchor couplings shall be equal to ACIPCO A 10895 or U.S. Pipe U-591.

2.24 VALVE KEYS

The Contractor shall provide to the Owner one valve key for every five valves provided, but no more than three and not less than one valve key. Valve keys shall be 72-inches long with a tee handle and a 2-inch square wrench nut. Valve keys shall be furnished by the valve manufacturers. Valve keys shall be equal to Mueller A-24610 or ACIPCO No. 1303 .

2.25 CONCRETE

Concrete shall have a compressive strength of not less than 3000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the Engineer. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

PART 3 EXECUTION

3.01 EXISTING UTILITIES AND OBSTRUCTIONS

- A. The Drawings indicate utilities or obstructions that are known to exist according to the best information available to the Owner. The Contractor shall call the Utilities Protection Center (UPC) (325-5000 or 1-800-282-7411) as required by Georgia law (Code Section

25-9-1 through 25-9-13) and all utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site at least 72 hours (three business days) prior to construction to verify the location of the existing utilities.

B. Existing Utility Location: The following steps shall be exercised to avoid interruption of existing utility service.

1. Provide the required notice to the utility owners and allow them to locate their facilities according to Georgia law. Field utility locations are valid for only 10 days after original notice. The Contractor shall ensure, at the time of any excavation, that a valid utility location exists at the point of excavation.
2. Expose the facility, for a distance of at least 200 feet in advance of pipeline construction, to verify its true location and grade. Repair, or have repaired, any damage to utilities resulting from locating or exposing their true location.
3. Avoid utility damage and interruption by protection with means or methods recommended by the utility owner.
4. Maintain a log identifying when phone calls were made, who was called, area for which utility relocation was requested and work order number issued, if any. The Contractor shall provide the Engineer an updated copy of the log bi-weekly, or more frequently if required.

C. Conflict with Existing Utilities

1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed water main does not permit safe installation of the water main by the use of sheeting, shoring, tying-back, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the water main to avoid horizontal conflicts if the proposed alignment of the water main to avoid horizontal conflicts if the new alignment remains within the available right- of-way or easement, complies with regulatory agency requirements and after a written request to and subsequent approval by the Engineer. Where such relocation of the water main is denied by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.
2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed water main does not permit the crossing without immediate or potential future damage to the utility, main, service, or the water main. The Contractor may change the proposed grade of the water main to avoid vertical conflicts if the changed grade maintains adequate cover and complies with regulatory agencies requirements after written request to and subsequent approval by the Engineer. Where such relocation of the water main is denied by the Engineer, the Contractor shall

arrange to have the utility, main, or service relocated.

D. Electronic Locator: Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.

E. Water and Sewer Separation

1. Water mains should maintain a minimum 10 foot edge-to-edge separation from sewer lines, whether gravity or pressure. If the main cannot be installed in the prescribed easement or right-of-way and provide the 10 foot separation, the separation may be reduced, provided the bottom of the water main is a minimum of 18-inches above the top of the sewer. Should neither of these two separation criteria be possible, the water main shall be installed below the sewer with a minimum vertical separation of 18-inches.
2. The water main, when installed below the sewer, shall be encased in concrete with a minimum 6-inch concrete depth to the first joint in each direction. Where water mains cross the sewer, the pipe joint adjacent to the pipe crossing the sewer shall be cut to provide maximum separation of the pipe joints from the sewer.
3. No water main shall pass through, or come in contact with, any part of a sanitary sewer manhole.

3.02 CONSTRUCTION ALONG HIGHWAYS, STREETS AND ROADWAYS

A. Install pipe lines and appurtenances along highways, streets and roadways in accordance with the applicable regulations of, and permits issued by, the Department of Transportation and County Dept. of Transportation with reference to construction operations, safety, traffic control, road maintenance and repair.

B. Traffic Control

1. The Contractor shall provide, erect and maintain all necessary barricades, suitable and sufficient lights and other traffic control devices; provide qualified flagmen where necessary to direct traffic; take all necessary precautions for the protection of the work and the safety of the public. Flagmen shall be certified by a Georgia DOT approved training program.
2. Construction traffic control devices and their installation shall be in accordance with the current Manual On Uniform Traffic Control Devices for Streets and Highways.
3. Placement and removal of construction traffic control devices shall be coordinated with the Georgia Department of Transportation and County Dept. of Transportation a minimum of 48 hours in advance of the activity.

4. Placement of construction traffic control devices shall be scheduled ahead of associated construction activities. Construction time in street right-of-way shall be conducted to minimize the length of time traffic is disrupted. Construction traffic control devices shall be removed immediately following their useful purpose. Traffic control devices used intermittently, such as "Flagmen Ahead", shall be removed and replaced when needed.
5. Existing traffic control devices within the construction work zone shall be protected from damage. Traffic control devices requiring temporary relocation shall be located as near as possible to their original vertical and horizontal locations. Original locations shall be measured from reference points and recorded in a log prior to relocation. Temporary locations shall provide the same visibility to affected traffic as the original location. Relocated traffic control devices shall be reinstalled in their original locations as soon as practical following construction.
6. Construction traffic control devices shall be maintained in good repair and shall be clean and visible to affected traffic for daytime and nighttime operation. Traffic control devices affected by the construction work zone shall be inspected daily.
7. Construction warning signs shall be black legend on an orange background. Regulatory signs shall be black legend on a white background. Construction sign panels shall meet the minimum reflective requirements of the Georgia Department of Transportation and County Dept. of Transportation. Sign panels shall be of durable materials capable of maintaining their color, reflective character and legibility during the period of construction.
8. Channelization devices shall be positioned preceding an obstruction at a taper length as required by the current Manual On Uniform Traffic Control Devices for Streets and Highways, as appropriate for the speed limit at that location. Channelization devices shall be patrolled to insure that they are maintained in the proper position throughout their period of use.

C. Construction Operations

1. Perform all work along highways, streets and roadways to minimize interference with traffic.
2. Stripping: Where the pipe line is laid along road right-of-way, strip and stockpile all sod, topsoil and other material suitable for right-of-way restoration.
3. Trenching, Laying and Backfilling: Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day.

4. Shaping: Reshape damaged slopes, side ditches, and ditch lines immediately after completing backfilling operations. Replace topsoil, sod and any other materials removed from shoulders.
 5. Construction operations shall be limited to 400 feet along areas, including clean-up and utility exploration.
- D. Excavated Materials: Do not place excavated material along highways, streets and roadways in a manner which obstructs traffic. Sweep all scattered excavated material off of the pavement in a timely manner.
- E. Drainage Structures: Keep all side ditches, culverts, cross drains, and other drainage structures clear of excavated material. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.
- F. Landscaping Features: Landscaping features shall include, but are not necessarily limited to: fences; property corners; cultivated trees and shrubbery; manmade improvements; subdivision and other signs within the right-of-way and easement. The Contractor shall take extreme care in moving landscape features and promptly re-establishing these features.
- G. Maintaining Highways, Streets, Roadways and Driveways
1. Maintain streets, highways, roadways and driveways in suitable condition for movement of traffic until completion and final acceptance of the Work.
 2. During the time period between pavement removal and completing permanent pavement replacement, maintain highways, streets and roadways by the use of steel running plates. Running plate edges shall have asphalt placed around their periphery to minimize vehicular impact. The backfill above the pipe shall be compacted as specified elsewhere up to the existing pavement surface to provide support for the steel running plates.
 3. Furnish a road grader or front-end loader for maintaining highways, streets, and roadways. The grader or front-end loader shall be available at all times.
 4. Immediately repair all driveways that are cut or damaged. Maintain them in a suitable condition for use until completion and final acceptance of the Work.

3.03 PIPE DISTRIBUTION

- A. Pipe shall be distributed and placed in such a manner that will not interfere with traffic.
- B. No pipe shall be strung further along the route than 1,000 feet beyond the area in which the contractor is actually working without written permission from the Owner. The Owner

reserves the right to reduce this distance to a maximum distance of 200 feet in residential and commercial areas based on the effects of the distribution to the adjacent property owners.

- C. No street or roadway may be closed for unloading of pipe without first obtaining permission from the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets and roadways upon which pipe is distributed.
- D. No distributed pipe shall be placed inside drainage ditches.
- E. Distributed pipe shall be placed as far as possible from the roadway pavement, but no closer than five feet from the roadway pavement, as measured edge-to-edge.

3.04 LOCATION AND GRADE

- A. The Drawings show the alignment and grade of the water main and the location of valves, hydrants and other appurtenances.
- B. Prior to clearing and grubbing, construction staking shall conform to the requirements of Section 01055 of these Specifications.
- C. Prior to clearing and grubbing, the Engineer will provide a temporary bench mark along the water main route and at all other locations where the alignment of the water main changes significantly.
- D. After the Contractor locates and marks the water main centerline or baseline, the Contractor shall perform clearing and grubbing.
- E. Construction shall begin at a connection location and proceed without interruption. Multiple construction sites shall not be permitted without written authorization from the Engineer for each site.
- F. The Contractor shall be responsible for any damage done to reference points, base lines, center lines and temporary bench marks, and shall be responsible for the cost of re-establishment of reference points, base lines, center lines and temporary bench marks as a result of the operations.
- G. Not Used

3.05 LAYING AND JOINTING PIPE AND ACCESSORIES

- A. Lay all pipe and fittings to accurately conform to the lines and grades established by the Engineer.

B. Pipe Installation

1. Proper implements, tools and facilities shall be provided for the safe performance of the Work. All pipe, fittings, valves and hydrants shall be lowered carefully into the trench by means of slings, ropes or other suitable tools or equipment in such a manner as to prevent damage to water main materials and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.
2. All pipe, fittings, valves, hydrants and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Engineer, who may prescribe corrective repairs or reject the materials.
3. All lumps, blisters and excess coatings shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit or any foreign materials before the pipe is laid. No pipe containing dirt shall be laid.
4. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing or other materials shall be placed in the pipe at any time.
5. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.
6. It is not mandatory to lay pipe with the bells facing the direction in which work is progressing.
7. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade, shall not be permitted.
8. Provide detection tape for all non-metallic pipe. Detection tape shall be buried 4 to 10-inches deep. Should detection tape need to be installed deeper, the Contractor shall provide 3-inch wide tape. In no case shall detection tape be buried greater than 20-inches from the finish grade surface.

C. Alignment and Gradient

1. Lay pipe straight in alignment and gradient or follow true curves as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.
2. Maintain a transit, level and accessories on the job to lay out angles and ensure

that deflection allowances are not exceeded.

- D. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint or as approved by the Engineer.
- E. Joint Assembly
 - 1. Push-on, mechanical, flange and restrained type joints shall be assembled in accordance with the manufacturers recommendations.
 - 2. The Contractor shall inspect each joint within 1,000 feet on either side of main line valves to insure 100 percent of the pipe spigot, except as noted otherwise.
 - 3. Each restrained joint shall be inspected by the Contractor to ensure that it has been ohmed 100 percent.
 - 4. The Contractor shall internally inspect each pipe joint to insure proper assembly for pipe 24-inches in diameter and larger after the pipe has been brought to final alignment.
- F. Cutting Pipe: Cut ductile iron pipe using an abrasive wheel saw. Cut PVC pipe using a suitable saw; remove all burrs and smooth the end before jointing. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings,, valves, accessories and closure pieces in the correct location. Only push-on or mechanical joint pipe shall be cut.
- G. Lining Repair: Repair epoxy linings and recoat spigot ends of cut pipe with an epoxy coating as specified in Part 2 of the Section and as specified below:
 - 1. Remove all burrs and areas of loose lining materials by sanding or scraping to bare metal.
 - 2. Remove oil and lubricants used during filed cutting.
 - 3. Lining shall be stripped back a minimum of 10-inch from the spigot end into well adhered lined areas.
 - 4. Roughen 1 to 2-inches of good lining with a rough grade (40 grit) emery paper, rasp or small chisel, to allow an overlap between new and existing lining.
 - 5. Apply lining repair material in the number of coats required to match the

thickness requirements as specified in Part 2 of this Section and in accordance with the manufacturers recommendations.

H. Polyethylene Encasement: Installation shall be in accordance with AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired to the satisfaction of the Engineer.

I. Valve and Fitting Installation

1. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of pressure-containing bolting and test plugs, cleanliness of valve ports and especially seating surfaces, handling damage and cracks. Defective valves shall be corrected or held for inspection by the Engineer. Valves shall be closed before being installed.
2. Valves, fittings, plugs and caps shall be set and joined to the pipe in the manner specified in this Section for cleaning, laying and joining pipe, except that 12-inch and larger valves shall be provided with special support, such as treated timbers, crushed stone, concrete pads or a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve. Valves shall be installed in the closed position.
3. A valve box shall be provided on each underground valve. They shall be carefully set, centered exactly over the operating nut and truly plumbed. The valve box shall not transmit shock or stress to the valve. The bottom flange of the lower belled portion of the box shall not transmit shock or stress to the valve. The bottom flange of the lower belled portion of the box shall be placed below the valve operating nut. This flange shall be set on brick, so arranged that the weight of the valve box and superimposed loads will bear on the base and not on the valve or pipe. Extension stems shall be installed where depth of bury places the operating nut in excess of 30-inches beneath finished grade so as to set the top of the operating nut 30-inches below finished grade. The valve box cover shall be flush with the surface of the finished area or such other level as directed by the Engineer. Provide an 8-inch thick, 18-inch square or round concrete pad around the valve box as detailed on the Drawings.
4. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.
5. A valve marker shall be provided for each underground valve. Unless otherwise detailed on the Drawings or directed by the Engineer, valve markers shall be installed 6-inches inside the right-of-way or easement.

J. Hydrant Installation

1. Prior to installation, inspect all hydrants for direction of opening, nozzle threading, operating nut and cap nut dimensions, tightness of pressure-containing bolting, cleanliness of inlet elbow, handling damage and cracks. Defective hydrants shall be corrected or held for inspection by the Engineer.
2. All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the roadway, with pumper nozzle facing the roadway, except that hydrants having two-hose nozzles 90 degrees apart shall be set with each nozzle facing the roadway at an angle of 45 degrees.
3. Hydrants shall be set to the established grade, with the centerline of the lowest nozzle at least 12-inches above the ground or as directed by the Engineer.
4. Each hydrant shall be connected to the main with a 6-inch branch controlled by an independent 6-inch valve. When a hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by placing coarse gravel or crushed stone mixed with coarse sand from the bottom of the trench top at least 6-inches above the drain port opening in the hydrant to a distance of 12-inches around the elbow.
5. When a hydrant is set in clay or other impervious soil, a drainage pit 2 x 2 x 2 feet shall be excavated below each hydrant and filled with coarse gravel or crushed stone mixed with coarse sand under and around the elbow of the hydrant and to a level of 6-inches above the drain port.
6. Hydrants shall be located as shown on the Drawings or as directed by the Engineer. In the case of hydrants that are intended to fail at the ground-line joint upon vehicle impact, specific care must be taken to provide adequate soil resistance to avoid vehicle impact, specific care must be taken to provide adequate soil resistance to avoid transmitting shock moment to the lower barrel and inlet connection. In loose or poor load bearing soil, this may be accomplished by pouring a concrete collar approximately 6-inches thick to a diameter of 24-inches at or near the ground line around the hydrant barrel.

K. Air Valve Manholes

1. Construct the vault or manhole as detailed on the Drawings.
2. The frame and cover shall be cast into the top slab or cone.
3. Manholes shall be constructed such that their walls are plumb.

3.06 CONNECTIONS TO WATER MAINS

- A. Make connections to existing pipe lines with tapping sleeves and valves, unless specifically shown otherwise on the Drawings.
- B. Location: Before laying pipe, locate the points of connection to existing water mains and uncover as necessary for the Engineer to confirm the nature of the connection to be made.

- C. Interruption of Services: Make connections to existing water mains only when system operations permit. Operate existing valves only with the specific authorization and direct supervision of the Owner.
- D. Tapping Saddles and Tapping Sleeves
 - 1. Holes in the new pipe shall be machine cut, either in the field or at the factory. No torch cutting of holes shall be permitted.
 - 2. Prior to attaching the saddle or sleeve, the pipe shall be thoroughly cleaned, utilizing a brush and rag, as required.
 - 3. Before performing field machine cut, the water tightness of the saddle or sleeve assembly shall be pressure tested. The interior of the assembly shall be filled with water. An air compressor shall be attached, which will induce a test pressure as specified in this Section. No leakage shall be permitted for a period of five minutes.
 - 4. After attaching the saddle or sleeve to an existing main, but prior to making the tap, the interior of the assembly shall be disinfected. All surfaces to be exposed to potable water shall be swabbed or sprayed with a one percent hypochlorite solution.
- E. Connections Using Solid Sleeves: Where connections are shown on the Drawings using solid sleeves, the Contractor shall furnish materials and labor necessary to make the connection to the existing pipe line.
- F. Connections Using Couplings: Where connections are shown on the Drawings using couplings, the Contractor shall furnish materials and labor necessary to make the connection to the existing pipe line, including all necessary cutting, plugging and backfill.

3.07 THRUST RESTRAINT

- A. Provide restraint at all points where hydraulic thrust may develop.
- B. Retainer Glands: Provide retainer glands where shown on the Drawings and on fire hydrants and all associated fittings, valves and related piping. Retainer glands shall be installed in accordance with the manufacturers's recommendations, particularly, the required torque of the set screws. The Contractor shall furnish a torque wrench to verify the torque on all set screws which do not have inherent torque indicators.
- C. Harnessing
 - 1. Provide harness rods only where specifically shown on the Drawings or directed by the Engineer.
 - 2. Harness rods shall be manufactured in accordance with ASTM A 449 and shall have an allowable tensile stress of no less than 39,600 psi. Harness rods shall be

hot dip galvanized or field coated with bitumastic before backfilling.

3. Where possible, harness rods shall be installed through the mechanical joint bolt holes. Where it is possible, provide 90 degree bend eye bolts.
4. Eye bolts shall be of the same diameter as specified in AWWA C111 for that pipe size. The eye shall be welded closed. Where eye bolts are used in conjunction with harness rods, an appropriate size washer shall be utilized with a nut on each end of the harness rod. Eye bolts shall be of the same material and coating as the harness rods.

D. Hydrants: Hydrants shall be attached to the water main by the following method:

1. For mains 12-inches and smaller, the isolation valve shall be attached to the main by connecting the valve to the hydrant tee.
2. For mains larger than 12-inches, the isolation valve shall be attached to the main by providing an anchor coupling between the valve and tapping saddle.
3. The isolation valve shall be attached to the hydrant by providing an anchor coupling between the valve and hydrant.

E. Thrust Collars: Collars shall be constructed as shown on the Drawings. Concrete and reinforcing steel shall meet the requirements as specified in this Section. The welded-on collar shall be designed to meet the minimum allowable load shown on the Drawings. The welded-on collar shall be attached to the pipe by the pipe manufacturer.

F. Concrete Blocking

1. Provide concrete blocking for all bends, tees, valves, and other points where thrust may develop, except where other exclusive means of thrust restraint are specifically shown on the Drawings.
2. Concrete shall be as specified in this Section.
3. Form and pour concrete blocking at fittings as shown on the Drawings and as directed by the Engineer. Pour blocking against undisturbed earth. Increase dimensions when required by over excavation.

3.08 INSPECTION AND TESTING

A. Pressure and Leakage Test

1. All sections of the water main subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section of main will be considered ready for testing after completion of all thrust restraint and backfilling. See Section 02666 for Piping Testing and Acceptance.

3.10 DISINFECTING PIPELINE

- A. After successfully pressure testing each pipeline section, disinfect in accordance with AWWA C651 for the continuous-feed method and these Specifications. See Section 02675, Disinfection of Potable Water Facilities.

3.11 PROTECTION AND RESTORATION OF WORK AREA

- A. General: Return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is started.
 - 1. The Contractor shall plan, coordinate, and prosecute the work such that disruption to personal property and business is held to a practical minimum.
 - 2. All construction areas abutting lawns and yards of residential or commercial property shall be restored promptly. Backfilling of underground facilities, ditches, and disturbed areas shall be accomplished on a daily basis as work is completed. Finishing, dressing, and grassing shall be accomplished immediately thereafter, as a continuous operation within each area being constructed and with emphasis placed on completing each individual yard or business frontage. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.
 - 3. Handwork, including raking and smoothing, shall be required to ensure that the removal of roots, sticks, rocks, and other debris is removed in order to provide a neat and pleasing appearance.
 - 4. The Department of Transportation's engineer shall be authorized to stop all work by the Contractor when restoration and cleanup are unsatisfactory and to require appropriate remedial measures.
- B. Man-Made Improvements: Protect, or remove and replace with the Engineer's approval, all fences, walkways, mail boxes, pipe lines, drain culverts, power and telephone lines and cables, property pins and other improvements that may be encountered in the Work.
- C. Cultivated Growth: Do not disturb cultivated trees or shrubbery unless approved by the Engineer. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.
- D. Cutting of Trees: Do not cut trees for the performance of the work except as absolutely necessary. Protect trees that remain in the vicinity of the work from damage from equipment. Do not store spoil from excavation against the trunks. Remove excavated material stored over the root system of trees within 30 days to allow proper natural watering of the root system. Repair any damaged tree over 3-inches in diameter, not to be removed, under the direction of an experienced nurseryman. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the Contractor. No stumps, wood piles, or trash piles will be permitted on the work site.
- E. Disposal of Rubbish: Dispose of all materials cleared and grubbed during the construction of the Project in accordance with the applicable codes and rules of the appropriate county,

state and federal regulatory agencies.

F. Swamps and Other Wetlands

1. The Contractor shall not construct permanent roadbeds, berms, drainage structures or any other structures which alter the original topographic features within the easement.
2. All temporary construction or alterations to the original topography will incorporate measures to prevent erosion into the surrounding swamp or wetland. All areas within the easement shall be returned to their original topographic condition as soon as possible after work is completed in the area. All materials of construction and other non-native materials shall be disposed by the Contractor.
3. The Contractor shall provide temporary culverts or other drainage structures, as necessary, to permit the free migration of water between portions of a swamp, wetland or stream which may be temporarily divided by construction.
4. The Contractor shall not spread, discharge or dump any fuel oil, gasoline, pesticide, or any other pollutant to adjacent swamps or wetlands.

END OF SECTION

**SECTION 02666
PIPING TESTING AND ACCEPTANCE**

PART 1 GENERAL

1.01 SUMMARY

- A. Furnish all labor, materials, tools, equipment and related items required to perform tests of gravity pipelines and perform integrity and leakage tests of pressure and vacuum piping.
- B. The testing requirements covered under this Section shall apply to all piping systems covered under Section 02665 of these specifications.

1.02 SUBMITTALS

Submittals shall conform to the requirements of these Specifications and shall include a description of the testing procedures to be employed and the report form to be furnished.

PART 2 PRODUCTS

2.01 TEST MEDIUMS

The Owner will provide the necessary water required for testing the Work. The Contractor shall furnish all other test mediums. The Contractor shall furnish all equipment, necessary piping and required labor to transport water from its source to the test locations for use in testing.

2.02 TEST EQUIPMENT

The Contractor shall furnish all labor and equipment, including required pumps with regulated bypass meters and gauges, for conducting of the piping tests.

PART 3 EXECUTION

3.01 GENERAL

- A. The entire length of all pressurized piping and gravity lines shall be field tested for tightness by a test as described in this Section.
- B. The timing and sequence of testing shall be scheduled by the Contractor, subject to the approval of the Engineer. The Contractor shall provide the Engineer with a minimum of 24 hours notice prior to the start of any test. All tests must be observed by the Engineer or his authorized representative.
- C. The Contractor shall repair any leaks discovered during the initial filling of the piping and during the testing sequence. All known and visible leaks shall be repaired, whether or not

the leakage rate is within allowable limits.

3.02 MAJOR PIPING

- A. All piping not listed under Article 3.02 shall be tested in accordance with the Article 3.03. This shall include gravity and pressure sewer and sludge lines; potable and non-potable water lines, whether cast iron, ductile iron, steel, copper or PVC. Storm drains shall be exempted from testing required by this Section.
- B. Clean and test lines before requesting final acceptance. Where any obstruction is met, clean the lines by means of rods, swabs, or other instruments. When requested by the Engineer, flush out lines and manholes before final inspection.
- C. Gravity Piping
 - 1. Pipe lines shall be straight and show a uniform grade between manholes. Correct any discrepancies discovered during inspection.
 - 2. Pipe joints for pipelines 30-inches in diameter and larger shall be air tested individually. The joint tester assembly shall be placed over the joint and shall be pressurize the joint area to 4 psi. The pressure shall not drop more than 2 psi in 10 seconds. The joint tester assembly shall be equal to that as supplied by Cherne Industries, Inc.
 - 3. Infiltration Tests: Use only when groundwater is two feet above the top of the pipe.
 - a. Install suitable weirs in manholes selected by the Engineer to determine the leakage of ground water into the sewer. Measure leakage only when all visible leaks have been repaired and the ground water is two feet above the top of the pipe. If leakage in any section of the pipeline exceeds 100 gpd/inch/diameter/mile, locate and repair leaks. Repair methods must be approved by the Engineer. After repairs are completed, re-test for leakage.
 - b. Furnish, install and remove the necessary weirs, plugs and bulkheads required to perform the leakage tests. Where continuous monitoring of flow level is required, the Contractor shall provide and operate monitoring equipment.
 - 4. Exfiltration Tests: Hydrostatically test piping when groundwater is not two feet above the top of the pipe.
 - a. Test pipe between manholes or structures with a minimum of 10 feet hydrostatic pressure, measured at the center of the pipe at the upstream manhole or structure.
 - b. The ends of the pipe in the test section shall be closed with suitable watertight bulkheads. Inserted into the top of each bulkhead shall be a 2-inch pipe nipple with an elbow. At the upper end of the test section, a 12-inch riser pipe shall be connected to the 2-inch nipple. The test section of pipe shall be filled through the pipe connection in the lower bulkhead which shall be fitted with a valve, until all air is exhausted and until water

overflows the riser pipe at the upper end. Water may be introduced into the pipe 24 hours prior to the test period to allow complete saturation. House service lines, if installed, shall also be fitted with suitable bulkheads having provisions for the release of air while the test section is being filled with water.

- c. During the test period, which shall extend over a period of 2 hours, water shall be introduced into the riser pipe from measured containers at such intervals as are necessary to maintain the water level at the top of the riser pipe. The total volume of water added during the test period shall not exceed that specified for infiltration.
5. PVC Deflection Test: Test PVC gravity sewer for excessive deflection by passing a "pig" through the line with a diameter equal to 95 percent of the nominal inside diameter of the pipe. Excavate and install properly any section of pipe not passing this test. Re-test until results are satisfactory. This test shall be performed within the first 30 days of installation and during final inspection, at the completion of this Contract.

D. Pressure Piping

1. All sections of pipeline subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section of line will be considered ready for testing after completion of all thrust restraint and backfilling.
2. Each segment of pipeline between line valves shall be tested individually.
3. Test Preparation
 - a. For pipelines less than 24-inches in diameter, flush pipeline section thoroughly at flow velocities greater than 2.5 feet per second, adequate to remove debris from pipe and valve seats. For pipelines 24-inches in diameter and larger, the main shall be carefully swept clean and mopped, if directed by the Engineer. Partially operate valves and hydrants to clean out seats. Provide correctly sized temporary outlets in number adequate to achieve flushing velocities.
 - b. Provide temporary blocking, bulkheads, flanges and plugs as necessary, to assure all new pipe, valves and appurtenances will be pressure tested.
 - c. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. Unless permanent air vents are in place, insert temporary corporation stops at highpoints to expel air as line is filled with water.
 - d. Fill pipeline slowly with water. Provide a suitable pump with an accurate water meter to pump the line to the specified pressure. Differential pressure at valves and hydrants shall equal the maximum possible, but shall not exceed manufacturer's pressure rating. Where necessary, provide temporary back pressure to meet the differential pressure restrictions.
 - e. Valves and hydrants shall not be operated in either the opening or closing direction at differential pressures above their rated pressure.
4. The test pressure shall be measured at the lowest point in the test segment and

shall be maintained for a minimum of two hours. Test piping in accordance with the minimum test pressures shown below:

Pipe Designation	Pipe Size, inches	Test Pressure, psi
Potable Water	All Sizes	250

5. The test pressure shall not vary by more than 5 psi for the test duration. Should the pressure drop more than 5 psi at any time during the test period, the pressure shall be restored to the specified test pressure. Provide an accurate pressure gage with graduation not less than 5 psi.
6. Leakage: Leakage shall be defined as the quantity of water that must be pumped into the test section equal to the sum of the water, to maintain pressure within 5 psi of the specified test pressure for the test duration plus water required to return line to test pressure at the end of the test. Leakage shall be the total cumulative amount measured on a water meter.
7. Test Results: No test section shall be accepted if the leakage exceeds the limits determined by the following formula:

$$L = \frac{SD(P)^{1/2}}{133,200}$$

Where:

L	=	allowable leakage, in gallons per hour
S	=	length of pipe tested, in feet
D	=	nominal diameter of the pipe, in inches
P	=	average test pressure during the leakage test, in pounds per square inch (gauge)

As determined under Section 4 of AWWA C600.

If the water main section being tested contains lengths of various pipe diameters, the allowable leakage shall be the sum of the computed leakage for each diameter. The leakage test shall be repeated until the test section is accepted. All visible leaks shall be repaired regardless of leakage test results.

8. Completion: After a pipeline section has been accepted, relieve test pressure. Record type, size and location of all outlets on record drawings.

3.03 MISCELLANEOUS PIPING

- A. Upon completion of each piping system or sub-system, blow the lines free of dirt and debris and test in the presence of the Engineer. Wherever possible, test before the trench is backfilled. Drain piping shall be tested prior to encasement in concrete. The minimum test duration shall be one hour. The pipeline shall fail the test if a measurable pressure

drop is observed. Unless specified otherwise in Divisions 2 through 16 of these Specifications, test in accordance with the following requirements:

System	Test Medium	Test Pressure	Pipe Material
Low Pressure Air Lines (less than 4")	Air	15 psi	Stl
Chemical Feed Lines (Gases) Chlorine	Nitrogen Gas	150 psi 30 psi	BSP PVC
Chemical Feed Lines (Liquids) Ferric Chloride Chlorine	Nitrogen Gas Nitrogen Gas	150 psi 150 psi	PVC PVC
Hydraulic Tubing	Service Fluid	50 psi above operating	All
Pneumatic Tubing Drain Piping (less than 6")	Air Water	50 psi 5 psi	All All

- B. Repair and retest any piping system found to be leaking until results are satisfactory to the Engineer.

3.04 MANHOLES

- A. Prior to testing manholes for watertightness, all liftholes shall be plugged with a non-shrink grout, all joints between precast sections shall be properly sealed and all pipe openings shall be temporarily plugged and properly braced. Each manhole shall pass one of the following tests:
1. Exfiltration Tests: The manhole, after proper preparation as noted above, shall be filled with water. The maximum allowable leakage shall be 0.1 gallon per hour per foot of diameter per foot of depth. Tests shall last a minimum of eight hours. The manholes may be backfilled prior to testing.
 2. Vacuum Tests: The manhole, after proper preparation as noted above, shall be vacuum tested prior to backfilling. The test head shall be placed at the inside of the top of the cone section and the compression head inflated to 40 psi to effect a seal between the vacuum base and the manhole structure. Connect the vacuum pump to the outlet port with the valve open. A vacuum of 10-inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9-inches. The manhole shall pass if

the time is greater than 60 seconds for 48-inch diameter manholes. If the manhole fails the initial test, necessary repairs shall be made with non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained. Vacuum testing equipment shall be equal to that as manufactured by P.A. Glazier, Inc.

3.05 REPAIRS

If the leakage exceeds the specified allowable limits, the point or points of leakage shall be sought out and remedied by the Contractor at no additional cost to the Owner. Repair methods must be approved by the Engineer.

3.06 FLUSHING AND CLEANING

The systems shall not be used, except for chemical cleaning, until the Engineer has been assured that cleaning has been accomplished.

3.07 FINAL ACCEPTANCE

- A. No pipeline installation shall be accepted until all known and visible leaks have been repaired, whether or not the leakage is within the maximum allowable limits.
- B. The Contractor will certify that all required tests have been successfully completed before the Work is accepted.

END OF SECTION

**SECTION 02675
DISINFECTION OF POTABLE WATER FACILITIES**

PART 1 GENERAL

1.01 SUMMARY

- A. The work covered by this Section includes furnishing all labor, equipment, materials and chemicals required to disinfect all potable water facilities in accordance with the procedures specified herein.
- B. Upon completion of the construction and installation of equipment, the Contractor shall sterilize all plant units, piping, pumps, wells and connections thereto, all distribution system piping and storage tanks and any surfaces that shall be in contact with potable water.

1.02 STANDARDS

Procedures for disinfecting water mains, water storage facilities, wells and water treatment plants, unless otherwise modified herein, shall conform to the requirements of AWWA Standards C651, C652, C653 and C654.

PART 2 PRODUCTS

2.01 DISINFECTION AGENT

The disinfection agent shall be free chlorine or chlorine compound. The method of application and type of disinfecting agent shall both be acceptable to the Engineer.

PART 3 EXECUTION

3.01 DISINFECTION OF STRUCTURES AND TANKS

- A. Prior to disinfection, all surfaces shall be thoroughly flushed with clear water after all debris and dirt has been removed.
- B. Disinfection shall be accomplished by the application of clear water containing a minimum of 50 parts per million (ppm) of available chlorine: in new lines at least 25 ppm free chlorine shall be applied. The chlorine bearing water shall remain in contact with the surfaces being sterilized for a period of not less than 24 hours. At the end of the contact period the chlorine residual in all units and at extremities of pipe line and other representative points shall be at least 25 ppm.
- C. In the process of chlorinating newly constructed units and newly installed pipe, all valve or other appurtenances shall be operated at least five times while the units and pipelines

are filled with the disinfection agent.

- D. Upon completion of the disinfection procedure, reduce the chlorine residual of disinfection water to levels required for discharge per requirements of federal, state and local regulatory agencies. Treat water with sulfur dioxide or other reducing chemicals to neutralize chlorine residual. Treat water with sulfur dioxide or other reducing chemicals to neutralize chlorine residual. All units and piping shall be flushed with potable water until the chlorine residual. All units and piping shall be flushed with potable water until the chlorine residual remaining is one part per million or less and the replacement water throughout the units, upon suitable bacteriological tests, has proved to be of acceptable quality and in conformance with Georgia Department of Natural Resources, Environmental Protection Division Standards for municipal water supplies. This satisfactory quality of water shall continue for two full days as demonstrated by laboratory examination of samples taken from a tap located and installed in such a way as to prevent outside contamination.
- E. No portion of new work shall be placed in service until disinfection has been completed and approved by the Engineer. Should the initial treatment fail to result in acceptable water, the chlorination procedure shall be repeated until satisfactory results are obtained.

3.02 DISINFECTION OF PIPELINE

- A. After successfully pressure testing each potable pipeline section, disinfect in accordance with AWWA C651 for the continuous-feed method and these Specifications.
- B. Specialty Contractor: Disinfection shall be performed by an approved specialty contractor. Before disinfection is performed, the Contractor shall submit a written procedure for approval before being permitted to proceed with the disinfection. This plan shall also include the steps to be taken for the neutralization of the chlorinated water.
- C. Chlorination
 - 1. Apply chlorine solution to achieve a concentration of at least 25 milligrams per liter free chlorine in new line. Retain chlorinated water for 24 hours.
 - 2. Chlorine concentration shall be recorded at every outlet along the line at the beginning and end of the 24 hour period.
 - 3. After 24 hours, all samples of water shall contain at least 10 milligrams per liter free chlorine. Re-chlorinate if required results are not obtained on all samples.
- D. Disposal of Chlorinated Water: Reduce chlorine residual of disinfection water to less than one milligram per liter if discharged directly to a body of water or to less than two milligrams per liter if discharged onto the ground prior to disposal. Treat water with sulfur dioxide or other reducing chemicals to neutralize chlorine residual. Flush all lines until residual is equal to existing system.

- E. Bacteriological Testing: After final flushing and before the water along main is placed in service, the Contractor shall collect samples from the line and have tested for bacteriological quality in accordance with the rules of the Georgia Department of Natural Resources, Environmental Protection Division. Testing shall be performed by a laboratory certified by the State of Georgia. Re-chlorinate lines until required results are obtained.

END OF SECTION

SECTION 02830
FENCING

PART 1 - GENERAL

1.1 Description:

- A. Furnish all labor, materials and services required to install all polyvinyl coated (PVC) chain link fencing and gates shown on Drawings and as specified herein. Extent of fencing, location, number, and size of gates shall be as shown on the drawings.

PART 2 - PRODUCT

2.1 Chain Link Fence:

A. Fabric:

- 1. Fabric shall comply with the requirements of ASTM F668:
 - a. Height: 6-feet above grade level.
 - b. Mesh Size: 2-inch mesh.
 - c. Wire Diameter: 9-gage core wire, 6-gage finish diameter.

B. Framework:

- 1. Posts and rails shall conform to the strength requirements of ASTM F669. Posts, rails, braces and gate frames shall be:
 - a. Type II Pipe: Manufactured from steel conforming to ASTM A569 or 446, Grade D with a minimum yield strength of 50,000 psi, cold formed electric welded and coated in conformance with ASTM F1234, Type B external and Type D internal coatings.
 - b. Pipe shall meet the following size and dimension requirements, with tolerances as in ASTM F1083:

SIZE AND DIMENSION REQUIREMENTS OF FENCE AND GATE FRAMEWORK

o.d. inches	Weight, lbs/lineal ft.
1.660	1.84
1.900	2.28
2.375	3.12
2.875	4.64
4.000	6.56

2. Minimum posts shall be Type II pipe in the following sizes:
 - a. End, corner and pull posts for fabric heights: Up to 8-feet shall be 2.875-inch o.d.
 - b. Line or intermediate posts for fabric heights: Up to 8-feet shall be 2.375-inch o.d.
 - c. Gate posts for supporting one leaf of a double gate installation: 4.000-inch o.d.
 - d. Top Rail: 1.660-inch o.d. Type II pipe in manufacturer longest length, with expansion type couplings a nominal 6 - inch long for each joint. Provide means for attaching top rail securely to each gate, corner, pull and end post.
 - e. Post Brace Assembly: Manufacturer's standard adjustable at end and gate posts and at both sides of corner and pull posts, with the horizontal brace located at mid-height of the fabric. Use the same material as the top rail for brace, and truss to line post with a 3/8-inch diameter rod and adjustable tightener.

C. Fittings:

1. Fittings shall be manufactured in conformance with the requirements of ASTM F626, including material of manufacture, dimensions and dimensional tolerances, coatings and coating weights.
 - a. End, Pull and Line Post Caps: Provide weather tight closure cap for each post. Provide line post caps with loop to receive top rail Barbed Wire Extensions.
 - b. Tension or Stretcher Bars: Provide tension for stretcher bars to connect fabric to end, gate and corner posts.
 - c. Tension Bands: Shall be minimum of 14 gauge (0.074-inch) in thickness and 3/4-inch width.
 - d. Brace Bands: Shall be a minimum of 12 gauge (0.105-inch) in thickness and 3/4-inch width.
 - e. Tension Wire: Shall be a minimum 6 gauge galvanized.
 - f. Barbed Wire: Fabric shall be surmounted with three (3) strands of barbed wire. Each strand shall consist of two No. 12 1/2 twisted line wires, hot dip galvanized No. 14 galvanized 4-point barbs spaced not more than 4 in. apart.
 - g. Barbed Wire Extension: All intermediate and corner posts shall be equipped with malleable iron, hot dip

galvanized extension arms to support the barbed wire. Intermediate and corner arms shall have provision for passing top rail and corner arms.

h. Hinged Swing Gates:

- (1) Two (2) leaves are required.
- (2) Top rails shall be 2" diameter, minimum, Schedule 80 pipe.
- (3) Intermediate rails shall be 2" diameter, minimum, Schedule 40 pipe; provide two (2) per leaf.
- (4) Diagonal brace rails shall be 1-5/8" diameter, minimum, Schedule 40 pipe.
- (5) Provide all necessary hinges and hardware for complete installation and operation.
- (6) Provide center plunger rod and catch.

D. Padlocks:

1. Provide latch with integral padlock eyes as a part of the latch.
2. Padlocks for gates shall be furnished with two (2) keys each. All heavy-duty padlocks shall be keyed alike. Provide heavy-duty lockable gate catch for each pair of gates.

E. Anchor Grout:

1. Non-shrink, controlled expansive, polymer modified cement product, non-corrosive, pourable, high early strength, with compressive strength of not less than 2,400 psi / 1-hour.

PART 3 - EXECUTION

3.1 General:

A. Install fence in compliance with ASTM F567.

1. Perform all work in a safe and orderly fashion in accordance with the Occupational Safety and Health Act of 1970.
2. New fence shall be located as shown on the plan sheets. If necessary, the fence may be offset at steps and other obstructions.
3. The fence shall be set such that the bottom of the fence is no more than one (1) inch above the grade. At the Contractor's option, minimal grading may be done at depressions or high spots. Additional fence fabric shall be installed to bridge low areas.

B. Excavation: Follow the requirements of ASTM F567, Paragraph 4.

- C. Setting Posts: Follow the requirements of ASTM F567, Paragraph 3.
 - 1. Set posts 3" diameter or less a minimum of 42" deep in concrete footing (12" dia.)
 - 2. Set posts over 3" diameter a minimum of 48" deep in concrete footing (12" dia.)
 - 3. Footings shall be rounded to one inch above grade to shed water.
- D. Rail and Bracing Installation: Follow the requirements of ASTM F567, Para. 5 and 6.
 - 1. Install tension wire, continuous, at 2-inches above grade.
- E. Gates: Follow the requirements of ASTM F567, Paragraph 9.

3.2 Cleaning:

- A. Contractor shall clean all fencing.
 - 1. Where factory finish is scarred, touch-up with finish coating supplied by manufacturer.

END OF SECTION

**SECTION 03050
CONCRETE WORK**

PART 1 GENERAL

1.01 SUMMARY

- A. Furnish and install cast-in-place concrete as shown and indicated on the Drawings and as specified in this Section, complete.
- B. All formwork, reinforcing, sleeves, inserts, piping, hangers, anchors frames, and other items to be built into the concrete work shall be correctly positioned, secured and inspected by the Engineer prior to placing concrete.

1.02 SUBMITTALS

Submit concrete design mix and shop drawings on reinforcing, admixtures, waterstops and curing compound for the Engineer's review prior to any work.

1.03 STORAGE AND PROTECTION

All materials shall be stored and protected in accordance with the requirements of these Specifications.

1.04 QUALITY ASSURANCE

All concrete work shall be in accordance with the provisions of the American Concrete Institute's Building Code Requirements for Reinforced Concrete, Latest Edition (ACI 318), unless specified or noted otherwise.

PART 2 PRODUCTS

2.01 MATERIALS AND CONSTRUCTION

- A. Materials for use in concrete work including admixtures, aggregates, cement, form material, reinforcing and water shall be in accordance with the following:
 - 1. Cement: All cement shall be Type I and meet the requirements of ASTM C 150.
 - 2. Aggregates: Aggregates shall conform to requirements of ASTM C 33.
 - 3. Water: Mixing water for concrete shall be fresh, clean and potable.
 - 4. Admixtures: For each 100 pounds of cement the following amount of admixture shall be provided in accordance with the manufacturer's recommendations:
 - a. For air temperatures below 70 degrees F, provide 3 to 6 ounces of Master Builder's Pozzoloth 344-N (or 122-N) or 2 ounces of Sika Chemical Company's Plastocrete-A.

- b. For air temperature above 70 degrees F, provide 3 ounces of Master Builder's Pozzoloth 300-R or 3 ounces of Sika Chemical Company's Plastocrete-A.
 - c. An air-entraining admixture conforming to the requirements of ASTM C 260, equal to Master Builder's MB-AE 10, shall be used in all concrete exposed to freezing temperatures. The air content of freshly mixed air-entrained concrete, as determined by the method of ASTM C 233, shall be not less than three percent not more than six percent. The air-entrained admixture is in addition to the admixture specified in a. or b. above.
5. Formwork
- a. Form Material: Forms shall be of plywood or architectural type steel panel forms.
 - b. Form Oil: Form oil shall be non-staining, paraffin base type oil equal to Chevron K Pale40 as manufactured by Standard Oil Company.
 - c. Form Ties: Form ties shall have a minimum working strength of at least 3,000 pounds when fully assembled and shall be of the snap or break type with a water stop in the center. Ties shall be free of cones, washers or other devices which will leave a hole larger than 7/8-inch diameter in the exposed surface of the concrete. Ties shall be such that when forms are removed no metal shall be within 1-1/2 inches of the finished surface.
 - d. Chamfer Strips: Chamfer strips shall be placed in forms for exposed corners of columns and exposed edges of beams, slabs and curbs. Chamfer Strips shall have a minimum dimension of 1-inch.
6. Reinforcing Steel: Reinforcing steel shall be properly supported and secured in position before concrete is placed.
- a. Reinforcement Bars. Bar reinforcing steel shall conform to the requirements of ASTM A 615 Grade 60. The reinforcement shall be bent cold to the shapes indicated on the Drawings. This shall be done in the shop, before shipment, and not in the field, unless otherwise noted on the Drawings or directed by the Engineer
 - b. Wire Fabric: Wire fabric for concrete reinforcement, shall conform to the requirements of ASTM A 185.
 - c. Bending: Hooks of 90 degrees shall have a radius bend of the axis of the bar of not less than six bar diameters plus an extension of 12 bar diameters at the free end.
7. Waterstops: In expansion joints and in construction joints not shown as expansion joints, waterstops shall be polyvinyl chloride (PVC) and shall incorporate a galvanized steel wire along both edges which shall be used to secure the waterstop in position during concrete placement. Waterstop shall be Wirestop Type No. CR-9380, Vinylex Waterstop Type No. RB-38r or approved equal. The waterstop shall extend the entire length of the joint and all splices shall be heat welded and tested in accordance with the manufacturer's instructions.

8. Non-Shrink Grout

- a. All grout shall be non-metallic, non-shrink type. Cement shall be Type III Grout shall meet the following requirements:

Criteria	Test Method	Result
Workability	ASTM C 191	Initial set time not less than 60 minutes
Compressive Strength	ASTM C 109 (restrained condition)	One day - 3,000 psi
Shrinkage	ASTM C 827 and CRD 621	No shrinkage after placement or shrinkage after set

- b. The contractor shall furnish independent laboratory test results as evidence of full compliance with these requirements.

9. Standard Grout: Grout which is required by the Drawings or Specifications and is not otherwise specified, shall be composed of one part of cement and three parts of sand. Grout shall have a maximum water/cement ratio of 5.0 U.S. gallons per 94 pound bag of cement.
10. Epoxy Bonding Compound: Epoxy bonding shall be 100 percent solids with a minimum bond strength of 2,100 psi at 14 days. Epoxy bonding compound shall be equal to Sikadur Hi-Mod.
11. Expansion Joint Filler: Joint filler shall be a preformed type meeting the requirements of ASTM D 1751.
12. Curing Compound: Curing compound shall be an all resin-cure (not acrylic) based compound conforming to ASTM C309, Type I, Class B. The curing compound shall form a moisture impermeable film which retains a minimum of 95 percent of the mixing water beyond the required curing time. Curing compound shall be equal to Meadows Sealtight CS-309.

PART 3 EXECUTION

3.01 PLACING AND FASTENING OF REINFORCING

- A. Unless otherwise called for, provisions of the American Concrete Institute's Building Code Requirements for Reinforced Concrete (ACT 318), shall be strictly followed.
- B. All reinforcement shall be furnished in full length as indicated on the Drawings. No splicing of bars, except where shown on the Drawing, will be permitted.
- C. Splices which are permitted, shall have a lap of not less than forty times the diameter of the bar, unless otherwise shown. Splices shall be well distributed or otherwise located at points of low tensile stress.

3.02 CONCRETE COMPOSITION AND MIXING

- A. Concrete shall be proportioned by weight to give an ultimate compressive strength of 4,000 psi at 28 days when sampled and tested in accordance with ASTM C 31 and C 39. Concrete shall contain not less than 517 pounds of cement per cubic yard of concrete. The mix design shall provide for a slump of 3-inches minimum, 5-inches maximum.
- B. Ready-Mix: All reinforced structures shall be constructed using ready-mix concrete. Ready-mix concrete shall be mixed and transported in accordance with ASTM C 94.
- C. Batch Mixing On Site: Non-reinforced concrete may be batch mixed. The concrete shall be mixed in a batch mixer conforming to the requirements of the Mixer Manufacturers Bureau of the Associated General Contractors of America. The mixer shall bear a manufacturers rating plate indicating rated capacity and the recommended revolutions per minute, and shall be operated in accordance with these recommendations. It shall be equipped with a suitable charging hopper, water storage tank and a water-measuring device, and shall be capable of thoroughly mixing the aggregates, cement and water into a uniform mass within the specified mixing time, and of discharging the mix without segregation.
- D. The batch shall be so charged into the mixer that some water will enter in advance of the cement and aggregates. Water shall continue to flow for a period which may extend to the end of the first 25 percent of the specified mixing time. Controls shall be provided to insure that the batch cannot be discharged until the required mixing time has elapsed. When concrete of normal weight is specified, controls shall be provided to insure that no additional water may be added during mixing. The entire batch shall be discharged before mixer is recharged.
- E. Each batch of two cubic yards or less shall be mixed for not less than 1-1/2 minutes. The mixing time shall be increased by 15 seconds for each additional cubic yard or fraction thereof.

F. The mixer shall be clean and the pickup and throw over blades in the drum shall be replaced when they have lost 10 percent of their original depth.

G. Admixtures

1. Air-entraining and chemical admixtures shall be charged into the mixer as a solution and shall be dispensed by an automatic dispenser or similar metering device. Powdered admixtures shall be weighed or measured by volume as recommended by the manufacturer. The accuracy of any admixture shall be within $\pm$ three percent.
2. Addition of retarding admixtures shall not be significantly delayed after the addition of the cement.

3.03 PLACING

- A. Before concrete is placed, steel forms shall be uniformly coated with form oil and wood forms shall be thoroughly wetted.
- B. Concrete shall be placed to avoid the segregation or separation of aggregates, and displacement of reinforcing. Concrete shall not be allowed to drop freely more than four feet.
- C. All concrete shall be placed in daylight, the placing of concrete in any portion of the work shall not be begun if such work cannot be completed by daylight.
- D. Concrete shall not be placed when the atmospheric temperature is below 40 degrees F. If after placing concrete the temperature drops below 40 degrees F, the Contractor shall cover, heat and protect the work in a manner to keep the air surrounding the fresh concrete at a temperature not less than 45 degrees F for period of five days after concrete is placed.
- E. Concrete shall be compacted by the use of mechanical internal vibrating equipment supplemented by hand spading. Vibrating shall not be used to transport concrete within forms. Internal vibrators shall maintain a speed of at least 5,000 impulses per minute when submerged in concrete.
- F. Keys shall be formed in all construction joints .
- G. Waterstops shall be used where shown on the Drawings and as directed by the Engineer.

3.04 FINISHING

- A. All exterior concrete surfaces shall be finished to minimum 12-inches below finish grade. Interior concrete surfaces within buildings, and other surfaces shall be finished to 12-inches below finish grade. Interior concrete surfaces within buildings, and other such surfaces exposed to view shall be finished.
- B. The interior of basins shall be finished to a level not less than 12-inches below overflow level. Concrete not exposed to view, therefore not specified to be finished, shall have rough edges tooled off and shall be pointed and spot finished to fill irregularities.
 - 1. Vertical Surfaces
 - a. When concrete has set sufficiently to permit, forms and form ties shall be carefully removed. All depressions resulting from removal of form ties and all other holes and rough places shall be thoroughly wetted with water and pointed with sand cement grout.
 - b. After pointed surfaces have set sufficiently to permit, all surfaces specified to be finished shall be kept wetted with water and rubbed with a carborundum stone of medium fineness or other equally good abrasive, to bring the surface to a smooth texture and to remove all form and tie marks.
 - 2. Slabs
 - a. After concrete has been placed, struck off, consolidated and leveled, it shall not be worked further until ready for floating. Floating shall begin when the WATER sheen has disappeared and the mix has hardened sufficiently that the weight of a man standing on it leaves only a slight imprint on the surface. The surface shall then be consolidated by hand floating with wood floats.
 - b. After floating, interior surfaces shall be steel troweled until the surface is free from trowel marks or other imperfections, uniform in texture and appearance and true to plane.
 - c. Immediately after the floating has been completed, exterior surfaces shall be given a coarse transverse scored texture by drawing a broom or burlap belt across the surface.

3.05 CURING

A curing compound as previously specified shall be applied to all concrete surfaces except those which are to receive future concrete or mortar. The compound shall be applied in accordance with the manufacturer's recommendations.

3.06 TESTING

- A. All testing shall be performed by an independent laboratory and paid for by the Owner.
- B. Required Tests: The following tests of materials and concrete are required to be conducted in accordance with the current ASTM Standards.
1. Test Cylinders: Cylinders shall be made and cured in accordance with ASTM C 31. One set of five cylinders from the same batch of concrete shall be made for each day's placing of concrete.
 2. Two cylinders from each set shall be broken at seven days and two and 28 days in accordance with ASTM C 39. The test results shall be the average of the strengths of the cylinders tested at 28 days. One cylinder shall be held as a spare to be broken at 56 days in the event that cylinders broken at 28 days to not meet specified values.
 3. All sampling, molding, transporting, storing, curing, preparation for breaking and testing of cylinders shall be the responsibility of the laboratory and shall be performed by qualified laboratory personnel. The Contractor shall supply wheelbarrows, shovels mixing boards an shaded area for molding cylinders, an similar equipment required by the laboratory representative for molding test cylinders.
 4. Slump Tests: At least two slump tests shall be made on each day that concrete is placed. One slump test shall be made at the time cylinders are made for compression tests. Tests shall meet ASTM C 143.
 5. Test Results: The laboratory shall send one copy of all reports to the Engineer, one copy to the Contractor and one to the ready mix plant. Concrete test reports shall include slump tests and state where concrete was used in the structure.

3.07 IMPERFECT OR DAMAGED WORK

Defective or damaged work, or any work damaged before final acceptance, shall be satisfactorily removed and replaced in accordance with the requirements of the Drawings and Specifications. Removal and replacement of concrete work shall be done in such a manner that the strength of the structure will not be impaired. All testing required to verify compliance with the Specifications and ACI Code shall be paid for by the Engineer.

3.08 CLEANING

Upon completion of the work, all forms, equipment, protective coverings and rubbish resulting therefrom shall be removed from the premises. Finished surfaces shall be left in a condition satisfactory to the Engineer.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SUMMARY

Furnish and install the concrete reinforcement as shown and indicated on the Drawings and specified in this Section, complete in place.

1.02 SUBMITTALS

A. Shop Drawings

1. All shop drawings shall be of the same size. Shop drawings shall include placing drawings, bending details, and bar lists with bar marks. All details and notes appearing on the Drawings, giving information for the placing of reinforcing steel, shall be shown on the shop drawings. Shop drawings will not be reviewed without such information.
2. Wall reinforcing shall be shown in elevation.
3. Show location and size of all penetrations greater than 6-inches in diameter or across the opening with the corresponding added reinforcing around the penetrations.
4. Submittals shall be completed for each structure. Partial submittals are not permitted and will be returned unmarked. Each submittal shall clearly indicate the structure and Drawing numbers that the work is for. The identifying numbers of the shop drawings for each structure shall be in numerical order.
5. Location and arrangement of accessories shall be clearly indicated.
6. All shop drawings shall be checked by the fabricator and contractor before being submitted to the Engineer.

B. Mill tests of reinforcing steel shall be submitted prior to each use for 15 tons or less shipped to the site. Tests shall be conducted in conformance with ASTM A 615, and methods prescribed therein.

1. Cost of mill tests shall be borne by Contractor.
2. Three copies of each test report stating whether the material meets the requirements of the ASTM specifications shall be submitted to the Engineer.
3. Certified copies of the mill tests may be considered evidence of compliance provided such tests are regularly conducted by the reinforcement supplier by experienced, competent personnel using adequate testing equipment. In case of

doubt as to the adequacy or accuracy of the mill tests, the Engineer may require the Contractor to furnish, at no additional cost to the Owner, test results from an independent testing laboratory acceptable to the Engineer on mill samples or delivered steel reinforcement.

PART 2 PRODUCTS

2.01 REINFORCING BARS

- A. Bar reinforcement shall be deformed-type bars conforming to ASTM A 615. Reinforcement shall be manufactured from new billet steel of American manufacture, Grade 60.
- B. Reinforcing steel shall be shop fabricated to shapes and dimensions indicated on the Drawings and in compliance with applicable provisions of ACI 315 and ACI 318.
- C. Bars shall be bent cold. Bars shall be pre-fabricated to detail and delivered on the job plainly tagged and ready to set.

2.02 WELDED WIRE FABRIC

Welded wire fabric shall be in flat sheets conforming to ASTM A 185, with wire conforming to ASTM A 82.

2.03 ACCESSORIES

- A. All chairs and bolsters shall have plastic-covered or galvanized steel legs at formed slabs and beams. For slabs on grade, bare metal is acceptable.
- B. For slabs on grade 10-inches or less, all reinforcing shall be supported on chairs and/or bolsters as required to properly position the bars or welded wire fabric.
- C. For slabs on grade greater than 10-inches, reinforcing shall be supported directly on concrete brick bearing on the subgrade or the system noted above for slabs 8-inches or less.

PART 3 EXECUTION

3.01 STORAGE OF MATERIALS

Reinforcing steel delivered to the site, not immediately placed in forms, shall be protected from mud and excessive rust-producing conditions by storing in a well-drained area and supported off the ground. All reinforcing shall be properly tagged with their bar marks and location in the structure clearly noted.

3.02 TOLERANCES

- A. Allowable tolerance for fabricating steel reinforcement shall be as follows:

Item	Maximum Tolerance Inches	
Sheared Length of Bars	+1	-1
Depth of Truss Bars	+0.0	-1/2
Outside Dimensions of Stirrups, Ties and Spirals	+1/2	-1/2
Location of Bends	+1	-1

- B. Allowable tolerances for placing steel reinforcement shall be as follows:

Item	Maximum Tolerance, Inches	
Concrete Cover from Outside of Bar to Finished Surfaces	+1/4	-0.0
Lateral Spacing of Bars in Plane of Reinforcement in Beams and Joists	+1/4	-0.0
Lateral Spacing of Bars in Plane of Reinforcement in Plane of Reinforcement in Slabs and Walls	+1	-1
Spacing of Stirrups, Ties and Spirals Along Longitudinal Axis of Member	+1/2	-1/4
Height of Bottom Bars in Slabs, Beams and Joists	+1/4	-1/4
Height of Top Bars in Slabs, Beams and Joists		
Depth 8" and Less	+1/4	-1/4
Depth 9" - 24"	+1/2	-1/2
Depth 25" & Greater	+1	-1

3.03 PLACEMENT AND ANCHORAGE

- A. Space metal chairs, bolsters, spacers and hangers in accordance ACI 315.
- B. Reinforcement, at the time concrete is placed, shall be free from rust scale or other coatings that will destroy or reduce bond. Bars with kinks or bends not shown on the plans shall not be used.
- C. Reinforcement shall be accurately placed in accordance with the Drawings and shall be adequately secured in position with not less than 16 gauge annealed wire or suitable clips at intersections. Reinforcement shall be held securely at the required distance from the forms. Nails shall not be driven into outside forms to support reinforcement.
- D. Install welded wire fabric reinforcement for concrete slabs on ground and as otherwise indicated. Lap all joints 6-inches and wire securely. Extend mesh to within 2-inches of sides and ends of slabs. Sheets that do not lay flat when in their intended position will be rejected. Tags designating the wire size and spacing shall be left on each sheet until ready for use. Tuck ends of welded mesh well down into edge of beams or walls. Do not leave unreinforced border strips. Welded wire fabric shall not contain loose rust. All welded wire fabric shall be supported and tied in its proper location.
- E. Conduits: Where conduits are permitted in slabs, low conduit shall be wired to the upper side of bottom reinforcing and top conduit shall be wired to lower side of top steel. Where parallel conduits occur, they shall be separated by at least 2-inches clear.

3.04 SPLICING

- A. Splicing of reinforcement shall be as shown and indicated on the Drawings. Splices not shown on the Drawings shall be Class B splice, in accordance with ACI 318. Any changes to the location and type of splices desired by the Contractor must be specifically requested and must meet with the acceptance of the Engineer before they can be used.
- B. Splices shall not be made at point of maximum stress and shall provide sufficient lap to transfer stress between bars by bond.
- C. Mechanical splices may be used instead of lap splices provided that their location and type meets with the acceptance of the Engineer.

END OF SECTION

**SECTION 03300
CAST-IN-PLACE CONCRETE**

PART 1 GENERAL

1.01 SUMMARY

Furnish and install the cast-in-place concrete as shown and indicated on the Drawings as specified in this Section, complete.

1.02 SUBMITTALS

- A. Mix designs for all groups and classes of concrete.
- B. Strength and slump tests results.
- C. Certificates of compliance for each of the following:
 - 1. Cement
 - 2. Aggregates
 - 3. Fly ash
 - 4. All admixtures

PART 2 PRODUCTS

2.01 CEMENT

Cement shall be standard Portland Cement of American manufacture, conforming to ASTM C 150, Type I. Only one brand of commercial Portland cement shall be used in the exposed concrete of the structure. Cement reclaimed by cleaning bags or from leaking containers shall not be used in this work.

2.02 CONCRETE AGGREGATES

- A. Fine aggregate shall be sand having clean, hard, durable, uncoated grains and free from deleterious substances shall conform to ASTM C 33.
- B. Coarse aggregate shall be crushed stone having clean, hard, durable, uncoated particles conforming to ASTM C 33.

2.03 WATER

Water used in mixing concrete shall be clean and free from deleterious amounts of acids, alkalis or organic materials.

2.04 EXPANSION JOINT FILLER

See Section 03050 of these Specifications for expansion joint filler.

2.05 WATERSTOPS

See Section 03050 of these Specifications for waterstops.

2.06 VAPOR BARRIER

Vapor barrier shall be polyethylene sheeting, minimum 10 mil thickness, conforming to ASTM C 171.

2.07 ADMIXTURES

- A. Water reducing admixture shall conform to ASTM C 494, Type A.
- B. Water reducing, retarding admixture shall conform to ASTM C 494, Type D.
- C. Non-Corrosive, Non-Chloride Accelerator: The admixture shall conform to ASTM C 494, Type C.
- D. Air entraining admixture shall conform to ASTM C 260.
- E. Fly ash shall conform to ASTM C 618, Type F.
- F. High range water reducer (HRWR) shall conform to ASTM C 494, Type F or G and shall be one of the following:
 - 1. Rheobuild 1000 or 716, manufactured Master Builders
 - 2. Daracem 100, manufactured by W.R. Grace
 - 3. Sikament 320, manufactured by Sika Corporation
 - 4. Eucon 37, manufactured by Euclid Chemical Company
- G. Calcium Chloride: Calcium chloride or admixtures containing more than 0.1 percent chloride ions are not permitted.

2.08 CURING AND SEALING COMPOUNDS

- A. Curing compound shall be acrylic based, conforming to ASTM C 309.
- B. Sealing compound shall be one of the following:

1. Masterseal 340, manufactured by Mater Builders
2. Sikaguard 70, manufactured by Sika Corporation
3. Super Rez Seal, manufactured by Euclid Chemical Company

PART 3 EXECUTION

3.01 CONCRETE QUALITY

- A. Two groups of concretes are required. Group I is concrete with a HIGH RANGE WATER REDUCER (HRWR), Group II is concrete without HRWR.
1. Group I: All Group I concrete shall contain the specified fly ash. The combined weight of cement and fly ash shall contain no less than 20 percent nor more than 25 percent of fly ash. The combined weight of cement and fly ash shall be used as the weight of cement in the determining of the water-cement (w/c) ratio. The following class of concrete is required:

Class of Concrete	Compressive Strength @ 28 days	Slump Range	Maximum W/C Ratio
A	4,000	1" - 2"	0.4

- a. The slump range in the above table is required prior to adding the High Range Water Reducer (HRWR). Slump tests shall be made prior to adding the HRWR. The HRWR shall be added to the concrete at the batch plant. The slump range required after the addition of the HRWR is 7 to 10-inches. HRWR shall be capable of maintaining 7 to 10-inch slump in excess of 60 minutes of continuous mixing at 4 to 6 rpm in a truck mixer and workability up to 90 minutes. After introduction of HRWR, concrete temperature shall be maintained within 3 degrees F for 90 minutes when concrete temperatures are in excess of 90 degrees F. Except for the air-entrainment admixture, no other admixture shall be used with the HRWR. The HRWR manufacturer shall supply jobsite technical service to the contractor. The manufacturer shall be consulted for mix proportions and dosage rates. No added chlorides shall be used. The initial set shall not be in excess of six hours at temperatures above 50 degrees F. HRWR shall be used with due consideration given to the air temperature at the time of batching and casting.
- b. Air Content: All concrete shall have an air content of 4.0 percent to 7.0 percent.
- c. Group I concrete shall be used in all walls and column for liquid

containment structures.

2. Group II: The following classes of concrete are required:

Class of Concrete	Compressive Strength @ 28 days	Slump Range	Maximum W/C Ratio
A	4,000	3" - 5"	0.45
B	3,000	3" - 5"	0.56

- a. Air Content: All concrete shall have an air content of 3.0 to 6.0 percent.
- b. Admixture Usage: All concrete placed at air temperatures above 50 degrees F shall contain a water reducing admixture or water reducing-retarding admixture. All concrete placed at air temperatures below 50 degrees F shall contain the specified non-corrosive non-chloride accelerator.
- c. Group II concrete shall be used for all work not specified as Group I concrete.
- d. Fly ash is required in all slabs for liquid containment structures, either on grade or formed. Provisions for fly ash use in Group I concrete shall apply.
- e. The use of fly ash is not required for the remainder of Group II concrete, but is permitted. If used, the provisions for fly ash use in Group I concrete shall apply.

3.02 MIX DESIGNS

- A. Mix designs shall be proportioned in accordance with ACI 211.1 making maximum use of the course aggregate. The proportioning shall be based on the requirements of a well-graded high density plastic workable mix within the slump range and strengths required. The mix shall contain no less than 1,850 pounds of course aggregate per cubic yard of concrete, shall be based on conventional conveying and shall not be altered for use in pumping. Pumping equipment, if used, shall be of sufficient size and design to pump the mix designed for conventional conveyance.
- B. Course Aggregate
 1. Course aggregate for all concrete liquid containment structures shall be Size No. 467.

2. Course aggregate for all other concrete work shall be Size No. 57.
 3. Size No. 467 may be used in lieu of Size No. 57 in concrete members whose minimum size dimensions is 8-inches or larger.
- C. Submit samples, in adequate quantities for each mix design and verification, of all concrete materials to be used on the project to the designated testing laboratory. Do not use any concrete in this work without acceptance and verification of design mix by the testing laboratory and the approval of the Engineer.
- D. If trial batches are used, the testing laboratory shall make strength tests from trial batches in the laboratory using materials and mix designs proposed for use by the Contractor. The testing laboratory shall prepare trial batches in accordance with ACI 211.1.
- E. If field experience method is selected, the proposed mix design shall be accompanied by complete standard deviation analysis and at least 30 consecutive strength tests that represent the proposed mix.
- F. The proposed mix design and supporting data shall be submitted to the Engineer for review and comments at least 21 days prior to the expected start of concreting operations.
- G. Compression test specimens made to verify the mixes shall be made in accordance with ASTM C 192. All compression test specimens shall be tested in accordance with ASTM C 39.

3.03 PLANT MIXING

- A. Proportioning Concrete
1. Proportions shall be in compliance with approved design mix for each class of concrete.
 2. The mixing plant shall be provided with adequate equipment and facilities for accurate measurement and control of the quantities of material and water used in the concrete.
 3. Concrete materials shall be measured by weight except that admixtures shall be measured by volume.
- B. Batching
1. Provide all necessary equipment to accurately determine and control actual amount of materials entering into the concrete mix. Individual ingredients shall be weighted separately for each batch. Accumulative weighing will be allowed if equipment is in acceptable working order as determined by the testing laboratory and approved by the Engineer. Accuracy of all weighing devices shall be such that successive quantities can be measured to within one percent of the desired amount.
 2. Completely discharge contents of the mixer before each new batch is loaded. Use

- of retempered concrete is not permitted.
3. Ready-mixed concrete shall be mixed and delivered in accordance with requirements of ASTM C 94 and the following:
- a. A separate water metering device (not truck tank) shall be used for measuring water added to the original batch.
 - b. Use of wash water as a portion of the mixing water is not permitted. Wash water added to empty drums after discharging shall be dumped before a new batch is received.
 - c. Centrally mixed concrete shall be mixed for the length of time specified herein, not shrink-mixed.
 - d. Mixing drums shall be watertight.
 - e. Concrete shall be discharged within one hour from the time concrete was mixed, if centrally mixed, or from time the original water was added, if transit-mixed.
 - f. Furnish delivery ticket with each load of concrete delivered under these Specifications. Delivery ticket shall show clearly the class and strength of concrete, size of coarse aggregate, water per cubic yard, its slump, quantities of all admixtures, the date and time of departure from the batching plant, and the time of placement.

3.04 CONVEYING EQUIPMENT

- A. If concrete is to be transported in carts or buggies, the carts or buggies shall be equipped with pneumatic tires.
- B. Equipment for chuting or other methods of conveying concrete shall be of such size and design as to insure a practically continuous flow of concrete at delivery without segregation of concrete.

3.05 CONVEYING

- A. Concrete shall be conveyed from mixer to place of final placement by methods which will prevent separation or loss of the material.
- B. Runway supports shall not bear upon reinforcing steel or fresh concrete.
- C. All conveying equipment shall be thoroughly cleaned before each run of concrete is begun.

3.06 DELIVERY AND PROTECTION OF MATERIALS

- A. Deliver ready-mixed concrete in compliance with requirements of ASTM C 94.
- B. The following tests shall be made at the work site prior to placement of concrete:

1. Slump Tests: ASTM C 143
2. Air Content: ASTM C 173 or C 231
3. Test Cylinders: ASTM C 31

3.07 SEVERE-WEATHER PROVISIONS

- A. Hot Weather Concreting: Protect in accordance with ACI 305R except as modified herein.
1. Provide adequate methods of lowering temperature of concrete ingredients so that the temperature of concrete when placed does not exceed 90 degrees F.
 2. Concrete shall not be placed when the air temperature is expected to exceed 100 degrees F within 12 hours after casting.
 3. When the air temperature is 75 degrees F and above, forms and reinforcing shall be thoroughly wetted with water so that the concrete will be placed against wet and cooled surfaces. All excess water shall be removed before casting the concrete.
 4. Protection and Curing - Slabs (On Grade and Formed)
 - a. Protect slabs from damage due to dry winds and high temperatures.
 - b. Protect slabs from direct sun at temperatures of 85 degrees F and above.
 - c. Moist curing of all slabs shall start as soon as the surface of the fresh concrete is hard enough to permit curing without damage to the surface of the concrete.
 5. Protection and Curing - Formed Surfaces: As soon as the concrete has set, wet the forms and keep the forms wet during the curing period. Provide for keeping the top of the walls, and other surfaces, moist during the curing period.
- B. Cold-weather Concreting: Protect in accordance with ACE 306R except as modified herein.
1. Provide adequate equipment for heating concrete materials and protecting concrete from damage during freezing or near-freezing weather. No frozen materials, or materials containing ice, shall be used.
 2. All concrete materials and all reinforcement, forms, fillers and ground with which concrete is to come into contact shall be free from frost.
 3. Whenever the temperature of the surrounding air is below 40 degrees F and falling, all concrete placed in the forms shall have a temperature of between 70 and 80 degrees F, and adequate means shall be provided for maintaining a temperature of not less than 70 degrees F for three days, or 50 degrees F for five days, or for as much more time as is necessary to insure proper curing of the concrete. If high early strength concrete is used, the requirement for maintenance of 50 degrees F may be reduced to three days.
 4. Use only the specified non-chloride accelerator. Calcium chloride or admixtures containing more than 0.1 percent chloride ions are not permitted.
 5. Housing, covering or other protection used in connection with curing shall remain in place and intact at least 24 hours after the artificial heat is discontinued.

3.08 CONSTRUCTION JOINTS AND EXPANSION JOINTS

- A. Formed Construction Joints in Containment Structures and Where Otherwise Shown: Prior to placing concrete next to the joint, the joint surface shall be thoroughly cleaned and dampened with water. Remove all free water so that the surface of the joint show signs of drying before placing the adjacent concrete.
- B. Construction joints in beams, girders and slabs, where Waterstops are not Specified or Shown to be installed: These joints shall be located at points of minimum shear and their locations shall be approved by the Engineer before they are bulkheaded. These joints shall be roughened and thoroughly cleaned of all foreign matter and laitance and dampened with water. Remove all free water and slush with a coat of neat cement grout before placing the adjacent concrete. Place the adjacent concrete before the next cement grout takes its initial set.
- C. Construction Joints in Beams, Girders and Slabs: Where waterstops are specified or shown to be installed. These joints shall be treated as specified in paragraph A. above.
- D. Construction Joints in Columns: These joints, unless otherwise shown on the Drawings, shall be located at the bottom of the girder, beam or slab it receives, and at the top of slabs when the column continues through a slab level. These joints shall be treated as specified in paragraph B. above.
- E. Expansion Joints: Expansion joints shall be installed where shown on the Drawings.

3.09 WATERSTOPS

Waterstops shall be provided at all formed construction joints and shall be made continuous throughout their length.

3.10 INSPECTION OF WORK BEFORE PLACING CONCRETE

- A. Inspect the area to receive concrete for any deficiencies which would prevent proper placing of concrete. Do not proceed with placing concrete until such deficiencies are corrected.
- B. Do not place in the concrete any item that is not required to be in the concrete by the Drawings and Specifications. Insert all the items shown on the Drawings or specified properly positioned and secured. Openings other than those which are facilitated by sleeves shall be properly formed and positioned.
- C. Remove hardened, or partially hardened, concrete on forms or reinforcement before placing concrete.
- D. Do not place concrete on earth until the fill or excavation has been prepared as set forth under the applicable sections of the Specifications for that work.

- E. Give the Engineer at least 48 hours notice before any concrete is to be placed.

3.11 PLACING

- A. Place concrete as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Do not place concrete on work that has partially hardened or been contaminated by foreign material, and do not use re-tempered concrete. In no case shall Group II concrete be placed when the elapsed time after addition of water and cement to batch exceeds one hour. For Group I concretes, this elapsed time may be extended if sufficient data from the construction indicates a time extension is permissible and if approved by the Engineer.
- B. Concrete shall be placed in a manner to avoid the displacement of reinforcing, and coating or spattering the reinforcing steel. The placing of concrete within form work shall be regulated so that the pressure within form work does not exceed the design pressure. In placing concrete each layer shall be placed following the preceding layer to prevent lines of separation or cold joints in the work. After the concrete reaches its initial set, jarring the formwork or placing strain or vibrations on the ends of projecting reinforcing bars shall be avoided.
- C. Group I concrete shall not be dropped more than 10 feet. Group II concrete shall not be dropped more than four feet. All concrete placed over PVC waterstops shall drop no more than 6-inches until there is at least one foot of concrete above the PVC waterstop, at which point the drop distances may be increased to those noted above.
- D. Once concrete placing has started, it shall be carried on as a continuous operation until placing of the concrete between construction joints is completed.
- E. Concrete shall be placed in layers not over 12-inches deep and each layer shall be compacted with the aid of mechanical internal-vibrating equipment supplemented hand spading. Vibrators shall in no case be used to transport concrete. Use of form vibrators is not permitted. Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the concrete. At least one spare working vibrator shall be on the job site as a back-up. Duration of vibrator use shall be limited to that necessary to produce satisfactory consolidation without causing objectionable segregation. Vibrator shall not be lowered into courses that have begun to set. Apply vibrator at uniformly spaced points not further apart than the visible effectiveness of the machine. Type and use of vibrators shall be in accordance with ACI 301.
- F. Provide vapor barrier under all slabs on soil, sand or stone. Use largest sheets practicable to reduce number of joints. Lap joints a minimum of 24-inches. Remove torn and punctured sheets and replace with new sheets prior to placing concrete. Placing of concrete shall be done in a manner that will not damage the vapor barrier material.

3.12 PROTECTION

Protect freshly placed concrete from damage or injury due to water, falling objects, persons or anything that may mar or injure finish surface on concrete. Only light use of slabs will be permitted for the first 14 days after placing of the concrete.

3.13 CURING

- A. Curing shall conform to ACI 308 except as modified herein.
- B. All Slabs on Grade: After placement and finishing, concrete shall be maintained in a moist condition for at least seven successive days during which the temperature of the concrete is 50 degrees F or above. For temperatures of 50 degrees F and below, curing period shall be 14 successive days. Concrete shall be kept moist by any one, or combination, of the following methods:
 - 1. Ponding or Immersion: Continually immerse the concrete in water throughout the curing period. Water shall not be more than 20 degrees F less than the temperature of the concrete.
 - 2. Fog Spraying or Sprinkling: Provide uniform and continuous application of water throughout the curing period.
 - 3. Pervious Sheeting: Completely cover surface and edges of the concrete with two thicknesses of wet sheeting. Overlap sheeting 6-inches over adjacent sheeting. Sheeting shall be at least as long as the width of the surface to be cured. During application, do not drag the sheeting over the finished concrete nor over sheeting already placed. Wet sheeting thoroughly and keep continuously wet throughout the curing period.
 - 4. Impervious Sheeting: Wet the entire exposed surface of the concrete thoroughly with a fine spray of water and cover with impervious sheeting throughout the curing period. Lay sheeting directly on the concrete surface and overlap edges 12-inches minimum. Provide sheeting not less than 18-inches wider than the concrete surface to be cured. Secure edges and transverse laps to form closed joints. Repair torn or damaged sheeting or provide new sheeting. Inspect surface of concrete daily for wetness. The surface shall be kept continuously wet during the curing period.
- C. All Other Concrete: After placement, concrete shall be maintained in a moist condition for the same periods as specified above for slabs on grade.
 - 1. Concrete in Formed Surfaces - Slabs, Beams, Columns and Building Walls: Keep forms and exposed surfaces wet with water during the curing period. If forms are removed before the end of the curing period, apply a curing compound within one hour after form removal.
 - 2. Concrete in Formed Surfaces - Containment Vessel Walls: Deep forms wet with water during the curing period. If forms are removed before the end of the curing period, continue the moist curing in accordance with Paragraph A. of these

Specifications.

3.14 PATCHING

- A. As determined by the Engineer, any concrete which is out of alignment or level, a defective surface or has defects which reduce its structural adequacy, shall be considered as not conforming with the Drawings and Specifications and shall be rejected.
- B. Do not take any remedial action on concrete with any defect without the permission of the Engineer.
- C. Unless the Engineer grants permission to patch the rejected concrete, remove the rejected concrete and replace it with concrete that conforms to the Drawings and Specifications. The location of cut lines and the extent of removal will be determined by the Engineer.
- D. If the Engineer grants permission to patch the rejected concrete, it shall be done in accordance with the following:
 - 1. Permission to patch rejected concrete will not be a waiver of the Engineer's right to require complete removal of the rejected concrete if the patching does not, in the Engineer's judgment, restore the concrete to the requirements of the Specifications and Drawings.
 - 2. Patching shall be accomplished after the curing is completed.
 - 3. Defective areas shall be chipped away to a depth of not less than 1-inch, in all cases to sound concrete, with edges perpendicular to the surface. Feather edges will not be permitted. Remove all loose material and thoroughly clean the chipped surfaces with a high pressure air hose delivering air at 100 psi. The area to be patched and an area at least 6-inches wide surrounding it shall be dampened. a bonding grout shall be prepared using a mix of approximately one part cement to one part fine sand passing a No.30 mesh sieve, mixed to the consistency of thick cream, and then well brushed into the surfaces as noted below in paragraph 5.
 - 4. The patching mixture shall be made of the same materials and of approximately the same portions as used for the original concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than one part cement to two and one-half parts sand by damp, loose volume. White Portland cement shall be substituted for a part of the gray Portland cement to produce a color matching the color of the surrounding concrete, as determined by a trial patch. The quantity of mixing water shall be no more than necessary for handling and placing. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.
 - 5. After surface water has evaporated from the area to be patched, the bond coat shall be well brushed into the surface. When the bond coat begins to lose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to leave the patch slightly

higher than the surrounding surface. To permit initial shrinkage, it shall be left undisturbed for at least one hour before being finally finished. The patched area shall be kept damp for seven days. Finishing tools that produce a finish matching the surrounding shall be used.

- E. Tie holes left by withdrawal of rods or the holes left by removal of ends of wall ties shall be filled solid with mortar after first being wetted. For holes passing through the wall, a plunger-type grout gun shall be used to force the mortar through the wall starting at the back face. a piece of burlap or canvas shall be held over the hole on the outside and when the hole is filled, the excess mortar shall be struck off with the cloth flush with the surface. Holes not passing through the walls shall be filled with a small tool that will permit packing the hole solid with mortar. Any excess mortar at the surface of the wall shall be struck off flush with a cloth. Mortar shall consist of one part cement, two and one-half parts sand and no more water than necessary for handling and packing.

3.15 FINISHES ON FORMED SURFACES

- A. Upon completion of patching, surfaces of concrete shall be finished as follows:
1. Brushed Finish Surface Coating
 - a. The brush finish surface coating shall be applied over a Smooth Form Finish.
 - b. The materials used shall be applied in two separate coats to provide a uniform finish on exposed surfaces that have received the initial rubbed finish. The materials shall be mixed and applied strictly in accordance with the written recommendations of the product manufacturer. The actual application of the material shall be performed by workers who have been instructed in the preparation and application of the material. The final brushing of the material during application shall be performed in such a manner as to present a uniform and attractive appearance, with the final brushing generally being done in one direction. The materials shall be especially manufactured for the purpose of waterproofing exterior concrete surfaces, and enhancing the appearance of the concrete surface. The final color of the finish shall be pearl gray, or near that of good quality cured natural concrete. Texture of material shall be approved by the Engineer. Material shall be Thorocoat as manufactured by Thoro System Products.
 - c. The following surfaces shall receive a brushed finish surface coating:
 - (1) All exterior wall concrete surfaces to levels not less than 6-inches below finish grade.
 - (2) All interior wall concrete surfaces within buildings and other such surfaces exposed to view in the finished work (except floor slabs).
 - (3) The interior side on containment tank walls to a level not less than 12-inches below normal liquid level, including top of walls.

2. Smooth Form finish is required for all concrete surfaces exposed to view in the completed work and all liquid containment structure walls whether exposed to view or not in the completed work. Accomplish the required patching and the following touch-up:
 - a. Remove all burrs.
 - b. Remove all form marks.
 - c. Smooth out lines of indentations.
3. Rough Form Finish shall be produced by filling all tie holes and honeycomb and in other respects leaving the surface as formed. All concrete surfaces which will be covered by earth and which will not be visible in the completed structure (except as note above for liquid containment structure walls which shall have a Smooth Form Finish), may receive a Rough Form Finish.

3.16 STEEL TROWELED FINISH - FLOOR SLABS

- A. Steel troweled finish shall be applied to the surface of all building and liquid containment structure floor slabs and interior equipment pads.
- B. Concrete shall be placed, consolidated, struck-off and leveled to the proper elevation. After the surface has stiffened sufficiently to permit the operation and the water sheen has disappeared, the surface shall be wood floated, by hand or power floated, at least twice, to a uniform sandy texture. Floors shall be leveled such that depressions between high spots do not exceed 1/4-inch under a 10 foot straightedge except where drains occur, in which case the floors shall be pitched to the drains as indicated on the Drawings.
- C. After the concrete has received a wood float finish, it shall be troweled at least twice to a smooth finish. The drying of the surface moisture before floating or troweling shall not be hastened by the dusting on of dry sand or cement. The first troweling shall be done by a power trowel and shall produce a smooth surface relatively free of defects. Additional troweling shall be done by hand after the surface has hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the hand troweling operations. The finished surface shall be free of any trowel marks or other imperfections; shall be uniform in texture and appearance, and shall be in true plane within the tolerance specified. Any deviation from this condition which remains after the troweling is completed shall be corrected by grinding.

3.17 BROOM FINISH

- A. Broom finish shall be applied to:
 1. All exterior side walks, walkways and platforms.
 2. All steps and landings, both interior or exterior.

- B. The surface shall be given a floated finish as specified above, then finished with a flexible bristle broom or burlap belt drawn across the surface. Surface must be hardened sufficiently to retain the scoring or ridges. Scores or ridges shall be transverse to traffic or at right angles to the slope of the slab.

3.18 TESTING LABORATORY

- A. The testing laboratory shall have access to all places where concrete materials and concretes are manufactured, stored, proportioned, mixed, placed and tested. Duties shall include, but not necessarily be limited to the following;
 - 1. Make, store, transport, cure and test compression specimens made during placing of concrete. Compression test specimens shall be tested in accordance with ASTM C 39. Test reports shall show all pertinent data, such as class of concrete, exact location of pour, air temperature, date of pour, time of pour, truck number for ready-mixed concrete, date on which specimen was broken, age of specimen, compressive strength of specimen, concrete slump test results and air content of concrete from which the specimen was made. One copy each of all tests shall be sent to the Contractor and two copies each to the Engineer.
 - 2. Each strength test requires four standard test cylinders.
 - 3. Samples for strength tests of each class placed each day shall be taken not less than once a day, nor less than once for each 50 cubic yards of concrete, nor less than once for each 1,000 square feet of surface area for slabs or walls.
 - 4. Each class of concrete shall be tested with at least five strength tests.
 - 5. From each set of four cylinders, one cylinder shall be broken at seven days and will be used as an aid in determining the early strength of the concrete and the 28 day strength, two shall be tested at 28 days and shall comprise a strength test under the definition of these Specifications and one cylinder retained in reserve for later testing if required.
 - 6. Test for unit weight of concrete when the first load of each class of concrete is delivered and thereafter at the discretion of the testing laboratory.
- B. Periodically inspect the batching plant and file a report with the Engineer stating whether the supplier's equipment and methods meet the requirements of these Specifications.
- C. Temperature and Placing Record: Temperature record shall be made each day during the concreting operations. Records shall also include location, quantity and starting and finishing time of placement for all concrete work. Copy distribution shall be as specified above for test reports.

- D. Testing of all cast-in-place concrete for conformance with these specifications shall be made by a Designated Testing Laboratory selected and paid by the Owner.

3.19 EVALUATION OF COMPRESSION TESTS

- A. Evaluation of compression test results shall be as follows: For each class of concrete, compression-strength tests for laboratory-cured cylinders shall be considered satisfactory if the averages of the results of all sets of three consecutive compression-strength tests equal or exceed the 28 day design compression-strength specified; and, no individual cylinder strength test falls below the required compression strength by more than 500 psi. Strength tests of specimens cured under field conditions may be required by the Engineer to check the adequacy of curing and protecting of the concrete placed. Specimens shall be molded by the field testing laboratory at the same time and from the same samples as the laboratory-cured specimens.
- B. Faulty Concrete: Failure to comply with any of the specified conditions shall constitute faulty concrete. Unless otherwise directed by the Engineer, faulty concrete shall be removed and replaced with concrete as specified, at no expense to the Owner.
- C. Additional Test: If permitted by the Engineer, additional tests shall be subject to the approval of the Engineer and at no expense to the Owner. Load tests, if permitted by the Engineer, shall be conducted in accordance with the loading criteria as required by the design of the structure, as determined by the Engineer
- D. Neither the results of laboratory verification tests nor any provision in the Contract Documents shall relieve the Contractor of the obligation to finish concrete of the class and strength specified.

END OF SECTION

**SECTION 03602
NONMETALLIC GROUTING**

PART 1 GENERAL

1.01 SUMMARY

This Section describes nonmetallic grout and grouting methods to be used in the setting of motors, compressors, pumps, aerators, vessels, tanks, pipe supports, structures and other miscellaneous items of equipment that require grout between their baseplate, 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 necessary or convenient to the Contractor for the proper preparation, placement and curing of grout.
- B. Non-shrink, epoxy and sand-cement grouts shall be stored, mixed, handled and placed in accordance with the recommendations of the grout manufacturer and the American Concrete Institute (ACI), as applicable.

1.03 SUBMITTALS

- A. Prior to placement of any non-shrink 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 are in conformance with the material and mechanical requirements specified herein. Certified copies of independent laboratory test results or mill test results from 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 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.

1.05 SAFETY

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 heavy equipment items shall be grouted in place with a nonmetallic, noncorrosive, nongaseous, non-shrink grout requiring no cutback or protective coating. Non-shrink grout shall show zero shrinkage from the placement volume or initial expansion volume as determined by ASTM C 827, and shall have an initial set time at 70 degrees F of not less than 45 minutes as determined by ASTM C 191. When tested in accordance with ASTM C 109, non-shrink grout shall have a one-day compressive strength of not less than 2,000 psi and a 28-day strength of not less than 9,000 psi 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 ions, calcium chloride, oxidizing catalysts, gas-forming agents, harmful aluminums or corrosive chemicals and shall be resistant to oil, water and sewage. The grout shall be premixed and shall require only the addition of water prior to placement. The 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. Non-shrink grout shall be EUCO N-S Grout as manufactured by Master Builders Company, or Upcon High Flow Grout as manufactured by UPCO Division of Emhart Chemical Company.

2.02 SAND-CEMENT GROUT

- A. Column baseplate, pipe support baseplates, tanks and miscellaneous small items of equipment shall be grouted in place using a sand-cement grout consisting of one part Portland cement, two 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 uncrated particles.
- B. Fine aggregate shall be free from organic material and injurious amounts of deleterious substances and shall be graded as follows:

Sieve Size No.	Percent (by weight) Passing
4	100
8	95 - 100
16	60 - 100

30	35 - 70
50	15 - 35
100	2 - 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 binder shall be dried prior to use to remove any free moisture.

2.03 EPOXY GROUT

Epoxy grout shall be used in special equipment grouting applications requiring 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 solids, polyamide epoxy binder and fine aggregate conforming to the requirements specified herein for sand-cement grout. Epoxy grout shall consist of not less than one part not more than two parts, by weight, fine aggregate to one part epoxy binder. When cured at a temperature of 73 degrees F, neat epoxy binder shall have a one 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 1001 Regular".

2.04 WATER

Water used in preparation of non-shrink and sand-cement grout shall be clean, potable water, free from oil, alkali, acid, organic matter and other deleterious substances.

PART 3 EXECUTION

3.01 FOUNDATION PREPARATION

- 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 roughened condition. All surfaces to be in contact with the grout, including the bottom of the baseplates or sole plates, shall be thoroughly cleaned until free of all oil, grease, laitance, dust, curing compounds and other foreign substances. If the surface is to receive non-shrink 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 an air hose or 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.

3.02 MIXING

- A. The 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 non-shrink 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 tempered by adding water.
- B. Components of epoxy grout systems shall be accurately proportioned and thoroughly mixed so as to produce a uniform and homogeneous mixture. Accuracy of proportioning of epoxy compounds shall be $\pm$ five 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 in by a low speed (400-600 rpm) motor to prevent introduction of excessive amounts of entrained air into the mixture. Mixing shall continue until the mixture is uniform and homogeneous, but in no case less than three 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 five minutes to allow initial air release.

3.03 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 baseplate or bedplate are filled. Air-relief holes shall be provided, if necessary, to eliminate entrapped air. If a pourable or flow-able 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 to be placed. Grout shall be placed until it protrudes from the entire perimeter area. Baseplates shall be located so as to provide a minimum clearance of 1-inch between the foundation and the bottom of the baseplate. The temperature of the foundation and baseplate or soleplate shall be maintained above 45 degrees F during placement and for at least 24 hours thereafter. Heating of foundation and baseplate surfaces shall be accomplished using heated enclosures, heat lamps or radiant heaters so as to achieve uniform heating. Use of

direct flame shall be prohibited. Concrete structures shall be heated a minimum of four hours prior to grouting to ensure proper heating of the concrete mass. Temperature of heated surfaces shall not exceed 100 degrees F at the time of placement. When placing non-shrink or sand-cement grout under unusually hot or cold weather conditions, grouting practices shall comply with the requirements of ACI 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 isotherm 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 isotherm 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 baseplate or bedplate not to exceed 1-inch in thickness.

3.04 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 troweled 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 three days. All voids shall be re-grouted using the same grouting material. Removal of shims and wedges from column baseplates and pipe support baseplates 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 seven 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 05100
STRUCTURAL STEEL**

PART 1 GENERAL

1.01 SUMMARY

Furnish and install all the structural steel work as shown on the Drawings and specified in this Section, complete.

1.02 INDUSTRY STANDARDS

AISC 360-10 Specification for Structural Steel Buildings, June 22, 2010 by the American Institute of Steel Construction (AISC) shall govern all structural steel work.
AWS D1.1 – Structural Welding Code, Latest Ed.

1.03 QUALIFICATIONS

- A. Steel shall be of American manufacture.
- B. Welders: Before assigning any welders in the shop or field to work on work covered by this Section, the Contractor shall provide the Engineer with the name of the welders to be employed on the work, together with certification that each of these welders has passed qualifications tests using procedures covered in the American Welding Society Standard B 3.01, Part II.
 - 1. The Contractor shall require any welder to retake the test when, in the opinion of the Engineer, the work of the welder creates a reasonable doubt as to the proficiency of the welder. Tests, when required, shall be conducted at no additional expense to the Owner.
 - 2. Re-certification of the welder shall be made to the Engineer only after the welder has taken and passed the required test.
 - 3. Any welder or welding operator who has not been employed at the process for which they have been qualified (and for which process assigned to on this Project) for a period of six months shall be re-qualified.

1.04 SUBMITTALS

- A. Shop Drawings: Develop, prepare and provide all necessary shop drawings. Shop drawings shall not be reproductions of the Contract Drawings. Materials shall not be fabricated or delivered to the site before the shop drawings have been reviewed by the Engineer and marked "NO EXCEPTIONS TAKEN" by the Engineer.
- B. Shop drawings shall include all information for the fabrication and erection of the structural

steel work, including cuts, copes, blocks and the location, type and size of bolts and welds.

- C. All welds, both shop and field, shall be indicated by standard welding symbols of the American Welding Society Standard Code for Arc and Gas Welding in Building Construction.
- D. All Contractor requests for substitutions shall be clearly marked as such on the shop drawings. In addition, the Contractor shall submit, in writing, accompanying the shop drawings, a description of the substitution and the reasons therefore. Substitutions will not be permitted unless approved by the Engineer.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Structural Steel: Wide Flange shapes shall conform to ASTM A 992, Gr. 50.
- B. All other structural rolled shapes and plates shall conform to ASTM A 36 or A 572.
- C. High strength bolts shall conform to ASTM A 325.
- D. Unfinished bolts shall conform to ASTM A 307.
- E. Anchor bolts shall conform to ASTM F 1554, Gr. 36.
- F. Headed anchors and shear connectors shall conform to ASTM A 108.
- G. Electrodes
 - 1. Electrodes and flux used for submerged arc welding shall be of the same manufacturer. The flux shall be free of contamination from dirt, mill scale and other foreign material. Fuse flux used in welding shall not be reused.
 - 2. Electrodes for manual metal-arc welding shall conform to AWS D1.1, Classification E70, low hydrogen content.
 - 3. The bare electrodes and flux used in combination for submerged arc welding shall conform to the requirements of the AWS Code. Grade SAW-2 shall be used for welding.

PART 3 EXECUTION

3.01 FABRICATION

- A. Workmanship: AISC governs. All erection marks shall be painted.
- B. Assembly: Structural material shall be fabricated and assembled in the shop to the greatest

extent possible. Shearing, flame-cutting and chipping shall be done carefully and accurately. Assembled pieces shall be taken apart, if necessary, for removal of burrs and shavings produced by the remaining operation. Parts not completely connected in the shop shall be secured by bolts, to the extent required, to prevent damage in shipment and handling.

- C. Connections: The type of shop and field connections shall be as indicated on the Drawings. Bolts shall be installed in accordance with the RCSC Specification for Structural Joints Using High-Strength Bolts.
1. One-sided or other types of eccentric connections will not be permitted unless approved by the Engineer.
 2. ASTM A325 bolts shall be used for all bolted connections except for anchor bolts and where other bolts are shown on the Drawings.
 3. Surfaces of joints for welded and ASTM A 325 bolted connections shall comply with the cleanliness requirements of all joint surfaces and contact surfaces for Pretensioned type joints as specified in the RCSC Specification.
 4. Connections shown or specified with the use of ASTM A 325 bolts shall be bearing type, with bolts pretensioned per section 8.2 of the RCSC Specification.
 5. Direct Tension Indicator washers shall be used to ensure proper bolt pretension.
 6. Splices will be permitted only where shown or noted on the Drawings.
- D. Holes and Cut-Outs: Holes shall be cut, drilled or punched at right angles to the surface of the metal and shall not be made enlarged by burning. Holes in base or bearing plates shall be drilled. Holes shall be provided in members to permit connection of the work of other trades unless otherwise noted. Holes shall be clean-cut without torn or ragged edges. All burrs caused by drilling or reaming shall be removed prior to final assembling.
- E. Surfaces to be Saw-Cut: Contact surfaces between columns and base plates, abutting ends of columns at column connections, ends of stiffeners bearing against flanges, and where indicated on the Drawings, and wherever specified elsewhere herein.

3.02 SOURCE QUALITY CONTROL

- A. The material to be furnished shall be subject to inspection and tests in the shop and field. Inspection and tests in the shop and field will be conducted by the testing laboratory. Inspection in the shop or field will not relieve the Contractor of the responsibility to furnish satisfactory materials and workmanship. When materials and workmanship do not conform to the Specifications requirements, the Engineer reserves the right to reject material, workmanship or both, at any time before final acceptance of the structure. Additional testing of rejected material or workmanship shall be paid for by the Contractor.
- B. All completed or partially completed shop and field welds shall be subject to non-destructive testing such as radiographic, magnetic particle, dye penetrant or ultrasonic procedures. The minimum amount of non-destructive testing is as follows:

1. 100 percent ultrasonic testing of all groove full penetration welds.
2. 20 percent of all fillet welds shall be tested by either the Dye Penetrant Method or the Magnetic Particle Method.
3. The radiographic method shall be used to correlate the other methods and check the welds, as determined by the Engineer.
4. All welds shall be visually checked by the testing laboratory.
5. All joint preparations and fit-up for shop and field welds shall be approved by the testing laboratory before commencement of welding.

3.03 PRODUCT HANDLING

- A. Delivery of Material: Deliver the fabricated structural steel to the site in such sequence as to provide for the most efficient erection of the material with minimum on-site storage time.
- B. Storage: Provide on-site storage for fabricated steel before erection. If the steel material is on-site, it shall be stored above ground on platforms, skids or other supports. Material shall be kept free from dirt, grease and other foreign matter and shall be protected from corrosion.

3.04 ERECTION

- A. The Drawings and Specifications show and specify the completed structure but do not indicate the method and means of construction. The Contractor shall supervise and direct the work and be solely responsible for implementing the necessary means, methods and safety precautions to provide the completed structure.
- B. Splices and field connections shall be made as shown and noted on the Drawings. Unless noted otherwise, all field connections shall be bolted. Errors in shop fabrication or deformation resulting from handling and transportation that prevent the proper assembly and fitting of parts shall be reported immediately to the Engineer for directions as to the method of correction. Suitable corrections, as determined by the Engineer, shall be made at no additional cost to the Owner.
- C. Anchor bolts and anchors shall be properly located and built into connecting work. Bolts and anchors shall be preset by the use of templates or such other methods as may be required to locate the anchors and anchor bolts accurately. All base plate anchor bolt nuts shall be turned down tight.
- D. Column bases and bearing plates may be attached or loose as approved on the shop drawings. Base plates and bearing plates shall be supported and aligned by leveling screws, steel wedges or shims.
 1. After the supported members have been plumbed, properly shimmed and positioned, and the anchor nuts tightened, the entire bearing area under the plate shall be dry-packed, solidly with non-shrink grout as specified in Section 03602 of these Specifications.
 2. Wedges and shims shall be removed after grout has set and shim holes shall be

patched with grout.

- E. High-Strength Bolting: Installation of the high-strength bolts shall be by the turn-of-nut method. Alternatively, Direct Tension Indicator devices may be used in accordance with the manufacturer's written instructions and the RCSC Specification. All bolted joints shall be subject to the inspection and testing by the testing laboratory and the Engineer.
 - 1. Bolts shall be driven accurately into the holes without damaging the thread. Bolt heads shall be protected from damage during driving. Bolt heads and nuts shall rest squarely against the metal or washers. Where bolts are to be used on beveled surfaces, beveled washers shall be provided to give full bearing to the head or nut.
 - 2. All bolts in a joint shall be tightened and the wrench shall be returned at least once to every bolt in the joint to "touch-up" bolts previously tightened, which may have been loosened by the tightening of subsequent bolts, until all are tightened to the prescribed amount.
- F. Alignment: After assembly, the members forming parts of a completed frame or structure shall be aligned and adjusted accurately before being fastened. Tolerances shall conform to AISC. Fastening of splices of compression members shall be done after the abutting surfaces have been brought completely into contact. Bearing surfaces and surfaces that will be in permanent contact shall be cleaned before the members are assembled. As erection progresses, the work shall be securely fastened to take care of all dead load, wind and erection stresses.
- G. Drift-pins may be permitted only to bring together the parts, and shall not be used in such a manner as to distort or damage the metal.
- H. Turn-of-nut Tightening: When the turn-of-nut method is used to provide the bolt tension specified in the RCSC Specification there shall first be enough bolts brought to a "snug-tight" condition to insure that the parts of the joint are brought into full contact with each other. "Snug-tight" shall be defined as the tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench. Following this operation, bolts shall be placed in any remaining holes in the connection and brought to snug-tightness. All bolts in the joint shall then be tightened additionally by the applicable amount of nut rotation with tightening progressing systematically from the most rigid part of the joint to its free edges. During the operation there shall be no rotation of the part not turned by the wrench.
- I. Cutting: The use of a gas cutting torch in the field for correcting fabrication errors will not be allowed on any member in the structural framing. The use of a gas cutting torch is permissible only on minor members, when the member is not under stress, and then only after the approval of the Engineer has been specifically given.
- J. Welding: All welding procedures, equipment and joint preparations shall be approved by the testing laboratory and Engineer prior to any welding for this Project.

3.05

SHOP PAINTING

- A. All structural steel shall have all surfaces prepared and painted as follows:
1. Surface Preparation: All surfaces receive a blast cleaning conforming to SSPC SP6-82.
 2. Shop Painting: All properly prepared surfaces shall be given one shop coat of primer, 2 mils in thickness, compatible with the specified finish paint.
 3. Surfaces to be field welded shall not be painted prior to welding.
 4. Field Painting: Finish paint shall be field applied and shall be in accordance with Section 09900 of these Specifications.

END OF SECTION

**SECTION 05120
STRUCTURAL METALS**

PART 1 GENERAL

1.01 SUMMARY

- A. This Section covers all items fabricated from shapes, plates, sheets, rods, bars or castings and all other wrought or cast metal except component parts of equipment and items covered by other sections.
- B. Fabricated metal items, which are detailed on the Drawing but not mentioned specifically therein, shall be fabricated in accordance with the applicable requirements of this Section.

1.02 FACTORY TESTING

- A. Prior to delivery, all basic materials specified herein shall be tested and inspected by an approved independent commercial testing laboratory. Payment for such service will be made by the Contractor. If approved by the Engineer, certified tests performed by the manufacturer's testing laboratory at no cost to the Owner will be acceptable.
- B. If so desired by the Engineer, inspection of the fabrication shall be made at the place of manufacture. Access shall be permitted to all places where the work is being done.

1.03 SUBMITTALS

Detailed shop drawings, product data sheets and erection and installation details for miscellaneous metal items shall be submitted in accordance with Section 01340 of these Specifications. Submittals shall indicate thickness, type, grade, class of metal, dimensions and shall show construction details, reinforcement, anchorage, welds, fasteners and installation with relation to other construction.

1.04 STORAGE AND PROTECTION

- A. Store structural metals above ground on platforms or other supports and protect from weather with suitable covering. Do not permit water ponding or moisture collection on stored items.
- B. Handle steelwork to prevent damage to members and to shop paint coat and to prevent accumulation of mud, dirt or other foreign materials capable of interfering with field paint application.

1.05 QUALITY ASSURANCE

Structural steel manufacturers shall provide written certification to the Engineer that all materials furnished comply with all applicable requirements of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS AND CONSTRUCTION

- A. All materials shall be new and undamaged and shall conform to pertinent AISC, ANSI, ASTM or other industry standards. Unless specified otherwise in other sections, all materials in fabricated metal items shall conform to the following requirements:
1. Structural steel shapes, plates and bars shall conform to Specifications of Structural Steel ASTM A36.
 2. Structural steel tubing shall conform to ASTM A501.
 3. Stainless steel shall conform to the following AISI Type 304 for sheets and plates; AISI Type 316 for bolts and stainless steel items in corrosive areas.
 4. Galvanizing shall be hot dipped in accordance with Specifications for Zinc (Hot Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plate, Bars and Strip ASTM A123.
 5. Gray cast iron shall conform to ASTM A48, Class 30B.
 6. Ductile iron shall conform to ASTM A536, Grade 65-40-18.
 7. Aluminum alloy shall conform to the following Aluminum Association Specifications and designations:

6061-T6	Structural Shapes, Tubes and Pipes in Corrosive Areas, Sheets, Plates, Wire, Rods, Bars, Bolts and Screws
6063-T6	Tubes and Pipes in Non-Corrosive Areas
6066-T6	Weldings and Extrusions
6151-T6	Forgings and Forging stock
 8. High strength steel bolts, nuts and washers shall conform to ASTM A 325.
 9. 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, semifinished pattern and shall 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.
 10. Electrodes for welding structural steel shall conform to Specification for Mild-Steel Covered Arc-Welding Electrodes, AWA A5.1, E-70 series. Electrodes for welding aluminum shall conform to AWS A5.10.
- B. Stairs and Platforms: Stairs and platforms shall be fabricated from steel conforming to ASTM A 36 and shall be hot dipped galvanized after fabrication, unless noted otherwise. Stair and platform design, fabrication and installation shall conform to OSHA regulations.
- C. Checkered Floor Plates: Unless otherwise shown, checkered floor plates shall be 6061-T6 aluminum alloy with raised diamond pattern on the upper surface. Floor plate shall have a minimum thickness of 1/4-inch and shall be designed for an extreme fiber stress in bending of not more than 10,000 psi and a deflection of not more than 1/300 of span under a uniform load of 200 pounds per square foot. However, in no case shall the thickness of the floor

plates be less than that shown on the Drawings for the specified clear span.

D. Welding and Brazing - General

1. 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. Intermittent welds shall have an effective length of at least 2-inches and shall be spaced not more than 6-inches apart.
2. 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 Welding Code shall also apply to welded aluminum structures. The welding process and welding operators shall 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 costs associated with the qualification or testing of welders and welding operators shall be borne by the Contractor.
3. 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, non-metallic inclusions, lack of fusion, incomplete penetration and cracking shall constitute grounds for rejection of welds.

E. Shop Fabrication

1. Structural steel shall be fabricated in conformity with dimensions, arrangement, sizes and weights or thicknesses shown on the Drawings or stipulated in Specifications.
2. All members and parts, as delivered and erected, shall be free of winds, warps, local deformations or unauthorized bends. Holes and other provisions for field connections shall be accurate and shop checked, so that proper fit will result when the units are assembled in the field.

F. Galvanizing

1. All galvanizing shall be done by the hot-dip process, after fabrication in conformity with requirements of ASTM A 124, A 153, A 384 and A 385. Articles to be galvanized shall be pickled before galvanizing.
2. 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.
3. Galvanized articles shall be free from uncoated spots, blisters, flux, black spots, dross, projections and other defects not consistent with acceptable galvanizing practice.

4. 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.

PART 3 EXECUTION

3.01 INSTALLATION

A. Structural Steel

1. General: Except as otherwise specifically noted on the Drawings, or specified herein, all materials and work for structural steel and miscellaneous metal work shall be in conformity with applicable provisions of the latest edition of the AISC “Steel Construction Manual” and AISC “Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings”.
2. Connections
 - a. Connections not specifically detailed on the Drawings shall be as defined in Tables I and III, Framed Beam Connections, in the seventh edition of the AISC manual. The shop fabricated portion of structural connections may be bolted or welded. Except for connections detailed on the drawings or specified otherwise, field connections shall be made with ASTM A 325 high strength bolts.
 - b. Connections for miscellaneous metal work not included in the AISC definition of structural steel may be made with ASTM A 307 bolts. Bolts shall be equipped with self-locking nuts or lock washers.
 - c. High strength bolts shall be installed using turn-of-nut tightening as described in Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts as set forth in the AISC manual. Beveled washers shall be used when the bearing faces of bolted parts have a slope of 1:20 or greater with respect to a plane perpendicular to the bolt axis. A platform or other means of access shall be provided at each field connection and shall be left in place until the connection has been inspected by the Engineer.
 - d. Field welded connections will not be acceptable for structural steel unless shown on the Drawings or specifically permitted by the Engineer. Where structural or miscellaneous steel connections are welded, all butt and miter welds shall be continuous and where exposed to view shall be ground smooth. In addition, intermittent welds shall have an effective length of at least 2-inches and shall be spaced not more than 6-inches apart.
 - e. Field Erection: Before assembly, surfaces to be in contact with each other shall be thoroughly cleaned. All parts shall be assembled accurately as shown on the Drawings. Light drifting to match unfair holes will not be permitted. Any enlargement of holes necessary to make connections in the field shall be done by reaming with twist drills. Enlarging holes by burning is absolutely

prohibited.

B. Structural Aluminum

1. General: Except as specifically noted on the Drawings, or specified herein, all materials and work for structural aluminum shall conform with the applicable provisions of the latest edition of Specifications for Aluminum Structures, published by the Aluminum Association, Inc., New York, New York.
2. Lay Out: Hole center may be center punched and cutoff lines may be punched or scribed. Center punching and scribing shall not be used where such marks would remain on fabricated material. A temperature correction shall be applied where necessary in the layout of critical dimensions. The coefficient of expansion shall be taken as 0.000013 per degree F.
3. Cutting: Material 0.50-inch thick or less shall be sheared, sawed, or cut with a router. Material more than 0.50 inch thick shall be sawed or routed. Cut edges shall be true and smooth, and free from excessive burrs or ragged breaks. Edges or plates carrying calculated stresses shall be planed to a depth of 1/4-inch, except in the case of sawed or routed edges of a quality equivalent to a planed edge. Re-entrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting. Flame cutting of aluminum alloys is not permitted.
4. Heating: Structural material shall not be heated except as provided herein. Material may be heated to a temperature not exceeding 400 degrees F for a period not exceeding 30 minutes to facilitate bending. Such heating shall be done only when proper temperature controls and supervision are provided to ensure that the limitations on temperature and time are carefully observed. The Engineer shall be so informed if this method is to be used.
5. Punching, Drilling and Reaming: Rivet or bolt holes may be punched or drilled to finished size before assembly. The finished diameter of holes for unfurnished bolts shall be not more than 1/6-inch larger than the nominal bolt diameter. All holes shall be cylindrical and perpendicular to the principal surface. Holes shall not be drifted in such a manner as to distort the metal. All chips lodged between contacting surfaces shall be removed before assembly.
6. Bolting: All bolts for bolting aluminum shall be Type 304 or 316 stainless steel as specified herein.
7. Welding
 - a. Dirt, grease, forming or machining lubricants or any organic materials shall be removed from the areas to be welded by cleaning with a suitable solvent or by vapor degreasing. Additional operations to remove the oxide coating just prior to welding are required when the inert gas tungsten arc welding

method is used. This may be done by etching or scratch brushing. The oxide coating need not be removed if the welding is done with the automatic or semi-automatic inert gas shielding metal arc. Suitable edge preparation to assure 100 percent penetration in butt welds shall be used. Oxygen cutting shall not be used. Sawing, chipping, machining or shearing may be used.

- b. Any welding of aluminum shall be done using a non-consumable tungsten electrode with filler metal in an inert gas atmosphere (TIG) or using a consumable filler metal electrode in an inert gas atmosphere (MIG). No welding process that requires the use of a welding flux shall be used unless prior approval has been obtained from the Engineer. Preheating for welding is permissible provided the temperature does not exceed 400 degrees F for a total time of 30 minutes. Welding of any structure which is to be anodized shall be done using filler alloy rods which will to discolor when anodized.
- c. The welding process and welding operators shall both meet a qualification test conforming to the qualification methods described in the ASME Boiler and Pressure Vessel Code, Section IX, Welding Qualifications.

3.02 FIELD PAINTING

- A. Aluminum surfaces to be placed in contact with wood, concrete, or masonry construction shall be coated with bitumastic coating.
- B. Where aluminum surfaces come in contact with dissimilar metals, except stainless steel, the aluminum surfaces shall be kept from direct contact with said metal by the use of neoprene gaskets, 10 mil polyethylene film or insulating washers. Paint or galvanizing will not be considered as adequate protection.
- C. Unpainted aluminum surfaces shall be cleaned of all fabrication marking, grease, dirt and oil. Anodized surfaces shall be cleaned with a mild soap and water solution and no acid, caustic or abrasive cleaning agents shall be used.
- D. Structural and miscellaneous metals shall be cleaned, shop primed and painted in accordance with the requirements of Section 09900 of these Specifications.

3.03 INSPECTION AND TESTING

Materials or workmanship not conforming to the provisions of these Specifications shall be rejected anytime defects are found during the progress of the work.

3.04 CLEANING

Prior to the acceptance of the work under this Section, thoroughly clean all installed materials, equipment and related areas in accordance with the requirements of these Specifications.

END OF SECTION

**SECTION 05500
METAL FABRICATIONS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe and tube railings.
 - 2. Gratings.
 - 3. Miscellaneous metal fabrications.
 - 4. Shop coatings.
 - 5. Overhead door frames.
- B. Related Sections:
 - 1. Pre-manufactured metal fabrications: Elsewhere in Section 05500
 - 2. Sheet metal flashing: Section 07600

1.2 REFERENCES

- A. 29 CFR Part 1910.23 -- Guarding Floor and Wall Openings and Holes; Occupational Safety and Health Standards; Code of Federal Regulations; latest edition (with Amendments).
- B. AA DAF-45 -- Designation System for Aluminum Finishes; Aluminum Association; latest edition.
- C. ASTM A 36/A 36M-97 -- Standard Specification Carbon for Structural Steel, latest edition.
- D. ASTM A 47-99 -- Standard Specification for Ferritic Malleable Iron Castings; latest edition.
- E. ASTM A 53-12 -- Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless; latest edition.
- F. ASTM A 307-12 -- Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength; latest edition.
- G. ASTM A 366/A 366M-97 -- Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality; latest edition.
- H. ASTM A 500/ A 500M - 13 -- Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; latest edition.
- I. ASTM A 501-07 -- Standard Specification for Hot-Formed Welded and Seamless Carbon Steel

Structural Tubing; latest edition.

- J. ASTM A 563-07 -- Standard Specification for Carbon and Alloy Steel Nuts; latest edition.
- K. ASTM A 569/A 569M-98 -- Standard Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality; latest edition.
- L. ASTM A 570/A 570M- 98 -- Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality; latest edition.
- M. ASTM A 611-97 -- Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Structural Quality; latest edition.
- N. ASTM B 221-13 -- Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes; latest edition.
- O. ASTM B 429 / B 429M - 10 -- Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; latest edition.
- P. AWS D1.1/ D1.1M 2004 -- Structural Welding Code -- Steel; American Welding Society; latest edition.
- Q. AWS D1.3-98 -- Structural Welding Code--Sheet Steel; American Welding Society; latest edition.
- R. FS FF-B-561D -- Bolts, (Screw), Lag; latest edition.
- S. FS FF-B-588D -- Bolt, Toggle: and Expansion Sleeve, Screw; latest edition.
- T. FS FF-S-92B -- Screw, Machine: Slotted, Cross-Recessed or Hexagon Head; latest edition.
- U. FS FF-S-325 -- Shield, Expansion; Nail Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry); latest edition.
- V. FS FF-W-84A -- Washers, Lock (Spring); latest edition.
- W. FS FF-W-92B -- Washer, Flat (Plain); latest edition.
- X. FS TT-P-664D -- Primer Coating, Alkyd, Corrosion-Inhibiting, Lead and Chromate Free, VOC-Compliant; latest edition.
- Y. NAAMM MBG 531-88 -- Metal Bar Grating Manual; The National Association of Architectural Metal Manufacturers; latest edition.
- Z. SSPC-PA 1 -- Shop, Field, and Maintenance Painting; Steel Structures Painting Council; latest edition.

- AA. SSPC-Paint 12 -- Cold-Applied Asphalt Mastic (Extra Thick Film); Steel Structures Painting Council; latest edition.
- BB. SSPC-SP 1 -- Solvent Cleaning; Steel Structures Painting Council; latest edition.
- CC. SSPC-SP 3 -- Power Tool Cleaning; Steel Structures Painting Council; latest edition.
- DD. SSPC-SP 5 -- White Metal Blast Cleaning; Steel Structures Painting Council; latest edition.
- EE. SSPC-SP 6 -- Commercial Blast Cleaning; Steel Structures Painting Council; latest edition.
- FF. SSPC-SP 8 -- Pickling; Steel Structures Painting Council; latest edition.
- GG. SSPC-SP 10 -- Near-White Blast Cleaning; Steel Structures Painting Council; latest edition.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance Requirements: Where complete sizes or dimensions of structural members, connections, or fasteners of any item are not indicated, design the item to produce strength appropriate to the use intended.
- B. Handrails: Design to resist the loads specified by applicable building code(s).
- C. Guardrails: Design to resist loads specified by applicable building code(s).
- D. Toe boards: Where toe boards are indicated as required, but are not detailed, design toe boards to conform to the requirements of 29 CFR 1910.23.

1.4 SUBMITTALS

- A. Shop Drawings: For each fabricated item, show the following:
 - 1. Plans and elevations.
 - 2. Jointing and connections.
 - a. Indicate welded connections using standard AWS symbols; indicate net weld length.
 - 3. Profiles of sections and reinforcing.
 - 4. Fasteners and anchors.
 - 5. Accessories.
 - 6. Location of each finish.
 - 7. For each fabricated item specified to comply with structural performance requirements, submit structural design information demonstrating compliance.
- B. Product Data: Manufacturer's specifications and installation instructions. Submit for:

1. All manufactured products used in fabrications.
- C. Samples of products and materials when requested.

1.5 JOB CONDITIONS

- A. Fit fabrications accurately to actual construction. If it is not practical or possible to take field measurements before fabrication, allow adequate fabrication tolerances and trim to fit.
- B. Coordination with Masonry and Concrete Work: Where fabricated items or their anchors are to be embedded into concrete and masonry work, deliver such items to those performing the installation, together with coordination drawings and installation instructions.

PART 2 - PRODUCTS

2.1 MATERIALS - METALS

- A. Steel Shapes:
1. Plates, bars, angles, channels, and H-sections: ASTM A 36.
 2. Tube:
 - a. Hot-rolled: ASTM A 501.
 - b. Cold-formed: ASTM A 500.
 3. Pipe: ASTM A 53 (black steel and hot-dip galvanized).
- B. Steel Sheet:
1. For structural uses: Hot-rolled, ASTM A 570; cold-rolled, ASTM A 611.
 2. For nonstructural uses: Cold-rolled, ASTM A 366; hot-rolled, ASTM A 569.
- C. Malleable Iron Castings: ASTM A 47.
- D. Aluminum Shapes: Alloy and temper suitable for application, strength required, and finish.
1. Pipe: Extruded; ASTM B 429.
 2. Tube: Extruded; ASTM B 429.
 3. Extrusions: ASTM B 221.
- E. Aluminum Finishes:
1. Anodized:
 - a. Natural, Class I: AA-M12C22A41 (nonspecular, as-fabricated mechanical finish; medium matte etched chemical finish; clear, architectural Class I anodic coating minimum 0.7 mil thick).

2.2 MANUFACTURED COMPONENTS

- A. Bar Gratings: Manufacture in accordance with "Standard Specifications for Metal Bar Grating and Metal Bar Grating Treads" (part of NAAMM MBG 531), except for specific requirements specified here.
- B. Bar Gratings:
 - 1. Aluminum.
 - 2. Pressure-locked construction.
 - 3. Bearing bars:
 - a. Thickness: 3/16 inch.
 - b. Depth: 1-1/2 inches.
 - c. Spacing: 15/16 inch.
 - 4. Cross bar spacing: 4 inches.
 - 5. Top surface: Serrated.
- C. Abrasive Castings: Cast iron with integral abrasive surface. American Safety Tread Co. is an approved manufacturer for Abrasive Castings.
 - 1. Style(s): As indicated on drawings.
 - 2. Abrasive: Aluminum oxide or silicon carbide grit, or both.
 - 3. Surface texture: Plain.
 - 4. Anchors: Manufacturer's standard.
 - a. For embedding into concrete: Wing anchor attached with bolt and nut, with countersunk holes and allowing future removal.
 - b. Anchor spacing: As recommended by manufacturer and as indicated.
 - 5. Coat surfaces in contact with concrete with bituminous mastic.

2.3 MATERIALS - MISCELLANEOUS

- A. Concrete: Normal weight ready-mix concrete as specified in Division 3.
 - 1. Compressive strength: 2500 pounds per square inch, minimum, at 28 days, unless otherwise indicated.
- B. Concrete Inserts: Style as required for application.
- C. Fasteners: Use fasteners suitable for the material being fastened and for the type of connection required.
 - 1. For exterior use or built into exterior walls: Nonferrous stainless steel, zinc coated or cadmium plated.
 - 2. Use fasteners of same material as items being fastened unless otherwise indicated.

3. Bolts and studs: ASTM A 307.
 4. Nuts: ASTM A 563.
 5. Lag bolts: FS FF-B-561.
 6. Machine screws: FS FF-S-92.
 7. Plain washers: FS FF-W-92.
 8. Lock washers: FS FF-W-84.
 9. Expansion shields: FS FF-S-325.
 10. Toggle bolts: FS FF-B-588.
- D. Bituminous Mastic: SSPC-Paint 12.
- E. Shop Primer: Rust-inhibitive, lead and chromate free, low VOC primer, complying with FS TT-P-664, or equivalent.

2.4 FABRICATION - GENERAL

- A. Fabricate and shop-assemble in largest practical sections for delivery to site.
1. Prepare and reinforce fabrications as required to receive applied items.
 2. Fabricate items with joints tightly fitted and secured.
 3. Make exposed joints tight, flush, and hairline.
- B. Mechanical Finishes: Complete finishing prior to fabrication wherever possible.
1. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match finish.
 2. Protect finish on exposed surfaces by using temporary protective covering.
- C. Fasteners: Use concealed fasteners if possible.
1. Exposed fasteners: Flathead, countersunk type unless otherwise indicated.
- D. Anchors: Fabricate to suit conditions indicated; use anchors of same material and finish as item except where specifically indicated otherwise.
- E. Welding:
1. Provide continuous welds at welded corners and seams.
 2. Exposed welds: Grind flush and smooth.
- F. Joints Exposed to Weather: Fabricate to keep water out, or provide adequate drainage of water that penetrates.

2.5 FABRICATION - SHEET METAL

- A. Comply with general fabrication requirements.
- B. Bend sheet metal corners to smallest possible radius.
- C. Welding Steel Sheet: Comply with AWS D1.3 recommendations.

2.6 FABRICATION - RAILINGS

- A. Railings - General: Construct as indicated.
 - 1. Preassemble in shop to maximum extent practicable.
 - 2. Bending of members: Use jigs to make each similar configuration the same; make neat bends without other deformation.
 - 3. Close exposed open ends of members using same material as used in member.
 - 4. Provide all components necessary for assembly of railings and for attachment to other work.
 - a. For attachment to concrete or masonry: Provide inserts for installation into concrete or masonry, or provide other type of anchorage.
 - b. For anchoring to steel: Use fittings bolted to structure unless otherwise indicated.
 - c. For anchoring to solid masonry: Use fittings fastened to masonry with bolts and expansion shields unless otherwise indicated.
 - d. Fasten fittings to railings in same manner as railing connections.
 - 5. Exterior railings:
 - a. Provide weep holes or other means for evacuation of water trapped in hollow members.
 - 6. Wall mounted handrails: Return railing to wall at ends except where otherwise indicated.
- B. Aluminum Pipe/Tube Railings:
 - 1. Aluminum pipe or tubing.
 - a. Finish: Anodized aluminum, natural.
 - 2. Connections: Welded and ground.
 - 3. Welding: Fill joints completely and grind off flush.
 - 4. Elbows: Bent or mitered.
 - 5. Tee and cross intersections: Coped and welded.
 - 6. Exposed ends: Close with prefabricated fittings or with aluminum plate, fully welded.
- C. Removable Railing Sections: Provide sockets to receive posts; provide removable tamperproof socket covers.

2.7 FABRICATION - GRATINGS

- A. Gratings - General:
 - 1. Provide toe boards at open sides of elevated gratings when curb is not otherwise indicated.
 - 2. Provide cutouts for penetrations indicated.

3. Arrange removable panels to permit removal without displacing penetrating items.
- B. Bar Gratings:
1. Banding bars: Cross section not less than bearing bars.
 2. Provide banding bars welded to perimeter of removable grating sections.
 - a. Provide minimum of 4 hold-down fasteners for each removable section.
 - b. Fasteners: As recommended by grating manufacturer, or as suitable for the purpose.
 3. Make no cuts or notches in bearing bars.
 4. Bolt fixed gratings to frame.
 5. Band edges of all openings that break more than 3 bearing bars.

2.8 FABRICATION - SHOP COATINGS

- A. Shop prime all iron and steel fabrications.
- B. Prepare surfaces to be coated as follows:
1. Solvent-clean in accordance with SSPC-SP 1.
 2. Exterior fabrications: Clean in accordance with SSPC-SP 5, SSPC-SP 6, SSPC-SP 8, or SSPC-SP 10.
 3. Interior fabrications: Clean in accordance with SSPC-SP 3, SSPC-SP 5, SSPC-SP 6, SSPC-SP 8, or SSPC-SP 10.
- C. Shop Priming: Comply with SSPC-PA 1.
1. Apply primer immediately following surface preparation.
 2. Do not prime surfaces to be welded.
 3. Do not prime surfaces in direct contact bond with concrete.
 4. Apply extra coat to corners, welds, edges, and fasteners.
- D. Shop Painting: Comply with SSPC-PA 1.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Anchor metal fabrications to substrates indicated; provide all fasteners required.
- B. Perform all field fabrication required for installation.
1. Fit joints tightly.
 2. Weld joints as indicated.
 - a. Weld in accordance with AWS code.
 - b. Exposed welds: Grind flush and smooth.

- C. Install items in correct location, plumb and level, without rack or warp.
- D. Provide temporary supports and bracing as required.
- E. Install manufactured components in accordance with manufacturer's instructions.
- F. Coat aluminum surfaces in contact with concrete and masonry with bituminous mastic.

3.2 INSTALLATION - GRATINGS

- A. Bar Gratings: Install with anchors and clearances as recommended by NAAMM MBG 531 unless otherwise indicated.
- B. Install accessory items by welding unless otherwise indicated.

3.3 INSTALLATION - RAILINGS

- A. Align joints before anchoring railing.
- B. Verify that posts are plumb before anchoring.

3.4 CLEANING AND TOUCH-UP

- A. Touch up shop paint immediately after erection.
 - 1. Clean field welds, bolted joints, and areas where primer is damaged.
 - 2. Paint with material used for shop painting, minimum 2 mils dry film thickness.

END OF SECTION

**SECTION 05501
ANCHOR BOLTS**

PART 1 GENERAL

1.01 SUMMARY

- A. Furnish all labor materials and equipment required to install the following anchors:
1. Adhesive anchor bolts for mechanical equipment as detailed on the Drawings or as required by equipment manufacturer's anchor bolt setting plan.
 2. All expansion bolts indicated on the Drawings required to attach anchor ladders, handrails, stairs, ships ladders and structural steel shapes to hardened concrete or masonry.

1.02 APPLICABLE SPECIFICATIONS AND STANDARDS

- A. The following publications of issues listed below, but referenced to thereafter by basic designation only, apply to this Section to extent applicable in each reference thereto.
1. American Society for Testing and Materials (ASTM)
 F 593 - Specifications for Stainless Steel Bolts, Hex Cap Screws, and Studs
 F 594 - Specifications for Stainless Steel Nuts
 2. Federal Specification
 FF-S-325 - Shield, Expansion; Nail Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
 3. Manual of Steel Construction (AISC)

1.03 MATERIAL STORAGE

All material shall be stored in manner which will protect it from deterioration and damage.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Adhesive anchor bolts shall consist of a stainless steel threaded rod meeting the requirements of ASTM F 593 (AISI 304) and a sealed glass capsule containing polyester resin, quartz sand aggregate and a hardener. Installation shall be in conformance with the manufacturer's field representative for maximum pullout and shear strength. Adhesive anchor bolts shall be of AHVA Adhesive Anchors by Hilti, Inc. or "ParaBond Capsule Anchors" by Molly Fastener Group.

- B. Expansion anchor bolts shall be stainless steel, AISI Type 304 or 316 and shall be of the cinch anchor, wedge or self-drilling type. Expansion anchors shall conform to the applicable requirements of Federal Specifications 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 four bolt diameters. The minimum distance between the center of the expansion anchor and an edge or exterior corner shall not be less than 4-1/2 times the diameter of the hole in which it is installed. Expansion anchors shall be "Phillips Red Head" by Phillips Drill company, "Wej-It" by Expansion Products, or "Kwik-Bolt" by Hilti, Inc.
- C. All nuts shall be of stainless steel meeting requirements of ASTM F 594 Alloy Group I, Condition CW.
- D. All washers shall meet dimensional requirements of ASTM F 436. Material for washers shall be stainless steel, Type 304, 305, 384 or MX7.

PART 3 EXECUTION

3.01 ADHESIVE ANCHOR BOLT INSTALLATION

- A. Drilled Holes: Holes for adhesive anchors shall be drilled with a rotary percussion hammer drill with a carbide tipped masonry drill bit conforming to ANSI B94.12-77. Hole diameter and depth shall be as specified by the manufacturer.
- B. Hole Cleaning and Preparation: After drilling, dust and fragments shall be cleared out using a water jet, circular wire brush and compressed air. The hole may be damp but all water must be blown out.
- C. Curing: Anchor shall be unloaded and allowed to cure for manufacturer's recommended curing time.

3.02 EXPANSION BOLT INSTALLATION

- A. Drill expansion bolt holes into concrete through item being supported or locate by a template. Drill all holes by a tool designed by or approved by manufacturer of expansion anchors.
- B. Installation of expansion anchors shall be in compliance with manufacturer's recommendations for maximum holding power, but in no case shall depth of hole be less than four diameters. Minimum distance between center of any expansion anchor and an edge or exterior corner of concrete shall be not less than 4-1/2 times diameter of hole in which it is installed.

END OF SECTION

SECTION 07600
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sheet metal flashing and trim.
 - 2. Flexible flashings.
 - 3. Downspouts and conductor heads.
 - 4. Fasteners and attachment devices.
 - 5. Coatings and slip sheets to isolate sheet metal from dissimilar materials.
- B. Flashings which are integral with membrane roofing or waterproofing systems (base flashings) are not included in this section.
- C. Flashings which are integral with prefabricated roof accessories, equipment, and the like are not included in this section.
- D. Wood blocking, nailers, edge strips, and battens are not specified in this section.
- E. Related Sections:
 - 1. Weatherstripping of doors and windows: Section 08225.
 - 2. Duct and ventilation accessories: Section 15865.

1.2 REFERENCES

- A. AA DAF-45 -- Designation System for Aluminum Finishes; latest edition.
- B. Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA); latest edition.
- C. ASTM B 209 -- Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; latest edition.
- D. FS TT-C-494B -- Coating Compound, Bituminous, Solvent Type, Acid Resistant; latest edition.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's technical information and installation instructions, in sufficient detail to demonstrate products comply with contract documents.

- B. Shop Drawings: Detailed drawings clearly indicating component profiles, joints, transitions, fastening methods, and relationship of flashing materials to adjacent construction.
- C. Samples: Submit 6-inch-square samples of each type of metal and finish required.

1.4 QUALITY ASSURANCE

- A. Quality Standard:
 - 1. Fabricate and install sheet metal work in accordance with Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA) "Architectural Sheet Metal Manual," unless specifically indicated otherwise.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Sheet: ASTM B 209, Type 5050-T H43.
 - 1. Finish: AA-C22A41 (medium matte etched chemical finish; clear, architectural Class I anodic coating minimum 0.7 mil thick).
- B. PVC Sheet Flashing: Unreinforced polyvinyl chloride sheet, exhibiting no cracking when bent over a mandrel at minus 20 degrees F; minimum 0.020 inch thick.

2.2 ACCESSORY MATERIALS

- A. Fasteners: Corrosion-resistant metal of same material as the material being fastened, or other material recommended by sheet metal manufacturer. Match finish and color of exposed fastener heads to finish and color of sheet material being fastened.
- B. Installation Accessories, Flexible Flashings: Provide joint tape, adhesives, sealers, and fasteners as recommended by flexible flashing manufacturer for indicated applications.
- C. Sealant: As specified in Division 7.
 - 1. Use non-curing type for concealed joints.
 - 2. Use non-sag elastomeric type for exposed joints.
- D. Joint Adhesive: Two-component noncorrosive epoxy adhesive, recommended by metal manufacturer for sealing of nonmoving joints.
- E. Bituminous Coating: Heavy bodied, sulfur-free, asphalt-based paint; FS TT-C-494.

2.3 PREFORMED REGLET FLASHING SYSTEMS

- A. General: Fabricate reglet flashing system from 0.025-inch-thick aluminum sheet formed to provide secure interlocking of separate reglet and counter-flashing pieces. Factory-finish with manufacturer's standard epoxy enamel finish.
- B. Types Required:
 - 1. Surface-mounted type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, with channel for sealant at top edge.
 - 2. Concrete type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
 - 3. Masonry type: Provide with offset top flange for embedment in masonry mortar joint.
 - 4. Flexible flashing retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counter-flashing or where drawings show reglet without metal counter-flashing.
 - 5. Counter-flashing wind restraint clips: Provide stainless steel strips to be installed before counter-flashing to prevent wind uplift of the counter-flashing lower edge.

2.4 FABRICATION - GENERAL

- A. Form sheet metal to match profiles indicated, substantially free from oil-canning, fish-mouths, and other defects.
- B. Comply with SMACNA "Architectural Sheet Metal Manual" for applications indicated.
- C. Provide for thermal expansion of exposed sheet metal work exceeding 15 feet running length.
 - 1. Flashing and trim: Provide movement joints at maximum spacing of 10 feet; no joints allowed within 2 feet of corner or intersection.
- D. Conceal fasteners and expansion provisions wherever possible.
 - 1. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.
- E. Form a 1/2-inch hem on underside of exposed edges.
- F. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.
 - 1. Gage: As recommended by SMACNA or metal manufacturer for application, but in no case less than gage of metal being secured.

2.5 SHEET METAL FABRICATIONS

- A. General: As a minimum, fabricate flashings using materials in the thickness listed for each flashing application.
- B. Exposed Flashings - Low Slope Roofs or Waterproofing:
 - 1. Formed copings:
 - a. Aluminum sheet: 20 B & S gage (0.0320 inch).
- C. Semi-concealed Flashings - Low Slope Roofs or Waterproofing:
 - 1. Counter flashing:
 - a. Aluminum sheet: 20 B & S gage (0.0320 inch).
- D. Concealed Wall Flashings:
 - 1. Masonry through-wall flashing:
 - a. PVC (Polyvinyl Chloride) sheet.

2.6 DOWNSPOUTS AND CONDUCTOR HEADS

- A. Fabricate from same material and finish used for adjacent exposed flashings.
- B. Form sheet metal to profile dimensions indicated, free from distortions and defects detrimental to water-tight system.
- C. Provide precast concrete splash blocks at downspout discharge.
- D. Downspout Supports: Straps.
- E. Back-paint concealed metal surfaces with bituminous coating to a minimum of 15 mils dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions under which products of this section are to be installed and verify that work may properly commence. Do not proceed with the work until unsatisfactory conditions have been fully resolved.

1. Verify that nailers, blocking, and other attachment provisions for sheet metal work are properly located and securely fastened to resist effects of wind and thermal stresses.

3.2 PREPARATION

- A. Not Used
- B. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- C. Isolate dissimilar metals by means of a heavy bituminous coating, approved paint coating, adhered polyethylene sheet, or other means approved by the architect.

3.3 INSTALLATION

- A. General: Comply with sheet metal manufacturer's installation methods and recommendations in the SMACNA "Architectural Sheet Metal Manual."
- B. Sealed Joints: Form minimum 1-inch hooked joints and embed flange into sealant or adhesive. Form metal to completely conceal sealant or adhesive.
 1. Use joint adhesive for nonmoving joints specified not to be soldered.
 2. Moving joints: When ambient temperature is moderate (40-70 degrees F) at time of installation, set joined members for 50 percent movement either way. Adjust setting position of joined members proportionally for temperatures above 70 degrees F. Do not install sealant at temperatures below 40 degrees F. Refer to section on sealants elsewhere in Division 7 for handling and installation requirements for joint sealers.
- C. Surface-Mounted Reglets: Attach reglets securely to substrate, at locations indicated. Install elastomeric sealant at top edge. Refer to section on sealants elsewhere in Division 7 for handling and installation requirements for joint sealers.
- D. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglet or receiver of other sheet metal fabrication. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2 inches and bed with sealant.
- E. Flexible Flashing Installation:
 1. Comply with flashing manufacturer's instructions regarding surface preparation, handling, use of adhesives, and use of fasteners.

2. Take care during and after installation to avoid puncture or rupture of flexible flashing.
3. Secure flexible flashing to vertical surfaces using adhesive or combination of adhesive and fasteners.
4. Form continuous watertight seams between pieces of material using seam adhesive as recommended by flashing manufacturer.

3.4 CLEANING AND PROTECTION

- A. Repair or replace work which is damaged or defaced, as directed by the architect.
- B. Remove from sheet metal surfaces any debris or substances which will inhibit uniform weathering.
- C. Protect sheet metal work as recommended by the installer so that completed work will be clean, secured, and without damage at substantial completion.

END OF SECTION

SECTION 07900 JOINT SEALERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. The sealing of joints indicated on schedule at the end of this section.
 - 2. The sealing of exterior joints, including:
 - a. Exterior face of building expansion joints.
 - b. Wall joints.
 - c. Coping joints.
 - d. Joints around perimeter of frames.
 - e. Joints between stone sill and adjacent masonry. Joints between cast in place concrete and masonry. Joints between precast concrete panels and masonry.
 - 3. The sealing of interior joints, including:
 - a. Wall joints.
 - b. Joints around perimeter of frames.
 - 4. The sealing of joints in interior wet areas, including:
 - a. Toilet rooms.
 - 5. The sealing of joints in vehicular paving.
 - 6. The sealing of joints in floors and pedestrian paving.
 - 7. The sealing of penetrations through exterior walls and roofs by pipes, ducts and conduit.
 - 8. The sealing of other joints indicated on drawings.
- B. Joints of a nature similar to that of joints indicated on the schedule shall be sealed with same sealer, whether indicated on drawings to be sealed or not.
- . Related Sections:

1.2 REFERENCES

- A. AAMA 800-10 -- Voluntary Specifications and Test Methods for Sealants; American Architectural Manufacturers Association; latest edition.
- B. ASTM C 719-13 -- Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle); latest edition.
- C. ASTM C 920-14 -- Standard Specification for Elastomeric Joint Sealants; latest edition.
- D. ASTM C 1193-13 -- Standard Guide for Use of Joint Sealants; latest edition.
- E. FS SS-S-200E -- Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold-Applied, for Portland Cement Concrete Pavement; latest edition.

1.3 DEFINITIONS

- A. Substrates:
 - 1. M-type substrates: Concrete, concrete masonry units, brick, mortar, natural stone. The term "masonry" means brick, stone, and concrete masonry work.
 - 2. G-type substrates: Glass and transparent plastic glazing sheets.
 - 3. A-type substrates: Metals, porcelain, glazed tile, and smooth plastics.
 - 4. O-type substrates: Wood, unglazed tile; substrates not included under other categories.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's data on each joint sealer, with instructions for substrate preparation and installation.
- B. Samples for Color Selection: Cured samples of actual products showing manufacturer's full range of colors. (Products exposed to view only.)
- C. Substrate Test Report for Each Sealer.
- D. Certified Product Test Reports: Independent testing agency reports showing compliance with all specified requirements.
 - 1. Reports may be on tests conducted up to 24 months before submission, provided the products tested were aged specimens of the same formulation as that to be used.
- E. Field Installation Test Reports.
- F. Certificates: For each sealer, provide manufacturer's certificate stating that the product complies with the specifications and is appropriate for the use it is being put to.
- G. Installer's Preconstruction Inspection Report: List all conditions detrimental to performance of joint sealer work.

1.5 QUALITY ASSURANCE

- A. Substrate Tests: Have samples of actual substrate materials tested by manufacturer(s) of sealer products.
 - 1. Test to determine what preparation procedures (if any) are necessary to make sealers adhere properly under environmental conditions that may occur during installation.
 - 2. Test to determine compatibility with substrates, backers, and secondary seals, if any.
 - 3. Use manufacturer's standard test methods.
 - 4. Report the sealer manufacturer's recommendations for substrate preparation and sealer installation and identify specific primer(s) required.
 - 5. The requirement for testing for this project will be waived if test reports based on

previous testing of the products and substrates to be used are acceptable to the architect.

- B. Field Installation Tests: Before installation, test the adhesion of all sealers to actual substrates.
 - 1. Seal at least 5-foot lengths of joints and cure properly. Try to pull sealer out of joint by hand, by method recommended by sealer manufacturer.
 - 2. Select test joints representative of joints to be sealed by the product to be tested.
 - 3. Perform tests for each type of sealer.
 - 4. Do tests in the presence of the architect and the technical representative of sealer manufacturer.
 - 5. Report acceptable results only.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original containers or bundles with labels showing manufacturer, product name or designation, color, shelf life, and installation instructions.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install sealers if any of the following conditions exist:
 - 1. Air or substrate temperature exceeds the range recommended by sealer manufacturer or is below 40 degrees F (4.4 degrees C).
 - 2. Substrate is wet, damp, or covered with snow, ice, or frost.
- B. Dimensional Limitations: Do not install sealers if joint dimensions are less than or greater than that recommended by sealer manufacturer; notify the engineer and get sealer manufacturer's recommendations for alternative procedures.

1.8 WARRANTY

- A. Submit written warranty signed by contractor and installer guaranteeing to correct failures in sealer work that occur within 5 years after substantial completion, without reducing or otherwise limiting any other rights to correction which the owner may have under the contract documents. Failure is defined as failure to remain weathertight due to faulty materials or workmanship. Correction is limited to replacement of sealers.

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

- A. General: Provide only products which are recommended and approved by their manufacturer for the specific use to which they are put and which comply with all requirements of the contract documents.

1. For each generic product, use only materials from one manufacturer.
 2. Provide only materials which are compatible with each other and with joint substrates.
 3. Colors of exposed sealers: As selected by the engineer from manufacturer's standard colors.
- B. Products: The design is based on the product(s) listed for each generic type. Comparable products of the manufacturers listed will be considered for substitution:
1. Silicone sealants:
 - a. Bostik Inc.
 - b. Dow Corning Corporation.
 - c. Pecora Corporation.
 - d. Tremco, Inc.
 - e. GE Silicones.
 - f. Rhone-Poulenc, Inc.
 2. Urethane sealants:
 - a. Bostik Inc.
 - b. Mameco International, Inc.
 - c. Pecora Corporation.
 - d. Products Research & Chemical Corporation.
 - e. Sika Corporation.
 - f. Sonneborn Building Products Division/ChemRex, Inc.
 - g. Tremco, Inc.
 - h. W. R. Meadows, Inc.
 3. Acrylic solvent-release sealants:
 - a. Pecora Corporation.
 - b. Koch Protective Treatments, Inc.
 - c. Tremco, Inc.

2.2 ELASTOMERIC SEALANTS

- A. Elastomeric Sealants - General: Chemically curing elastomeric sealants of types indicated, complying with ASTM C 920, including specific Type, Grade, Class, and Uses indicated, as well as all other requirements specified.
1. Where movement capability exceeding that measured by ASTM C 920 is specified, sealant shall withstand the total movement indicated while remaining in compliance with the other requirements specified, when tested in accord with ASTM C 719, with base joint width measured at the time of application.
 2. For M-type substrates: Comply with requirements for Use M.
 3. For G-type substrates: Comply with requirements for Use G.
 4. For A-type substrates: Comply with requirements for Use A.
 5. For O-type substrates: Comply with requirements for Use M (minimum) and Use O for the particular substrate.
- B. Mildew-Resistant Silicone Sealant: One-part, Type S, Grade NS, Class 25, Use NT,

formulated with fungicide, for interior use on non-porous substrates.

1. Products:
 - a. "Dow Corning 786"; Dow Corning Corporation.
 - b. "Sanitary 1700 Sealant"; GE Silicones.
 - c. "863 No.345 White"; Pecora Corporation.
 - d. "Rhodorsil 6B, White"; Rhone-Poulenc Inc.
 - e. "Omniplus White"; Sonneborn Building Products Division/ChemRex, Inc.
 - f. "Proglaze White"; Tremco, Inc.
- C. All-Purpose Urethane Sealant: Multipart, non-sag, Type M, Grade NS, Class 25, Uses NT, M, G and A.
 1. Products:
 - a. "Sikaflex 2c NS"; Sika Corporation.
 - b. "Sonolastic NP 2"; Sonneborn Building Products Division/ChemRex, Inc.
- D. Two-Part Non-sag Low-Modulus Urethane Sealant: Type M, Grade NS, Class 25, Use NT, plus movement capability of 50 percent in both extension and compression.
 1. Products:
 - a. "Vulkem 922"; Mameco International, Inc.
 - b. "Dynatrol II"; Pecora Corporation.
 - c. "Permapol RC-2"; Products Research & Chemical Corporation.
- E. Non-sag Urethane Sealant for Use T: Type S or M, Grade NS, Class 25, Use T.
 1. Products:
 - a. "Chem-Calk 2641"; Bostik Inc.
 - b. "Vulkem 227"; Mameco International, Inc.
 - c. "Dynatred"; Pecora Corporation.
 - d. "Sikaflex 1a"; Sika Corporation.
- F. Urethane Sealant for Water Immersion: One- or two-part urethane, Grade NS, Class 25, Use NT, specifically recommended by the manufacturer for sealing joints immersed continuously in water.
 1. Products:
 - a. "Vulkem 116"; Mameco International, Inc.
 - b. "Vulkem 922"; Mameco International, Inc.
 - c. "Permapol RC 270 Reservoir Sealant"; Products Research & Chemical Corporation.
 - d. "Sikaflex-2c NS" or "Sikaflex-1a"; Sika Corporation.

2.3 PAVING JOINT SEALANTS

- A. Two-Part Urethane Paving Sealant: Pourable, chemically curing (cold-applied) complying with FS SS-S-200:

1. Composition: Urethane, with minimum movement capability of plus or minus 12-1/2 percent.
 - a. Products:
 1. "Urexpan NR-300"; Pecora Corporation.

2.4 SOLVENT-RELEASE-CURING SEALANTS

- A. Acrylic Sealant: Nonsag, one-part, solvent-release-curing; complying with ASTM C 920, Type S, Grade NS, Use NT, with the following exceptions:
 1. Weight loss: 15 percent, maximum.
 2. Movement capability: 7-1/2 percent in both extension and compression, minimum.
 3. Products:
 - a. "60+ Unicrylic"; Pecora Corporation.
 - b. "PTI 738"; Koch Protective Treatments, Inc.
 - c. "Mono"; Tremco, Inc.

2.5 NONCURING SEALERS

- A. Butyl Polyisobutylene Sealant: Noncuring, nondrying, solvent-release; complying with 809.2, as described in AAMA 800.

2.6 SEALANT BACKERS

- A. Backers - General: Nonstaining; recommended or approved by sealant manufacturer for specific use.
- B. Backer Rods: Flexible, nonabsorbent, compressible polyurethane foam, either open-cell or non-gassing closed-cell, unless otherwise restricted by sealant manufacturer; preformed to appropriate size and shape.

2.7 MISCELLANEOUS MATERIALS

- A. Primers: Use primers determined to be required by substrate tests.
- B. Cleaners: As recommended by sealer manufacturer and not damaging to substrates.
- C. Masking Tape: Nonabsorbent, nonstaining.
- D. Tooling Agents: Approved by sealant manufacturer; nonstaining to sealant and substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints for characteristics that may affect sealer performance, including configuration

and dimensions.

- B. Do not begin joint sealer work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cleaning: Just before starting sealer installation, clean out joints in accord with recommendations of sealer manufacturers and as follows:
 - 1. Remove all material that could impair adhesion, including dust, dirt, coatings, paint, oil, and grease. Exception: Materials tested to show acceptable adhesion and compatibility.
 - 2. Dry out damp and wet substrates thoroughly.
 - 3. Clean M-type and O-type substrates by suitable mechanical or chemical methods.
 - 4. Remove loose particles by vacuuming or by blowing with oil-free compressed air.
 - 5. Concrete: Remove laitance and form-release coatings.
 - 6. Clean A-type and G-type substrates by chemical or other methods which will not damage the substrate.
 - 7. Use methods which will not leave residues that will impair adhesion.
- B. Priming: Prime substrates as recommended by sealer manufacturer.
- C. Masking Tape: Use masking tape to keep primers and sealers off of adjacent surfaces which would be damaged by contact or by cleanup. Remove tape as soon as practical.
- D. Install fillers where needed to provide proper joint depth or support for sealant backers.

3.3 INSTALLATION

- A. Comply with sealer manufacturers' installation instructions and recommendations, except where more restrictive requirements are specified.
- B. Gunnable and Pourable Sealants: Comply with recommendations of ASTM C 1193.
- C. Backers:
 - 1. Install backers at depth required to result in shape and depth of installed sealant which allows the most joint movement without failure.
 - a. Make backers continuous, without gaps, tears, or punctures.
 - b. Do not stretch or twist backers.
 - 2. If backers become wet or damp before installation of sealant, dry out thoroughly before proceeding.
- D. Sealants: Use methods recommended by manufacturer; completely fill the joint; make full contact with bond surfaces; tool nonsag sealants to smooth surface eliminating air pockets.
 - 1. Use concave joint shape shown in Figure 5A in ASTM C 1193, where not otherwise indicated.
 - 2. Use flush joint shape shown in Figure 5B in ASTM C 1193, where indicated.

3.4 PROTECTION AND CLEANING

- A. Clean surfaces adjacent to joints as work progresses and before sealants set using methods and materials approved by manufacturers of sealers and of surfaces to be cleaned.
- B. Protect joint sealers from contamination and damage.
- C. Remove and replace damaged sealers.

3.5 SCHEDULE OF JOINT SEALERS

- A. General: Unless otherwise indicated, joints around perimeter of frames, where indicated to be sealed, are to be sealed using sealer specified for the substrate adjacent to the frame.
- B. Exterior Joints for Which No Other Sealer Is Indicated:
 - 1. Use one of the following sealants:
 - a. Two-part nonsag low-modulus urethane sealant.
 - 2. Backer: Backer rod.
 - 3. Joint shape: Concave joint configuration.
- C. Interior Joints for Which No Other Sealer Is Indicated:
 - 1. Use one of the following sealants:
 - a. Two-part nonsag low-modulus urethane sealant.
 - b. Butyl polyisobutylene sealant.
 - 2. Backer: Backer rod.
 - 3. Joint shape: Concave joint configuration.
- D. Below-Grade Joints:
 - 1. Urethane sealant for water immersion.
 - 2. Backer: Backer rod.
 - 3. Joint shape: Concave joint configuration.
- E. Underwater Joints:
 - 1. Use one of the following sealants:
 - a. Urethane sealant for water immersion.
 - 2. Backer: Backer rod.
 - 3. Joint shape: Concave joint configuration.
- F. Exterior Joints Well Protected from Weather and Not Subject to Movement:
 - 1. Use one of the following sealants:
 - a. Acrylic sealant.
 - 2. Backer: Backer rod.
- G. Vehicular Paving Joints, Not Over 1-1/2 Percent Slope:

1. Use one of the following sealants:
 - a. Two-part cold-applied urethane paving sealant.
 2. Backer: Joint filler specified elsewhere.
- H. Interior Floor Joints and Pedestrian Paving Joints, Less than 1-1/2 Percent Slope:
1. Use one of the following sealants:
 - a. Two-part nonsag urethane sealant for Use T.
 2. Backer: Joint filler specified elsewhere.
 3. Joint shape: Flush joint configuration.
- I. Joints around Pipes, Ducts, and Conduit Penetrating Exterior Walls and Roofs:
1. Use one of the following sealants:
 - a. Same as used for adjacent substrates.
- J. Joints in Interior Wet Areas:
1. Use one of the following sealants:
 - a. Mildew-resistant silicone sealant.
 2. Backer: Backer rod.
 3. Joint shape: Concave joint configuration.
- K. Exterior metal to metal joints.:
1. Use one of the following sealants:
 - a. All-purpose urethane sealant.
 - b. Butyl polyisobutylene sealant.
 2. Backer: Backer rod.
 3. Joint shape: Concave joint configuration.

END OF SECTION

SECTION 08225
INSTITUTIONAL COMPARTMENT DOORS

PART 1 GENERAL

1.01 DESCRIPTION

A. The work covered in this section consists of furnishing SL-175 Fiberglass Reinforced Polyester (FRP) or approved equivalent, doors shown on drawings and schedules and specified herein.

1.02 QUALITY ASSURANCE

A. Standards: Comply with the requirements and recommendations in applicable specification and standards by AAMA, except to the extent more stringent requirements are indicated.

B. Performance: A minimum ten year record of production of frames, doors and panels and completion of similar projects in type and size.

C. Instruction: The manufacturer or his representative will be available for consultation to all parties engaged in the project including instruction to installation personnel.

D. Field Measurement: Field verify all information prior to fabrication and furnishing of materials. Furnish and install materials omitted due to lack of verification at no additional cost to Owner.

E. Regulation and Codes: Comply with the current edition in force at the project location of all local, state and federal codes and regulations, including the Americans with Disabilities Act of 1992.

1.03 SUBMITTALS

A. Product Data: Submit Manufacturer's specifications, standard details and installation recommendations for components of fiberglass reinforced polyester doors required for project.

B. Shop Drawings: Submit shop drawings for the fabrication and installation of fiberglass reinforced polyester doors, including elevations, detail sections of typical

composite members, hardware mounting heights, anchorages, reinforcement, expansion provisions and glazing.

C. Samples: Submit samples of each type and color of fiberglass reinforced polyester finish, and sections of extrusions or formed shapes.

D. Templates and Diagrams: Furnish templates, diagrams and other data to fabricators and installer of related work, as needed for coordination of doors, frames, hardware, concrete work and steel work.

1.04 JOB CONDITIONS

A. Materials supplied shall be delivered to the jobsite in their original unopened packages with labels intact. Materials shall be inspected for damage, and the manufacturer informed of any discrepancies. Unsatisfactory materials shall not be used.

B. Materials supplied shall be packaged in individual corrugated cartons. Doors shall “float” within cartons, with no portion of the door in contact with the outer shell.

C. Inspect surfaces that received work of this section. Report any unsatisfactory conditions to General Contractor. Proceeding with the work will be evidence of acceptance of job conditions.

1.05 PROJECT WARRANTY

A. Provide a written warranty signed by manufacturer, installer and contractor, agreeing to replace, at no cost to the Owner, any doors, frames or factory hardware installation which fail in materials or workmanship, within the warranty period. Failure of materials or workmanship includes: excessive deflection, faulty operation of entrances, deterioration of finish or construction in excess of normal weathering and defects in hardware installation. The minimum time period of warranty is ten (10) years from acceptance.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers are:
1. SL-175 with SpecLite3, SL-165 or SL-165SS as manufactured by Special-Lite, Inc., Decatur, Michigan, or approved equal.

2. SL-175 as manufactured by Tiger Door, Overly Door Co., or approved equal.

2.02 DESCRIPTION OF SYSTEM

A. System Components: Provide flush type SL-175 doors, 1 3/4" thick and sized per the plans and elevations. Provide continuous heavy-duty hinge and hardware as listed.

B. Materials

1. Aluminum Members: Alloy and temper as recommended by manufacturer for strength, corrosion resistance and application of required finish and control of color; ASTM B 221 for extrusions, ASTM B 209 for sheet/plate with aluminum wall thickness of 0.125".
2. Fasteners: Stainless steel or other materials warranted by manufacturer to be non-corrosive and compatible with aluminum components. All fasteners to be secured by torx screws.
3. Joinery: 3/8" galvanized steel tie rod, top and bottom bolted through an extruded spline and 3/16" reinforcing angles and secured with aircraft type nuts.
4. Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible; otherwise, provide non-magnetic stainless steel or hot-dip galvanized steel complying with ASTM A386.
 - a. Provide manufacturer's standard reinforcement for each type of hardware required, not less than .125" thick.
 - b. Provide manufacturer's recommended fastener reinforcements.
5. Core Material: CFC free urethane foam of five (5) pounds per cubic foot minimum density.
6. Face Material: SL-175 Fiberglass Reinforced Polyester, .120" minimum thickness, with smooth or pebble-like embossed pattern. Finish and Color to be selected by the Owner.
7. Abrasion Resistance: FRP face sheet to have no greater than .029 average weight loss percentage after Taber Abrasion Test - 25 cycles at 500

gram weight with H-18 wheel.

8. Stain Resistance: FRP face sheet to be unaffected after 24 hour exposure to SVS-1 white spray enamel. Must retain DE of .57 or less with MacBeth Colorimeter. Dark Brown (Bronze) FRP to be used as a basis.

9. Chemical Resistance: FRP face sheet to be unaffected after 4 hour exposure to acetic acid (10% solution), acetone, sodium hypochlorite (5.25% solution) and hydrochloric acid (10% solution). No discoloration or panel damage will be allowed.

C. Comply with fire-resistance and flammability regulations as interpreted by governing authorities and as follows:

1. FRP Face sheets tested in accordance with ASTM E-84 shall have the following ratings (Class "A"):

a. Smoke Developed: not greater than 310

b. Flame Spread: not greater than 15

D. Manufacturer Qualifications

Shall have produced fiberglass reinforced polyester doors for a minimum of ten (10) years.

1. Impact Strength of FRP Face Sheets: ASTM D256, Izod Impact Strength, 17 foot pounds per inch of notch.

2. Hardness of FRP Face Sheets: ASTM D2583, Barcol Meter Hardness Test, not more than 50.

3. Humidity Resistance of Face Sheets: ASTM D570, water absorption not greater than 0.40% after 24-hour immersion.

E. Hardware

1. Continuous Gear Hinge: Select Products SL-11HD

2. Roller Latch: Rockwood #590 x 626

3. Recessed Pull: SL-82

4. Hardware shall be furnished and factory installed by door supplier.

F. Frames

1. Manufacturer: Frames shall be 1034 series frames as manufactured by Special-Lite, Inc., Decatur, Michigan, or approved equal.
2. Aluminum to be extruded 6063-T5 alloy fitted with neoprene bulb.
3. Frames to extend from the floor to the top of the opening.

PART 3 EXECUTION

3.01 INSPECTION

- A. Inspect surfaces to receive work:

Commencement of work shall signify acceptance of conditions.

3.02 INSTALLATION

- A. Install doors and frames in accordance with the manufacturer specifications and recommendations.
- B. Set units plumb, level and true to line, without warp or rack of frames, dividers or doors. Anchor securely in place. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- C. Clearances: Door shall be installed with proper clearances and shall operate smoothly and easily.

3.03 COMPLETION

- A. Upon completion of installation, leave areas of work in neat, clean condition. Remove debris caused by work of this section from premises.
- B. Upon completion of installation, including work by other trades, lubricate, test and adjust doors to operate easily, free from warp, twist or distortion.

END OF SECTION

**SECTION 08710
DOOR HARDWARE**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. All door hardware indicated on the schedule attached to this section.

1.2 REFERENCES

- A. Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; Door and Hardware Institute (DHI); latest edition.

1.3 SUBMITTALS

- A. Make the following submittals in the order indicated, unless submitted simultaneously.
- B. Supplier Qualifications: To the engineer, for information.
- C. Product Data: Manufacturer's data for each different piece of hardware, with installation instructions.
- D. Hardware Schedule: Show manufacturer's complete identification for every item for every door.
 - 1. Cross-reference to item names and designations in contract documents.
 - 2. Indicate door/frame materials and sizes.
 - 3. Explain number codes and abbreviations.
 - 4. Indicate hardware mounting heights or locations, if different from those specified.
 - 5. Indicate finish for each item.
 - 6. Preliminary schedule will be reviewed if accompanied by product data.
- E. Keying Schedule: Separate schedule showing how each lock is keyed.
- F. Operation and Maintenance Data: For operating parts and finishes.
- G. Maintenance Agreement.

1.4 QUALITY ASSURANCE

- A. Qualifications of Supplier: A supplier of architectural finish hardware who has been supplying hardware for at least 2 years and who employs an architectural hardware consultant (AHC).

- B. Qualifications of Architectural Hardware Consultant(s) (AHC): Certified by the Door and Hardware Institute.

1.5 PROJECT CONDITIONS

- A. Sequence submittal of hardware schedule and door and frame submittals, allowing adequate time for review and resubmittal, if required, so that construction is not delayed; provide adequate information for review.
- B. Provide hardware installation templates to installers of hardware and to fabricators of other work which is required to be prepared in the shop or factory for hardware installation.
- C. Coordinate shop drawings of other work so that proper preparation is made.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hardware at the times and to the locations required for timely installation.
- B. Package each item separately or in container with items of same set only.
- C. Mark each item or package with hardware set number from hardware schedule.
- D. Provide a locked storage area controlled by the contractor for hardware not yet installed; take special care to prevent loss of long-lead items.

1.7 MAINTENANCE

- A. Provide all adjustment and maintenance tools recommended by hardware manufacturers.
- B. Installer shall provide letter agreement to the owner that, approximately 6 months after substantial completion, the installer shall visit the project, with the representative of the manufacturer(s) of locking devices, and accomplish the following:
 - 1. Readjust all hardware.
 - 2. Evaluate maintenance procedures and recommended changes or additions and instruct the owner's personnel.
 - 3. Identify items that have deteriorated or failed.
 - 4. Submit a written report; identify problems that are likely to recur.

PART 2 - PRODUCTS

- A. In addition to requirements of the hardware schedule, comply with the requirements below.
- B. Latching and Locking Devices: Bored locks, unless otherwise indicated, with appropriate

locking function; provide on every door.

2.1 MATERIALS - GENERAL

A. Manufacturers:

1. Obtain all items of each type from the same manufacturer.

B. Manufacturer's Names and Trade Names: Display of names, logos, or other identification is acceptable on lock or hinge edge of door, but not where visible on either face of door.

1. Exception: As directed by or acceptable to the engineer.
2. Exception: Manufacturer's name or other identification on rim of lock cylinders.

C. Fasteners: Provide hardware prepared by the manufacturer with fastener holes for machine screws, unless otherwise indicated.

1. Provide all fasteners required for secure installation.
2. Select fasteners appropriate to substrate and material being fastened.
3. Use flathead Phillips screws unless otherwise indicated.
4. Use fasteners impervious to corrosion outdoors and on exterior doors.
5. Exposed screws: Match hardware finish.
6. Where it is not possible to reinforce substrate adequately for screws, use through-bolts with sleeves or use sex bolts.
 - a. Do not use where head or nut would be exposed on face of door, unless specifically indicated or made necessary by other requirements.
 - b. Finish exposed heads and nuts the same as hardware on that side of the door.

D. Finishes: As indicated on attachment.

1. Items specified with the same finish shall match as closely as possible using standard manufactured products.

2.2 HINGES

A. Manufacturers:

1. Butt hinges: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
 - a. Stanley Hardware Division/The Stanley Works.
 - b. Hager Hinge Company.
 - c. McKinney Products Company.

2.3 LOCKS, LATCHES, AND BOLTS

A. Manufacturers:

1. Bored locksets and latchsets: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
 - a. Schlage Lock Company.
 - b. Sargent Manufacturing Company.
 - c. Yale Security, Inc.
2. Flush bolts: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
 - a. Door Controls International.
 - b. Glynn-Johnson Division/Ingersol-Rand.
 - c. H. B. Ives, A Harrow Company.

B. Strikes: Provide strike for each latch bolt and lock bolt.

1. Finish to match other hardware on door.
2. Use wrought box strikes with curved lips unless otherwise indicated.

2.4 LOCK CYLINDERS AND KEYING

A. Keying: Obtain the owner's keying instructions.

1. Key each lock differently unless otherwise directed, except keyed alike where two or more doors enter the same space.
2. Provide a new master key system.

B. Cylinders: Minimum 6-pin pin tumbler cylinders.

1. Construction: All parts brass, bronze, nickel silver or stainless steel.

C. Keys: Nickel silver.

1. Stamp each key with manufacturer's change symbol.
2. Provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.
3. Provide 3 of each change key.
4. Each master key system: 5 master keys.

D. Key Cabinet: Wall-mounted, for keys hung on hinged panels behind cabinet door.

1. Capacity: 150 percent of locks on project.
2. Provide key tags and hook labels.
3. Provide lock for cabinet; key lock to other locks of this section.

2.5 DOOR CONTROL DEVICES

A. Manufacturers:

1. Surface-mounted closers: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
 - a. LCN Closers Division/Schlage Lock Company.
 - b. Corbin Russwin Architectural Hardware Division/Black & Decker Corporation.
 - c. Rixson-Firemark, a subsidiary of Yale Security, Inc.

2.6 ARCHITECTURAL DOOR TRIM

A. Manufacturers:

1. Architectural door trim: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
 - a. Rockwood Manufacturing Company
 - b. Yale Security, Inc.
 - c. H. B. Ives, a Harrow Company.

2.7 OVERHEAD STOPS AND HOLDERS

A. Manufacturers:

1. Overhead Stops and Holders: Stainless steel construction
 - a. Glynn Johnson Corporation.

2.8 SEALS AND THRESHOLDS

B. Manufacturers:

1. Thresholds: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
 - a. Granite State Castings.
 - b. Wooster Products Corp.
 - c. American Abrasive Products

PART 3 - EXECUTION

3.1 PREPARATION

- A. Factory- or shop-prepare all work for installation of hardware.

3.2 INSTALLATION

- A. Follow hardware manufacturer's recommendations and instructions.
- B. Install surface-mounted items after substrates have been completely finished; install recessed items and recessed portions of items before finishes are applied and provide suitable, effective protection.
 1. When surface-mounted items are installed before final finish, remove, store, and reinstall, or apply suitable effective protection.
- C. Mount at heights specified in the Door and Hardware Institute's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 1. Exception(s):
 - a. As required by applicable regulations.
- D. Install hardware in correct location, plumb and level.
- E. Reinforce substrates as required for secure attachment and proper operation.
- F. Thresholds: Apply continuous bead of sealant to all contact surfaces before installing.

3.3 ADJUSTMENT

- A. Adjust each operable unit for correct function and smooth, free operation.
- B. Adjust door closers to overcome air pressure produced by HVAC systems.
- C. If hardware adjustment is completed more than one month before substantial completion, readjust hardware not more than one week before substantial completion.

3.4 INSTRUCTION OF OWNER'S PERSONNEL

- A. Instruct the owner's personnel in operation and maintenance of hardware, including finishes.

3.5 CLEANING

- A. Clean hardware; clean other work soiled during hardware installation.

3.6 CONTRACT CLOSEOUT

- A. Deliver all keys to the owner.

3.7 DOOR HARDWARE

- A. Doors to Include
 - Continuous hinge SL-11-HD-Clear
 - Lockset L9453-93A-626
 - Lever flush bolt 555-12" 2LD
 - O.H. stop GJ-804-H-652 or Floor Stop 442-626 or wall stop 409-PR 63 as required

END OF SECTION

SECTION 09900 PAINTING

PART 1 GENERAL

1.01 SUMMARY

This section includes, but is not necessarily limited to, standards for cleaning and painting structures and equipment described in the Drawings and Specification. Furnish all materials, equipment and labor necessary to complete the Work.

1.02 SUBSTITUTIONS

To the maximum extent possible, all coatings shall be the products of a single manufacturer. Guidelines for determination of acceptability of product substitutions are given in Supplemental Conditions. Contractors intending to furnish substitute materials or equipment are cautioned to read and strictly comply with these guidelines. The Engineer's decision regarding acceptability of a substitute product shall be final.

1.03 SUBMITTALS

All submittals shall be made in accordance with the requirements of these Specifications. The Contractor shall submit color charts for the Owner's use in color selection where appropriate. The Contractor will submit product data sheets for each type of paint used in the Work.

1.04 PAINTING REQUIREMENTS

- A. Finish paint all exposed surfaces except anodized or lacquered aluminum, stainless steel and copper surfaces. Exposures and surfaces are defined in 3.07 of this Section. Items to be left unfinished or to receive other types of finishes, such as tile, are specifically shown on the Drawings or specified.
 - 1. Unpainted Products: Full field cleaning and priming will be performed in accordance with specification requirements for unpainted products.
 - 2. Shop Primed Products
 - a. Manufactured products may be shop cleaned and primed. Shop cleaning must equal or exceed cleaning specified in the Painting Schedule. Clean as specified and re-prime all abrasions, weld splatter, excessive weathering and other defects in the shop prime coating.
 - b. Fully field clean and prime any shop primed products which the Engineer determines that were not cleaned in accordance with the Specification prior to priming, that the wrong primer was applied, that the primer was applied improperly, or has excessively weathered, or that the product is otherwise

unacceptable.

3. Finish Painted Products: Certain products such as electrical control panels and similar items may, with the approval of the Engineer, be furnished finish painted. Properly protect these products throughout the Project to maintain a bright and new appearance. If the finish surface are defaced, weathered or not of the selected color, repaint as necessary.
4. Existing Surfaces
 - a. Properly protect existing finish painted items and surfaces from damage throughout the Project.
 - b. Repair any damage to existing coatings repaired in accordance with the requirements of this Section, at no expense to the Owner.
5. Hardware: Remove all electrical plates, surface hardware, fittings and fastenings prior to painting operations. These items are to be carefully stored, cleaned and replaced upon completion of work in each area. Do not use solvent to clean hardware that may remove permanent lacquer finish.

1.06 QUALITY ASSURANCE

- A. The Contractor shall submit to the Engineer, for review, the following information concerning the materials the Contractor proposes to use in work covered by this Article:
 1. A list of all components (paints or other materials) to be used in each painting system required herein.
 2. A complete descriptive specification of each component.
- B. Only those systems and components which are judged acceptable by the Engineer shall be utilized in the work covered by this item. No materials shall be delivered to the job site until the Engineer has evaluated their acceptability.
- C. The following information shall be included on the label of all containers of materials supplied under this item:
 1. Manufacturer's name.
 2. Type of paint or other generic identification.
 3. Manufacturer's stock number.
 4. Color (if any).
 5. Instructions for mixing, thinning, or reducing (as applicable).

6. Manufacturer's application recommendations.
7. Safety and storage information.

1.07 MANUFACTURER'S REPRESENTATIVE DURING PAINTING OPERATIONS

An authorized representative of each coating manufacturer shall be present at the start-up and periodically (minimum of 2 additional visits) during painting operations. Such representatives shall instruct and observe the Contractor's workers and shall, at the completion of the work, certify in writing to the Engineer that the manufacturer's application recommendations have been adhered to. The cost of this work shall be borne by the Contractor.

1.08 TESTING EQUIPMENT

- A. The Contractor shall furnish and make available to the Engineer the following items of testing equipment for use. The specified items of equipment shall be available for the Engineer's use at all times when field painting or surface preparation is in progress:
 1. Wet film gauge.
 2. Surface thermometer.
 3. Keane-Tator surface profile comparator.
 4. Set of National Association of Corrosion Engineers (NACE) visual standards.
 5. Holiday (pin hole) detector (low voltage).
 6. Elcometer 345 magnetic dry film gauge

PART 2 PRODUCTS

2.01 MATERIALS

- A. Application Data: All applicable data currently published by the paint manufacturer relating to surface preparation, coverage, film thickness, application technique, drying and over-coating times is included by reference as a part of this Section. It will be the responsibility of the Contractor to obtain and fully understand the appropriate data sheets for the coatings specified.
- B. Products
 1. Paints shall be factory mixed and delivered to the site in unbroken original packages

bearing the manufacturer's name and brand designation and shall be applied in strict accordance with the manufacturer's printed specification. Two-component coatings, once mixed, shall be applied with the pot-life recommended by the manufacturer.

2. Unless otherwise specified, paints shall be of the best grade. All thinners, driers, varnish, etc., shall be of the best grade and shall be furnished by the coating manufacturer for use with the specified paints.
- C. Colors: The Owner will select the colors to be used on the various portions of the work. Provide color cards for the coatings proposed. Where more than one coat of paint is required, job tint the paint for each undercoat off-shade to show complete coverage.
- D. Acceptable Manufacturers: These specifications are written around products available from TNEMEC to provide a standard of quality. Other acceptable manufacturers include Carboline, PPG Protective & Marine Coatings, Valspar, Sherwin Williams and Induron. The manufacturer shall supply a description of their paint system equivalent to the specified system for approval of the Engineer.

2.02 PIPE AND EQUIPMENT IDENTIFICATION

Different colors will be used on pumps, motors, valves, piping systems and other surfaces as shown in **TABLE 1**.

2.03 MIXING AND TINTING

- A. When possible, all paints and other materials shall be mixed and tinted by the paint manufacturer prior to delivery at the job site.
- B. When job mixing and/or tinting is required, the manufacturer's recommendations shall be strictly adhered to. The Contractor shall be solely responsible for proper on-site mixing and/or tinting.

2.04 OSHA SAFETY COLOR USAGE GUIDE

- A. OSHA Safety colors, in accordance with ANSI Z3.1, shall be used for marking physical hazards and safety equipment and locations. The following OSHA Safety Color Usage Guide will be used in determining the coating color and type of marking required.
 1. Safety Red
 - Fire protection equipment
 - Fire boxes
 - Extinguishers
 - Exit signs
 - Sprinkler piping
 - Portable containers of flammable liquids

- Emergency stop bars
- 2. Safety Orange
 - Exposed box housings
 - Exposed edges of pulleys, gears, etc.
 - Safety starting buttons
- 3. Safety Yellow: Physical Hazard CAUTION (Generally used with Black in checks or stripes).
 - Unguarded edges of platforms
 - Elevator door edges
 - Bollards
 - Pulley Blocks
 - Material handling equipment
- 4. Safety Green: Safety Equipment and Locations
 - First aid kits and stretchers
 - First aid signs, dispensaries and drinking water stations

PART 3 EXECUTION

3.01 GENERAL

Adequately protect other surfaces from paint and damage. Repair damage as a result of inadequate or unsuitable protection.

3.02 PRODUCT HANDLING

A. Delivery

- 1. Deliver materials in original, sealed containers of the manufacturer with labels legible and intact.
- 2. Each container shall be clearly marked or labeled to show paint identification, date of manufacture, batch number, analysis or contents, identification of all toxic substances and special instructions.

B. Storage

- 1. Store material in a suitable location and in such a manner as to comply with all safety requirements including any applicable federal, state and local rules and requirements. Storage shall also be in accordance with the instructions of the paint manufacturer and the requirements of the insurance underwriters.

2. Restrict storage area to paint materials and related equipment.
3. Place any materials which may constitute a fire hazard in closed metal containers and remove daily from the Project site.

3.03 ENVIRONMENTAL CONDITIONS

Comply with the manufacturer's recommendations regarding environmental conditions under which coatings may be applied.

3.04 SURFACE PREPARATION

- A. General: All surfaces shall be thoroughly clean, dry, and free from oil, grease or dust. All steel shall have all weld flux and weld spatter removed and sharp peaks in welds ground smooth. The Engineer will inspect the surface preparation prior to the application of coatings.
- B. Ferrous Metals: Standards for the surface preparation of ferrous metals required in the Materials Schedules are the standards of the Steel Structures Painting Council (SSPC, SP-1 through SP-11). Inspection of these surfaces will be evaluated by field comparison with visual comparator panels. These panels shall be securely wrapped in clear plastic and sealed to protect them from deterioration and marring.
- C. Concrete Surfaces: For all concrete surfaces, the following surface preparation shall be employed:
 1. Wash (C-1): Wash and scrub all surfaces with a solution of 1-1/2 ounces of soap chips and 1-1/2 ounces of tri-sodium phosphate in each gallon of water used. Flush away all soap and dirt with clean water. After this washing the surface will be re-checked and any rough areas not suitable for painting shall be sandblasted smooth.
 2. Acid Etch (C-2): Surface preparation for painting shall not commence until 7 days after the concrete has been pronounced cured. Wash and scrub all surfaces with a solution of 1-1/2 ounces of soap chips and 1-1/2 ounces of tri-sodium phosphate in each gallon of water used. Flush away all soap and dirt with clean water and then etch the surface with a 15 percent or stronger solution of muriatic acid until an open-faced granular texture, similar to fine sandpaper, is obtained. Any areas that remain smooth are to be re-etched until the desired texture is achieved. Flush and scrub away with clear water all acid and loosened particles.
 3. Blast Cleaning (C-3): Remove all form oil and dirt by washing the surface with a solution of 1-1/2 ounces of soap chips and 1-1/2 ounces of tri-sodium phosphate in each gallon of water used. Blast clean all laitance and other foreign material from the surface of the concrete until an open-faced granular texture similar to fine sandpaper is achieved. These results should be accomplished with blast cleaning similar to "brush blasting" steel surfaces.

4. Prior to the surface preparation noted in paragraphs 1, 2, and 3 above, all concrete surfaces to be painted shall have a rubbed stone finish in accordance with Section 03300.
- D. Wood Surfaces: All wood surfaces shall be clean, dry and adequately protected from dampness. Sandpaper to a smooth even surface then dust off. After priming coat has dried, apply shellac to all knots, pitch and resinous sapwood. Putty all nail holes, cracks, open joints and other defects; color putty to match finish paint or stain.

3.05 APPLICATION

- A. Conditions: No paint shall be applied upon damp or frosty surfaces, or in wet or foggy weather. No paint shall be applied in temperatures below 40 degrees F, when freezing (32 degrees F) is predicted within 24 hours of application, or under temperature or humidity conditions not recommended by the manufacturer.
- B. Surface Preparation: After specified surface preparation, all surfaces shall be brushed free of dust or foreign matter. Surfaces shall be completely dry before any paint is applied. All voids, open or hollow places in masonry shall be repaired with an epoxy patching compound.
- C. Application: Paint shall be evenly spread in the proper thickness, so that there shall be no drops, runs or sags of the coating. Where runs and drops do occur, they shall be removed and the surface re-coated to the satisfaction of the Engineer. Sufficient time, as directed by the manufacturer, shall be allowed for the paint to dry before the application of succeeding coats.
- D. Protection of Work Area: Use drop cloths or other suitable means to protect other surfaces of the structure or equipment in place. Upon completion of the work, remove all paint spots from surfaces as directed by the Engineer.
- E. Inspection: The Engineer will inspect each coat prior to the application of subsequent coats.
- F. Defective Work: Remove and replace, at the direction of the Engineer, any painting work found to be defective or applied under adverse conditions.

3.06 PAINTING SCHEDULE

- A. General: The Painting Schedule summarizes the painting systems to be applied to the various surfaces.

3.07 MATERIAL SCHEDULES

Material Schedules list pretreatment coats, wash coats, seal coats, prime coats, intermediate coats, finish coats and cover coats that comprise a complete and compatible system of surface protection for the particular substrate. Maintain the unity of these systems, making sure all coats applied to any surface are from the same system and same manufacturer. Verify with the manufacturer the compatibility of the materials used.

3.08 MAINTENANCE MATERIALS

Furnish the Owner at least one gallon of each type and color of paint used for finish coats and one gallon of each type of thinner required. Containers shall be tightly sealed and clearly labeled.

PAINTING SCHEDULE

STEEL

EXPOSURE:	<u>EXTERIOR EXPOSED</u>
GENERIC TYPE:	EPOXY/POLYURETHANE
SURFACE PREPARATION:	SSPC-SP6
FIRST COAT, DFT (MILS):	TNEMEC SERIES 66 OR N69 HI-BUILD EPOXOLINE, 4.0-6.0, OR EQUAL
SECOND COAT, DFT (MILS):	TNEMEC SERIES 73 ENDURA-SHIELD, 2.0-3.0, OR EQUAL
TOTAL DFT (MILS):	6.0-9.0
TOTAL COATS:	2

EXPOSURE:	<u>INTERIOR EXPOSED</u>
GENERIC TYPE:	EPOXY
SURFACE PREPARATION:	SSPC-SP6
FIRST COAT, DFT (MILS):	TNEMEC SERIES 66 OR N69 HI-BUILD EPOXOLINE, 3.0-5.0, OR EQUAL
SECOND COAT, DFT (MILS):	TNEMEC SERIES 66 OR N69 HI-BUILD EPOXOLINE, 4.0-6.0, OR EQUAL
TOTAL DFT (MILS):	7.0-11.0
TOTAL COATS:	2

EXPOSURE:	<u>IMMERSION IN WASTEWATER</u>
GENERIC TYPE:	COAL TAR EPOXY
SURFACE PREPARATION:	SSPC-SP10
FIRST COAT, DFT (MILS):	TNEMEC SERIES 66 OR N69 HI-BUILD EPOXOLINE, 3.0-5.0, OR EQUAL
SECOND COAT, DFT (MILS):	TNEMEC 46H-413 HI-BUILD TNEME TAR, 14.0- 20.0 , OR EQUAL
TOTAL DFT (MILS):	17.0-25.0
TOTAL COATS:	2

EXPOSURE:	<u>IMMERSION IN WATER (POTABLE & RAW)</u>
GENERIC TYPE:	EPOXY
SURFACE PREPARATION:	SSPC-SP10
FIRST COAT, DFT (MILS):	TNEMEC SERIES 20 POTA-POX, 3.0-5.0, OR EQUAL
SECOND COAT, DFT (MILS):	TNEMEC SERIES 20 POTA-POX, 4.0-6.0, OR EQUAL
TOTAL DFT (MILS):	7.0-11.0
TOTAL COATS:	2

EXPOSURE:	<u>INTERIOR/IMMERSION SEVERE</u>
GENERIC TYPE:	VINYL ESTER
SURFACE PREPARATION:	SSPC-SP5
FIRST COAT, DFT (MILS):	TNEMEC SERIES 120-5002 VINESTER, 12.0-18.0, OR EQUAL
SECOND COAT, DFT (MILS):	TNEMEC SERIES 120-5001 VINESTER, 12.0-18.0, OR EQUAL
TOTAL DFT (MILS):	24.0-36.0
TOTAL COATS:	2

EXPOSURE:	<u>BELOW GRADE</u>
GENERIC TYPE:	COAL TAR EPOXY
SURFACE PREPARATION:	SSPC-SP10
FIRST COAT, DFT (MILS):	TNEMEC SERIES 66 OR N69 HI-BUILD EPOXOLINE, 3.0-5.0, OR EQUAL

SECOND COAT, DFT (MILS): TNEMEC 46H-413 HI-BUILD TNEME TAR, 14.0- 20.0, OR EQUAL
TOTAL DFT (MILS): 17.0-25.0
TOTAL COATS: 2

EXPOSURE: **HIGH TEMPERATURE, INTERIOR OR EXTERIOR EXPOSED**
GENERIC TYPE: SILICONE ALUMINUM (UP TO 1200 DEG. F)
SURFACE PREPARATION: SSPC-SP10
FIRST COAT, DFT (MILS): TNEMEC SERIES 39-1261 SILICONE ALUMINUM, 0.7-1.5, OR EQUAL
SECOND COAT, DFT (MILS): TNEMEC SERIES 39-1261 SILICONE ALUMINUM, 0.7-1.5, OR EQUAL
TOTAL DFT (MILS): 1.4-3.0
TOTAL COATS: 2

FACTORY PRIMED STEEL

EXPOSURE: **EXTERIOR EXPOSED**
GENERIC TYPE: EPOXY/POLYURETHANE
SURFACE PREPARATION: CLEAN AND DRY
FIRST COAT, DFT (MILS): FACTORY PRIME
SECOND COAT, DFT (MILS): TNEMEC SERIES 27 F.C. TYPOXY, 3.0-5.0, OR EQUAL
THIRD COAT, DFT (MILS): TNEMEC SERIES 73 ENDURA SHIELD, 2.0-3.0, OR EQUAL
TOTAL DFT (MILS): 5.0-8.0
TOTAL COATS: 2

EXPOSURE: **INTERIOR EXPOSED**
GENERIC TYPE: EPOXY
SURFACE PREPARATION: CLEAN AND DRY
FIRST COAT, DFT (MILS): FACTORY PRIME
SECOND COAT, DFT (MILS): TNEMEC SERIES 27 F.C. TYPOXY, 3.0-5.0, OR EQUAL
THIRD COAT, DFT (MILS): TNEMEC SERIES 66 OR N69 HI-BUILD EPOXOLINE, 4.0-6.0, OR EQUAL
TOTAL DFT (MILS): 7.0-11.0
TOTAL COATS: 2

GALVANIZED STEEL & NON-FERROUS METAL

EXPOSURE: **EXTERIOR EXPOSED**
GENERIC TYPE: EPOXY/POLYURETHANE
SURFACE PREPARATION: SSPC-SP6
FIRST COAT, DFT (MILS): TNEMEC SERIES 66 OR N69 HI-BUILD EPOXILINE, 2.0-3.0, OR EQUAL
SECOND COAT, DFT (MILS): TNEMEC SERIES 73 ENDURA-SHIELD, 2.0-3.0, OR EQUAL
TOTAL DFT (MILS): 4.0-6.0
TOTAL COATS: 2

EXPOSURE: **INTERIOR EXPOSED**
GENERIC TYPE: EPOXY
SURFACE PREPARATION: SSPC-SP6
FIRST COAT, DFT (MILS): TNEMEC SERIES 66 OR N69 HI-BUILD EPOXILINE, 2.0-3.0, OR EQUAL
SECOND COAT, DFT (MILS): TNEMEC SERIES 66 OR N69 HI-BUILD EPOXOLINE, 2.0-3.0, OR EQUAL
TOTAL DFT (MILS): 4.0-6.0
TOTAL COATS: 2

EXPOSURE: **IMMERSION**
GENERIC TYPE: EPOXY
SURFACE PREPARATION: SSPC-SP1 FOLLOWED BY BRUSH-OFF BLAST
FIRST COAT, DFT (MILS): TNEMEC SERIES 66 OR N69 HI-BUILD EPOXILINE, 3.0-5.0, OR EQUAL
SECOND COAT, DFT (MILS): TNEMEC SERIES 66 OR N69 HI-BUILD EPOXOLINE, 4.0-6.0, OR EQUAL
TOTAL DFT (MILS): 7.0-11.0

TOTAL COATS: 2

DUCTILE OR CAST IRON

EXPOSURE:	<u>EXTERIOR EXPOSED</u>
GENERIC TYPE:	EPOXY/POLYURETHANE
SURFACE PREPARATION:	SSPC-SP6
FIRST COAT, DFT (MILS):	TNEMEC SERIES 90-97 TNEME-ZINC, 2.5-3.5, OR EQUAL
SECOND COAT, DFT (MILS):	TNEMEC SERIES 66 OR N69 HI-BUILD EPOXOLINE, 3.0-5.0, OR EQUAL
THIRD COAT:	TNEMEC SERIES 73 ENDURA-SHIELD, 2.0-3.0, OR EQUAL
TOTAL DFT (MILS):	7.5-11.5
TOTAL COATS:	3

EXPOSURE:	<u>INTERIOR EXPOSED</u>
GENERIC TYPE:	EPOXY
SURFACE PREPARATION:	SSPC-SP6
FIRST COAT, DFT (MILS):	TNEMEC SERIES 90-97 TNEM-ZINC, 2.5-3.5, OR EQUAL
SECOND COAT, DFT (MILS):	TNEMEC SERIES 66 OR N69 HI-BUILD EPOXOLINE, 3.0-5.0, OR EQUAL
THIRD COAT:	TNEMEC SERIES 66 OR N69 HI-BUILD EPOXOLINE, 4.0-6.0, OR EQUAL
TOTAL DFT (MILS):	9.5-14.5
TOTAL COATS:	3

EXPOSURE:	<u>IMMERSION-WASTEWATER</u>
GENERIC TYPE:	COAL TAR EPOXY
SURFACE PREPARATION:	SSPC-SP6
FIRST COAT, DFT (MILS):	TNEMEC SERIES 66 OR N69 HI-BUILD EPOXOLINE, 3.0-5.0, OR EQUAL
SECOND COAT, DFT (MILS):	TNEMEC 46H-413 HI-BUILD TNEME-TAR, 14.0-20.0, OR EQUAL
TOTAL DFT (MILS):	17.0-25.0
TOTAL COATS:	1 OR 2

EXPOSURE:	<u>IMMERSION-WATER POTABLE WATER</u>
GENERIC TYPE:	EPOXY
SURFACE PREPARATION:	SSPC-SP6
FIRST COAT, DFT (MILS):	TNEMEC SERIES 91H20 TNEME-ZINC, 2.5-3.5, OR EQUAL
SECOND COAT, DFT (MILS):	TNEMEC SERIES 20 POTA POX, 4.0-6.0, OR EQUAL
THIRD COAT:	TNEMEC SERIES 20 POTA-POX, 4.0-6.0, OR EQUAL
TOTAL DFT (MILS):	10.5-15.5
TOTAL COATS:	3

PVC

EXPOSURE:	<u>EXTERIOR EXPOSED</u>
GENERIC TYPE:	EPOXY/POLYURETHANE
SURFACE PREPARATION:	SCARIFY
FIRST COAT, DFT (MILS):	TNEMEC SERIES 66 OR N69 HI-BUILD EPOXILINE, 2.0-3.0, OR EQUAL
SECOND COAT, DFT (MILS):	TNEMEC SERIES 73 ENDURA-SHIELD, 2.0-3.0, OR EQUAL
TOTAL DFT (MILS):	4.0-6.0
TOTAL COATS:	2

EXPOSURE:	<u>INTERIOR EXPOSED</u>
GENERIC TYPE:	EPOXY
SURFACE PREPARATION:	SCARIFY
FIRST COAT, DFT (MILS):	TNEMEC SERIES 66 OR N69 HI-BUILD EPOXILINE, 2.0-3.0, OR EQUAL
SECOND COAT, DFT (MILS):	TNEMEC SERIES 66 OR N69 HI-BUILD EPOXOLINE, 2.0-3.0, OR EQUAL
TOTAL DFT (MILS):	4.0-6.0
TOTAL COATS:	2

CONCRETE AND MASONRY, PRECAST, POURED-IN-PLACE AND DENSE CMU

EXPOSURE: **EXTERIOR EXPOSED**
GENERIC TYPE: MODIFIED EPOXY
SURFACE PREPARATION: CLEAN & DRY
FIRST COAT, DFT (MILS): TNEMEC SERIES 180 TNEME-CRETE, 8.0-10.0 (SPRAYED) , OR EQUAL
TOTAL DFT (MILS): 8.0-10.0
TOTAL COATS: 1

EXPOSURE: **IMMERSION WATER**
GENERIC TYPE: EPOXY
SURFACE PREPARATION: BRUSH-OFF BLAST
FIRST COAT, DFT (MILS): TNEMEC SERIES 20 POTA-POX, 4.0-6.0, OR EQUAL
SECOND COAT, DFT (MILS): TNEMEC SERIES 20 POTA-POX, 4.0-6.0, OR EQUAL
TOTAL DFT (MILS): 8.0-12.0
TOTAL COATS: 2

EXPOSURE: **INTERIOR EXPOSED**
GENERIC TYPE: WATERBORNE ACRYLIC EPOXY
SURFACE PREPARATION: CLEAN & DRY
FIRST COAT, DFT (MILS): TNEMEC SERIES 113 H.B.TNEME-TUF COAT, 4.0-6.0, OR EQUAL
SECOND COAT, DFT (MILS): TNEMEC SERIES 114 H.B TNEME-TUF COAT, 4.0-6.0, OR EQUAL
TOTAL DFT (MILS): 8.0-12.0
TOTAL COATS: 2

EXPOSURE: **INTERIOR,IMMERSION SEVERE**
GENERIC TYPE: VINYL ESTER
SURFACE PREPARATION: BRUSH-OFF BLAST
FIRST COAT, DFT (MILS): TNEMEC SERIES 120-5003 F & S, AS NEEDED, OR EQUAL
SECOND COAT, DFT (MILS): TNEMEC SERIES 120-5002 VINESTER,12.0-18.0, OR EQUAL
THIRD COAT: TNEMEC SERIES 120-5001 VINESTER,12.0-18.0, OR EQUAL
TOTAL DFT (MILS): 24.0-36.0
TOTAL COATS: 3

CONCRETE FLOORS

EXPOSURE: **INTERIOR EXPOSED**
GENERIC TYPE: EPOXY
SURFACE PREPARATION: BRUSH-OFF BLAST OR ACID ETCH
FIRST COAT, DFT (MILS): TNEMEC SERIES 66, 2.0-3.0, OR EQUAL
SECOND COAT, DFT (MILS): TNEMEC SERIES 66, 2.0-3.0, OR EQUAL
TOTAL DFT (MILS): 4.0-6.0
TOTAL COATS: 2

CONCRETE AND MASONRY, POROUS CMU AND CONCRETE

EXPOSURE: **EXTERIOR EXPOSED**
GENERIC TYPE: MODIFIED EPOXY
SURFACE PREPARATION: CLEAN & DRY
FIRST COAT, DFT (MILS): TNEMEC SERIES 180 TNEME-CRETE, 8.0-10.0 (SPRAYED) , OR EQUAL
SECOND COAT, DFT (MILS): TNEMEC SERIES 180 TNEME-CRETE, 8.0-10.0 (SPRAYED) , OR EQUAL
TOTAL DFT (MILS): 16.0-20.0
TOTAL COATS: 2

EXPOSURE: **INTERIOR EXPOSED**
 GENERIC TYPE: EPOXY
 SURFACE PREPARATION: CLEAN & DRY
 FIRST COAT, DFT (MILS): TNEMEC 54-660 MASONRY FILLER, 75-100 (sq.ft./gal.) , OR EQUAL
 SECOND COAT, DFT (MILS): TNEMEC SERIES 66 OR N69 HI-BUILD EPOXOLINE, 4.0-6.0, OR EQUAL
 THIRD COAT: TNEMEC SERIES 66 OR N69 HI-BUILD EPOXOLINE, 4.0-6.0, OR EQUAL
 TOTAL DFT (MILS): 8.0-12.0
 TOTAL COATS: 3

PLASTER AND GYPSUM WALL BOARD

EXPOSURE: **INTERIOR EXPOSED**
 GENERIC TYPE: ACRYLIC EMULSION
 SURFACE PREPARATION: CLEAN & DRY
 FIRST COAT, DFT (MILS): TNEMEC SERIES 6 TNEME-CRYL, 2.0-3.0, OR EQUAL
 SECOND COAT, DFT (MILS): TNEMEC SERIES 28 TNEME-CRYL, 2.0-3.0, OR EQUAL
 TOTAL DFT (MILS): 4.0-6.0
 TOTAL COATS: 2

WOOD

EXPOSURE: **INTERIOR OR EXTERIOR EXPOSED**
 GENERIC TYPE: ALKYD/WATERBORNE ACRYLIC EPOXY
 SURFACE PREPARATION: CLEAN & DRY
 FIRST COAT, DFT (MILS): TNEMEC SERIES 36 UNDERCOATER, 2.0-3.5, OR EQUAL
 SECOND COAT, DFT (MILS): TNEMEC SERIES 114 H.B.TNEME-TUFcoat, 4.0-6.0, OR EQUAL
 TOTAL DFT (MILS): 6.0-9.5
 TOTAL COATS: 2

TABLE 1

Pipe Identification and Color Coding

Pipe System	Paint Colors		Stencil Text
	Pipe	Letters and Arrows	
Chlorine Solution	Yellow	Black	Chlorine Solution
Electrical Conduits	Light Gray	NA	NA
Finished/Potable Water	Dark Blue	White	Potable Water
Fluoride	Light Blue w/Red Bands	White	Fluoride
Raw Water	Olive Green	White	Raw Water
Valves	Light Green	NA	NA
Vents	Black	White	Vent

Color Coding General Notes

1. All banding to be 2-inches wide and four feet on center.
2. Sample, drain, vent, metering, blowoff, decant, and hot lines shall be painted the same color combination as the piping system from which the line originates unless specified otherwise above. The additional pertinent text shall be applied to the pipe.
3. Insulated pipe, jacketed with aluminum, PVC, and/or stainless steel shall have the jacket unpainted. When valves and fittings for such lines are not insulated, the valves and fittings shall be color coded.
4. Building service lines such as plumbing lines and HVAC lines shall not be color coded but shall be painted the same color as the background construction.
5. All sludge lines not otherwise specified above shall be painted dark brown and stenciled as directed by the Engineer.
6. All lettering shall be done in capital letters of approved size and type.
7. Legend symbols shall be applied on piping on every run and spaced not greater than 8 feet apart.
8. Text shall be applied on piping in the middle of pipe runs for runs under 50 feet or in one room, whichever is the least distance. On runs greater than 50 feet, text shall be applied at third points in the run and no more than 35 feet apart.
9. Pumps, chemical tanks and other items of equipment to be painted shall be painted a color corresponding to their service, in accordance with the above schedule.

END OF SECTION

SECTION 10425 SIGNS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cast metal plaques. Not in Contract (NIC)
 - 2. Panel signs.
- B. Provide signage as indicated on the signage schedule Plan Sheet A-1.

1.2 REFERENCES

- A. ASTM B 584-04 -- Standard Specification for Copper Alloy Sand Castings for General Applications; latest edition.
- B. Metal Finishes Manual for Architectural and Metal Products; National Association of Architectural Metal Manufacturers (NAAMM); latest edition.

1.3 SUBMITTALS

- A. Product Data: Submit for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Shop drawings:
 - 1. Show fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.
 - 2. Provide message list for each sign required, including large-scale details of wording and lettering layout.
 - 3. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.

4. Furnish full-size rubbings for metal plaques.
- C. Samples:
1. Submit manufacturer's full range of samples for initial selection of color, pattern, and texture:
 - a. Plastic laminate.
 - b. Bronze.

1.4 QUALITY ASSURANCE

- A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance.
1. For each separate sign type required, obtain signs from a single manufacturer.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where necessary to ensure proper fitting. Show recorded measurements on final shop drawings.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Graphic Content and Style: Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.

2.2 MATERIALS

- A. Plastic Laminate: High-pressure plastic laminate engraving stock with face and core plies in contrasting colors.
- B. Bronze Castings: Copper alloy UNS C83600, complying with the requirements of ASTM B 584.
- C. Wall-Mounted Panel Sign Mountings:
1. Vinyl-tape mounting: Double-sided foam tape for use on smooth, nonporous surfaces.

2.3 FINISHES

- A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the architect from the manufacturer's standards.
- B. Metal Finishes: Comply with NAAMM "Metal Finishes Manual" for finish designations and applications recommendations.

2.4 CAST METAL PLAQUES (NIC)

- A. Castings shall be free from pits, scale, sand holes, or other defects. Hand-tool and buff borders and raised copy to produce the manufacturer's standard satin polished finish.
 - 1. Metal:
 - a. Bronze.
 - 2. Border:
 - a. Plain bevel.
 - 3. Border and foreground finish:
 - a. Bronze: Natural satin.
 - 4. Background texture:
 - a. Pebble texture.
 - 5. Background finish.
 - a. Cast bronze: Dark statuary finish to comply with the requirement specified for bronze finishes.

2.5 PANEL SIGNS

- A. General:
 - 1. Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
 - 2. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions.
- B. Frameless Panel Signs: Fabricate signs with edges mechanically and smoothly finished to conform with the following requirements:
 - 1. Edge condition: Square cut.
 - 2. Corner condition: Square corners.

- C. Backing: Permanently laminate face panels to backing sheets of material and thickness indicated using the manufacturer's standard process where required by fabricating process or mounting methods, or where otherwise indicated.
- D. Panel Sign Copy Process and Materials:
 - 1. Graphic Process: Mohawk Sign Systems Series 200A sand carved with 1/32" raised letters, numerals and braille copy.
 - 2. 1/8" thick melamine plastic laminate material. Fire retardant, and self-extinguishing, U.S. Government Specification LP-387A, Type NDP.
 - 3. Format Type B (with border), 3/8" wide, raised perimeter.
 - 4. Size: 2-1/2" high x length required, up to 24". 4-1/2" and length required for double line copy.
 - 5. Letterform: Helvetica Medium Upper Case, size 3/4" with Grade 2 braille below. Copy to be centered vertically and horizontally.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
 - 2. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
- B. Cast Metal Plaques:
 - 1. Mount plaques using the standard method recommended by the manufacturer for the type of wall surface indicated.
 - 2. Face mounting: Mount plaques using exposed fasteners with rosettes attached through the face of the plaque into the wall surface.
- C. Wall-Mounted Panel Signs:
 - 1. Attach panel signs in accordance with manufacturer's instructions and using mounting methods indicated.

3.2 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION

**SECTION 10521
FIRE EXTINGUISHERS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Portable fire extinguishers.
 - 2. Fire extinguisher mounting brackets.

1.2 REFERENCES

- A. Fire Protection Equipment Directory; Underwriters Laboratories Inc. (UL); latest edition.
- B. NFPA 10 -- Standard For Portable Fire Extinguishers; National Fire Protection Association; 2013.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's data showing compliance with contract documents.
- B. Operating and Maintenance Data: Instruction manual complying with requirements of NFPA 10.
- C. Certification: Installer shall submit written certification that the fire extinguishers installed comply with the contract documents and are fully and correctly charged.

1.4 QUALITY ASSURANCE

- A. Provide only fire extinguishers which comply with NFPA 10.
- B. Labels: Provide only fire extinguishers which are listed and labeled by Underwriters Laboratories Inc.

1.5 PROJECT CONDITIONS

- A. Do not deliver or install extinguishers until just before substantial completion.
- B. Do not use permanent fire extinguishers for construction period fire protection.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS

- A. Manufacturers: Products of the following manufacturers, provided they comply with requirements of contract documents, will be among those considered acceptable:

1. Fire extinguishers:
 - a. Amerex Corporation.
 - b. Ansul Fire Protection/A Grinnell Company.
 - c. Walter Kidde, The Fire Extinguisher Co.
- B. Fire Extinguishers:
 1. Rating: 4A:60B:C.
 2. Type: Multipurpose dry chemical (ammonium phosphate).
 - a. Stored pressure type.
 3. Wall mounted.
- C. Identification of Wall-Mounted Fire Extinguishers: Provide manufacturer's standard vinyl decal on wall above extinguisher.
- D. Brackets: Provide wall bracket for each wall-mounted extinguisher.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Perform installation in accordance with the manufacturer's instructions except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.
- B. Install extinguishers in locations indicated.
- C. Install brackets for wall mounted extinguishers at height necessary to place the top of the extinguisher at 48 inches above finish floor.

3.2 OWNER PERSONNEL INSTRUCTION

- A. Instruct designated personnel of owner in:
 1. Operation of extinguishers.
 2. Frequency of inspection and maintenance.
 3. Procedures for inspection and maintenance.
 4. Designation of inspection and maintenance entity.

END OF SECTION

SECTION 11311
HORIZONTAL SPLIT CASE PUMPS

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install **Two (2)** horizontal split case pumping units equipped complete, as shown on the drawings and as specified herein. Pump construction shall meet the Clean Water Act of 2014. Pump shall be as manufactured by Peerless Pump Model 6AE16N Mechanical Seal, Horizontal Frame Mount 60 Hp 230/460V 3Ph (basis of design) or prior approved equal.
- B. Horizontal split case pumps. Each unit shall be furnished with a pump and driver. Drivers are to be mounted on a structural steel heavy-duty base and connected to the pump with a flexible coupling.
- C. All necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in this specification or not shall be furnished and installed as required for an installation incorporating the highest standards for this type of service. Also included shall be supervisory services during installation and field testing of each unit and instructing the regular operating personnel in the proper care, operation, and maintenance of the equipment.
- D. **The Contractor shall require the pump manufacturer's representative to coordinate design with the supplier of the variable frequency drives. Motors for variable frequency drive applications shall adhere to NEMA MG 1, Part 31, Definite Purpose Inverter Fed Polyphase Motors.**

1.02 RELATED WORK

- A. Concrete work and the installation of anchor bolts are included in Division 3; however, anchor bolts for these units shall be furnished under this Section.
- B. Field painting is included in Section 09900
- C. Electrical work except as hereinafter specified is included in Division 16100.
- D. Valves, mechanical piping, piping appurtenances, pipe hangers, and pipe supports are included in Sections 02665 and 15094.

1.03 SUBMITTALS

- A. Shop drawings and product data, in accordance with Section 01340, shall include the following:

1. Dimensional drawings of each item of equipment and auxiliary apparatus to be furnished.
2. Foundation, pump support, and anchor bolt plans and details.
3. Schematic electrical wiring diagram and other data as required for complete pump installation.
4. Literature and drawings describing the equipment in sufficient detail, including parts list and materials of construction, to indicate full conformance with the detail specifications.
5. Total weight of pumping unit.
6. A statement that the pump will function properly as installed with respect to the suction piping layout as shown on the drawings.

B. Design Data

1. Manufacturer's rating curves, to satisfy the specified design conditions, showing pump characteristics of discharge, head, brake horsepower, efficiency and guaranteed net positive suction head required (NPSHR). Variable speed curves shall be provided showing at least four speeds plotted equally from maximum rpm to minimum RPM. Minimum RPM shall be no less than that required to obtain minimum flow. Curves shall show the full-recommended range of performance and include shut-off head. This information shall be prepared specifically for the pump model proposed. Catalog sheets showing a family of curves will not be acceptable.
2. **Motors for variable frequency drive applications shall adhere to NEMA MG 1, Part 31, Definite Purpose Inverter Fed Polyphase Motors.**

C. Test Reports

1. Tabulated data for the drive motors including rated HP, full load RPM, power factor and efficiency curves at 1/2, 3/4 and full load, service factor and KW input, including when the pump is at its design point. **Submit a certified statement from the motor manufacturer that the motors are capable of continuous operation on the power supply from the variable frequency drives to be furnished without affecting their design life for bearings or windings.**

D. Operation and Maintenance Data

1. Complete operating and maintenance instructions (O&M) shall be furnished for all equipment included under these specifications. The maintenance instructions shall include trouble shooting data and full preventative maintenance schedules and complete spare parts lists with ordering information.

1.04 QUALITY ASSURANCE

- A. To assure unity of responsibility, the pumps and motors shall be furnished and coordinated by the pump manufacturer. The Contractor shall assume responsibility for the satisfactory coordination, installation and operation of the entire pumping system including pumps, motors, variable speed drives and controls as specified.
- B. The equipment covered by these specifications is intended to be standard pumping equipment of proven ability as manufactured by concerns having extensive experience in the production of such equipment. A single manufacturer shall furnish units specified herein. The equipment furnished shall be designed, constructed, and installed to operate satisfactorily when installed as shown on the drawings.
- C. Pumps shall be manufactured in accordance with the Hydraulic Institute Standards, except where otherwise specified herein.
- D. The pump manufacturer shall be fully responsible for the design, arrangement, and operation of all connected rotating components, including soleplate(s), if any, of the assembled pumping unit mounted on a fabricated steel baseplate, to ensure that neither harmful nor damaging vibrations occur at any speed within the specified operating range.
- E. Vibration, when measured in the direction of maximum amplitude on the top of the pumps and the top of the motor bearing housing, shall not exceed the peak to peak displacement and maximum peak velocity level listed in the Hydraulic Institute Standards (current edition), at any speed within the specified operating speed range.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the unit and equipment are ready for operation.
- B. All equipment and parts must be properly protected against any damage during shipment. Store equipment in accordance with the manufacturer's instruction.
- C. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.
- D. The finished surfaces of all exposed flanges shall be protected by wooden or equivalent blank flanges strongly built and securely bolted thereto.
- E. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.
- F. For protection of bearings during shipment and installation, the bearing shall be properly processed. Anti-friction bearings, if prelubricated, shall be protected in accordance with the bearing manufacturer's recommendations against formation of rust during a long

period of storage while awaiting completion of installation and start-up of the machine in which they are used. Anti-friction bearings, which are not prelubricated, shall be properly treated in accordance with the bearing manufacturer's recommendation against formation of rust during a long period of storage while waiting completion of installation and start-up by the application of Exxon Rust-Ban No. 392, or equal treatment.

1.08 MAINTENANCE

- A. All spare parts shall be properly protected for long periods of storage and packed in containers that are clearly identified with indelible markings as to contents.
- B. Furnish the following spare parts for each pump.

<u>Quantity</u>	<u>Item</u>
1. 1 set per pump	AE Major Repair Kit P/N 96876227 Includes Casing Rings, Shaft Sleeve, Inside and Outside Shaft Bearings, Mechanical Seal Flange, Impellar Copling Keys, Case Gasket & Seals and Inboard Bearing Cover.

PART 2: PRODUCTS

2.01 GENERAL

- A. The pumping units shall all be supplied by one manufacturer and shall be complete including pumps, motors, controls, and appurtenances such as, but not limited to, couplings, guards, and gauges.
- B. The pumps, motors, drives, and controls shall be designed and built for 24-hour continuous service at any and all points within the required range of operation, without overheating, without cavitation, and without excessive vibration or strain. All parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness and to be especially constructed to meet the Specifications. Ample room and facilities shall be provided for inspection, repairs, and adjustment.
- C. All necessary foundation bolts, nuts, and washers shall be furnished and shall be Type 316 stainless steel.
- D. Each major piece of equipment shall be furnished with a nameplate (with embossed data) securely mounted to the body of the equipment. As a minimum, the nameplate for the pumps shall include the manufacturer's name and model number, serial number, rated flow capacity, head, speed, and all other pertinent data. As a minimum, nameplates for motors shall include the manufacturer's name and model number, serial number, horsepower, speed, input voltage, amps, number of cycles and power and service factors.

2.02 CONDITIONS OF OPERATION

- A. Each pump shall be designed for the conditions of service tabulated as follows and shall operate within the system head curves as appended.

Ridgewood

Pump Model-Peerless Pump	6AE16N
Impeller	2692931
Service:	Water
No. Of pumps:	2
Duty:	1
Standby:	1
Design capacity (gpm):	1000
Design total head (TH) (ft):	156
Minimum efficiency at design:	75%
Maximum speed (rpm):	1785
2nd design point capacity (gpm):	600
2nd design point head (ft):	186
Non-overloaded motor HP:	60
Minimum pump casing suction diameter (in):	8"
Minimum pump casing discharge diameter (in):	6"

Where total head (TH) is referred to in conjunction with the specified discharge requirements, it shall be understood to consist of the sum of the pressure head plus the velocity head, in feet, at the discharge nozzle of the pump minus the pressure head and the velocity head at the suction nozzle of the pump. The efficiency of the pump shall be understood to be based upon total head as just defined.

2.03 DESCRIPTION OF SYSTEM OPERATION

- A. Variable Speed Pumping System
1. A pumping rate controller (VFD) shall be provided for operation of the pumping units. The pump; motor drive and control system shall consist of an A.C. adjustable, frequency drive controller.
 2. The A.C. adjustable frequency drive controller shall respond to the control system to automatically start, change speeds and stop pumps in accordance with the ground storage tank level control program.

3.01 INSTALLATION

- A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Anchor bolts shall be set in accordance with the manufacturer's recommendations and setting plans.
- B. Qualified supervisory services, or manufacturers' representatives, shall be provided to insure that the work is done in a manner fully approved by the respective equipment manufacturer. The pump manufacturer's representatives shall specifically supervise or inspect the installation and alignment of the pump with the driver, the grouting, and the alignment of the connection piping and the installation of the field-installed mechanical seal. Services of the manufacturer's representatives and training shall be provided at startup of pumps.
- C. A certificate (Start Up Report) from each equipment manufacturer shall be submitted stating that the installation of his/her 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 FIELD TESTS

- A. In the presence of the Engineer, such tests as necessary to indicate that the pumps, motors, and variable speed drive generally conform to the efficiencies and operating conditions specified shall be performed. Provide, calibrate and install all temporary gauges and meters, shall make necessary tapped holes in the pipes, and install all temporary piping and wiring required for the field acceptance tests. Written test procedures shall be submitted to the Engineer for review.

END OF SECTION

SECTION 13200

PRESTRESSED CONCRETE STORAGE TANK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. This section specifies the design and construction of an AWWA D110 Type II, wire-wound prestressed concrete storage tank with galvanized steel diaphragm complete including all reinforcing, concrete work, accessories, disinfection and testing directly related to the tank.
- B. The tank contractor is responsible for furnishing all labor, materials, tools and equipment necessary to design and construct the prestressed concrete storage tank as indicated on the drawings and as described in this specification.

1.2 RELATED SECTIONS

- A. Section 02100 – Site Preparation
- B. Section 02200 – Earthwork and Excavation.
- C. Section 02610 – Piping.
- D. Section 02665 – Water Mains & Accessories
- E. Section 02675 - Disinfection of Potable Facilities
- F. Appendix A – Geotechnical Exploration

1.3 SUBMITTALS

- A. Shop Drawings: Provide shop drawings with a minimum size of 18" x 24" with a complete plan, elevation, and sectional views showing critical dimensions as follows:
 - 1. Size, location and number of all reinforcing bars.
 - 2. Thickness of all parts of the tank structure including floor, core wall, dome, and covercoat.
 - 3. Prestressing schedule including number and placement of prestressing wires on the tank wall and total applied force per foot of wall height.
 - 4. Location and details of all accessories required.
- B. Concrete Data: Submit concrete design mixes including ingredient proportions, minimum cementitious content, and water/cementitious ratio in accordance with Section 2.2 and 2.3 of this specification.
- C. Design Data: Submit structural calculations for the tank, signed and sealed by a professional engineer in accordance with Section 1.5 A.3 of this specification.
- D. Coating Data: Submit color charts for review by the engineer and owner. Once a color is chosen, submit actual drawdown samples for final approval prior to application of coating.

- E. Test Reports: Submit concrete strength reports for 7-day and 28-day breaks taken in accordance with the requirements of Section 3.3 A.1.
- F. Warranty Document: Submit warranty document in Owner's name in accordance with Section 1.6 A. of this specification.
- G. Cleaning and Disinfection Plan: Submit a cleaning and disinfection plan which complies with Section 3.4 of this specification.
- H. Project Record Documents: Record actual location layout and final configuration of tank and accessories on shop drawings and submit to engineer after construction of the tank is complete.

1.4 QUALITY ASSURANCE

A. Qualifications and Experience:

1. Tank Construction Company: Shall be a firm with ten years of experience in the design and construction of ANSI/AWWA D110 Type II wire-wound, circular prestressed concrete tanks with satisfactory evidence that it has the skill, reliability, and financial stability to build and guarantee the tank in accordance with the quality required by these specifications. The company constructing the tank shall have built completely in its own name in the past five years, and be presently responsible for, a minimum of twenty (20) dome-covered prestressed composite tanks of equal or greater size than that required for this project which meet these specifications and are now providing satisfactory service.
2. Construction: The entire tank, including all portions of the floor, wall, and roof shall be built by the tank construction company, using its own trained personnel and equipment.
3. Design: All design work for the tank shall be performed by a professional engineer with no less than five years of experience in the design and construction of ANSI/AWWA D110 Type II wire-wound, circular prestressed concrete tanks. The professional engineer shall be a full-time staff member of the tank construction company and shall be licensed to work in the state where the project is located.
4. The diaphragm design and epoxy injection procedure shall have been used in the twenty tanks required in Section 1.5 A.1 of this specification.

B. Prequalification:

- a. Complete details of other structural appurtenances as required by the project drawings showing principal sizes, thickness and reinforcing sizes and spacing.
- b. Complete design calculations which address applicable loads provided in Section 1.7 B. of this specification.
- c. Complete experience record for the tanks used to meet the experience requirement of Section 1.5 A. of this specification that have been designed and built in the tank construction company's own name. The record shall include the size of the tank, name, address and telephone number of the Owner, the year of construction and the name and telephone number of the Engineer for the project.

- d. Construction schedule which details the duration for tank construction.
1. The following are preapproved as acceptable tank construction companies:
 - a. The Crom Corporation, Gainesville, Florida.
 - b. Precon Corporation, Newberry, Florida

1.5 WARRANTY

- A. Provide a warranty document for workmanship and materials on the complete structural portion of the tank for a five-year period from the date of acceptance of the work. In case leakage or other defects appear within the five-year period, the tank construction company shall promptly repair the tank at its own expense upon written notice by the Owner that such defects have been found. Leakage is defined as a stream flow of liquid appearing on the exterior of the tank, the source of which is from the inside of the tank. The tank construction company shall not be responsible for, nor liable for, any subsurface condition. This warranty shall not apply to any accessory, equipment or product that is not a structural part of the tank and is manufactured by a company other than the tank construction company.

1.6 DESIGN CRITERIA

- A. The design shall be in conformance with applicable portions of American Concrete Institute (ACI) 372R Design and Construction of Circular Wire- and Strand-Wrapped Prestressed Concrete Structures, ANSI/AWWA D110 Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks, and currently accepted engineering principles and practices for the design of such structures.
- B. The following loadings shall be utilized in the design:

Ridgewood Water Production Facility

1. Capacity: 250,000 Gallons
2. Dimensions: 45'-0" Inside Diameter
21'-1" Water Depth
3. Fluid Loads: Shall be the weight of all liquid when the reservoir is filled to capacity. The unit weight of the liquid material shall be 62.4 lbs/ft³.
4. Roof Live Loads: Consideration shall be given to all applicable roof design loads in accordance with ANSI/AWWA D110, Section 3.3 and ASCE 7. The minimum roof live load for the structure shall be 20 psf.
5. Dead Loads: Consideration shall be given to all permanent imposed loads including concrete and steel.
6. Seismic Loads:
 - a. Seismic forces and moments resulting from water sloshing and seismic accelerations of the tank dome, wall, and water loads shall be calculated in accordance with ACI 350.3 or ANSI/AWWA D110.
 - b. If sufficient freeboard height is not provided to prevent uplift forces due to sloshing, the impulsive participation shall be increased due to the constrained motion of liquid, and the tank roof and its connection shall be designed to resist the uplift forces in accordance with P.K. Malhotra's "Earthquake Induced Sloshing in Tanks with Insufficient Freeboard".

7. Soil Pressure: Earth loads shall be determined by rational methods of soil mechanics. Soil pressure shall not be used in the design of the core wall to counteract hydraulic loads or provide residual compression in the wall.
 8. Differential Backfill Loads: Forces from differential backfill loads shall be considered in the design and shall be based on the at-rest coefficient. Passive resistance shall not be used to resist differential backfill loads.
 9. Wind Loads: Wind loads shall be considered in the design in accordance with ASCE 7.
- C. Floor: The design of the floor for the prestressed concrete tank shall conform to the following:
1. Concrete membrane floors shall be a minimum of 4" thick and have a minimum thickness of 8" of concrete over all pipe encasements and around sumps.
 2. A minimum percentage of 0.60% reinforcing steel shall be used in the membrane floor. The minimum percentage shall apply to all thickened sections and shall extend a minimum of 2' into the adjacent membrane floor.
- D. Core wall:
1. The wire-wound, prestressed concrete tank core wall shall be designed as a thin shell cylindrical element using shotcrete and an embedded, mechanically bonded, galvanized steel shell diaphragm.
 2. The design of the core wall shall take into account appropriate edge restraint. To compensate for bending moments, shrinkage, differential drying, and temperature stresses, the following minimum reinforcing steel shall be incorporated into the design:
 - a. The top 2' of core wall shall have not less than 1% circumferential reinforcing.
 - b. The bottom 3' of core wall shall have not less than 1% circumferential reinforcing.
 - c. Inside Face:
 - (1) The inside face of the core wall shall utilize the diaphragm as effective reinforcing.
 - (2) Additional vertical and horizontal reinforcing steel bars shall be used as required by design computations.
 - d. Outside Face:
 - (1) Vertical reinforcing steel in the outside face of the core wall shall be: minimum of #4 bars at 12" center to center.
 - (2) Additional vertical and horizontal reinforcing steel bars shall be used as required by design computations.
 3. The minimum core wall thickness shall be 3½".
 4. Reinforcing steel used in the core wall shall be designed using a maximum allowable design tensile stress, f_s , of 18,000 psi.
 5. Allowable compressive stress in the core wall due to initial prestressing force, f_{gi} , shall be:
 - a. 1250 psi + 75t psi/in. with 0.5 f'_{gi} maximum or less (where f'_{gi} is defined as compressive strength at time initial prestressing force is applied and t is the thickness of the core wall in inches).
 - b. Maximum of 2025 psi.

6. Allowable compressive stress in the core wall due to final prestressing force, f_g , shall be:
 - a. 1250 psi + 75t psi/in. with 0.45 f'_g maximum (where f'_g is defined as compressive strength required for final prestressing force and t is the thickness of the core wall in inches).
 - b. Maximum of 2000 psi.

E. Dome:

1. The dome roof shall be constructed of reinforced concrete and shall be circumferentially prestressed.
2. Dome shell reinforcement shall consist of reinforcing bars or welded wire fabric meeting ASTM A1064/A1064M, not galvanized. Bolsters for wire fabric and reinforcing bars shall be plastic. Wire ties shall be galvanized.
3. The dome ring girder shall be prestressed with sufficient wire to withstand the dome dead load and design live loads. The ring girder shall have cross section suitable to accept the applied prestressing forces.
4. The high water level in the tank shall be permitted to encroach on the dome shell no higher than the upper horizontal plane of the dome ring girder.
5. Overflow outlets or the overflow pipe shall be capable of providing an overflow open area three times the area of the largest influent pipe.
6. Overflow outlets plus the dome ventilator shall be capable of providing an open area three times the area of the largest pipe.
7. The dome shall be designed as a free-span, spherical thin shell with one-tenth rise in accordance with the following:
 - a. Typical Dome Design: The typical dome thickness and steel reinforcement shall meet the requirements of ANSI/AWWA D110.
 - b. In all cases, the thickness of the dome shall be no less than 3".
 - c. Dome Edge Design: The dome edge and upper wall shall be designed to resist the moments, thrusts, and shears that occur in this region due to dome and wall prestressing and loading conditions. The design of the edge region shall conform to the following:

(1) Dome Edge Thickness:

- (a) A determination of the buckle diameter shall be made, as defined by:

$$d_b = 2.5 \cdot \sqrt{r_d \cdot t_d} \text{ rounded up to the next foot}$$

Where: d_b = buckle diameter in feet

r_d = dome radius in feet

t_d = typical dome thickness in feet

- (b) Dome edge thickening shall begin at a radial location on the dome, defined as s_2 which is at least one buckle diameter away from the tank wall.

- (c) A springline haunch shall be provided, which extends radially from the inside face of the tank wall to radial location s_1 which is defined as:

$$s_1 = 0.6 \cdot \sqrt{1.5 \cdot r_d \cdot t_d} \text{ rounded up to the next foot}$$

Where: s_1 = distance from inside face of wall to haunch in feet
 s_2 = distance from inside face of wall to typical dome thickness in feet.

This springline haunch shall begin at the inside face of the tank wall with a springline thickness as required by paragraph (f) below and shall end at radial location s_1 with the following thickness:

$$t_{d1} = 1.33 \cdot t_d$$

Where: t_{d1} = minimum thickness at s_1 in feet
 t_d = typical dome thickness in feet at one buckle diameter from tank wall

- (d) Beginning at s_1 and continuing to s_2 the dome shell shall have a uniform straight line taper.
- (e) Parameters (b), (c), and (d) above are not required for domes where the calculated typical dome thickness is less than 75% of the actual typical dome thickness.
- (f) Sufficient concrete thickness at the springline of the dome shall be provided so that no more than 2' of the springline haunch is considered in calculating the effective dome edge ring cross sectional area. Compressive stress in this area shall not exceed 1000 psi when subjected to initial prestressing, offset by dead load only.

(2) Dome Edge Steel Reinforcement:

- (a) Throughout the dome edge, the percentage of steel reinforcement, both radially and circumferentially, shall be no less than 0.25% of the gross cross sectional area of concrete.
- (b) Along the dome edge, steel reinforcement shall be distributed between the upper and lower layers unless finite element analysis calculations indicate that tensile stress does not exist in the concrete along the bottom face of the dome edge. In that case, only top bars are required radially and circumferentially. In addition, radial and circumferential reinforcing bars will not be required along the bottom face of the dome edge where the calculated typical dome thickness is less than 75% of the actual typical dome thickness.
- (c) Where reinforcing bars are required in the bottom layer, they shall be placed near the tank wall to insure adequate development at the intersection between dome and wall.
- (d) In all cases, the percentage of circumferential steel reinforcement in the effective dome ring shall be no less than one percent of the gross cross

sectional area of concrete. The effective dome ring is defined as $\frac{1}{4}$ of the haunch length not to exceed 2'.

- (e) Where bottom dome edge steel reinforcement is required, vertical steel reinforcement along the inside face of the tank wall shall be no less than 0.5% of the cross sectional area of wall shotcrete.

F. Prestressing:

1. Circumferential prestressing of the tank shall be achieved by the application of cold-drawn, high-carbon steel wire complying with ASTM A821/A821M Type B, placed under high tension.
2. A substantial allowance shall be made for prestressing losses due to shrinkage and plastic flow in the shotcrete and due to relaxation in the prestressing steel.
3. The prestressing design shall conform to the following minimum requirements:
 - a. Working stress for the tank wall, f_s , shall be a maximum of 115,000 psi.
 - b. Working stress for the dome ring, f_{sd} , shall be a maximum of 120,000 psi.
 - c. The allowable design tensile stress in the prestressing wire before losses, f_{si} shall be 145,600 psi or no greater than $0.63 f_u$, where f_u is defined as the ultimate strength of the wire.
 - d. Areas to be prestressed will contain not fewer than 10 wires per foot of wall for 8 gauge and 8 wires per foot of wall for 6 gauge.
 - e. A maximum of 24 wires per layer per foot for 8 gauge and 20 wires per layer per foot for 6 gauge will be allowed.

G. Wall Openings:

1. When it is necessary for a pipe to pass through the tank wall, the invert of such pipe or sleeve shall be no less than 18" above the floor slab, and the prestressing wires required at the pipe elevation shall be distributed above and below the opening leaving an unbanded strip around the entire tank.
2. Unbanded strips shall have a vertical dimension of no more than 36" unless an axis-symmetric shell analysis is performed to account for compressive forces plus shear and moments caused by displacement of the prestressing wires into adjacent bands.

PART 2 PRODUCTS

2.1 PERFORMANCE

- A. Performance of the materials used in the tank construction shall conform to the minimum requirements of this specification.
- B. Substitutions to the materials in this specification may only be made if submitted in writing and approved by the engineer.

2.2 CONCRETE

- A. Concrete shall conform to ACI 301/301M.
- B. All concrete shall utilize Type I/II Portland cement.

- C. A maximum of 25% of cementitious material may be fly ash.
- D. Admixtures other than air-entraining and water reducing admixtures will not be permitted unless approved by the engineer.
- E. Coarse and fine aggregate shall meet the requirements of ASTM C33/C33M.

- F. Concrete mixes used in the construction of the tank shall conform to the following:

Mix	Compressive Strength (psi)	Minimum Cement Content (lbs)	Maximum Aggregate Size (in)	Maximum W/C Ratio	Air Content (%)	Slump (in)
Floor	4000	560	$\frac{3}{4}$	0.45		4" +/- 1"
Dome	4000	600	$\frac{3}{8}$	0.45		4" +/- 1"

2.3 SHOTCRETE

- A. Shotcrete shall conform to the requirements of ACI 506.2 except as modified herein.
- B. All shotcrete mixes shall utilize Type I/II cement.
- C. A maximum of 25% of cementitious material may be fly ash.
- D. All shotcrete in contact with diaphragm or prestressing wire shall be proportioned to consist of not more than three parts sand to one part Portland cement by weight. All other shotcrete shall be proportioned to consist of not more than four parts sand to one part Portland cement by weight.
- E. Admixtures will not contain more than trace amounts of chlorides, fluorides, sulfides or nitrates.
- F. Shotcrete mixes used in the tank construction shall conform to the following:

Mix	Compressive Strength (psi)	Maximum W/C Ratio	Air Content (%)	Slump (in)	Fiber Reinforcement (lbs/cyd)
Core Wall	4000	0.42		4" +/- 1"	-
Covercoat	4000	0.42		4" +/- 1"	

2.4 PRESTRESSED REINFORCEMENT

- A. The prestressing wire shall conform to the requirements of ASTM A821/A821M, Type B.
- B. The prestressing wire size shall be 0.162" (8 gauge), 0.192" (6 gauge) or larger, but no larger than 0.250".
- C. The ultimate tensile strength, f_u shall be, 231,000 psi or greater for 8 gauge wire, 222,000 psi or greater for 6 gauge.
- D. Splices for horizontal prestressed reinforcement shall be ferrous material compatible with the reinforcement and shall develop the full strength of the wire.

2.5 NON-PRESTRESSED REINFORCEMENT

- A. Non-prestressed mild reinforcing steel shall be new billet steel meeting the requirements of ASTM A615/A615M-12 with a minimum yield strength, f_y , of 60,000 psi.
- B. Welded wire reinforcing shall be plain wire conforming to the requirements of ASTM A1064/A1064M with a minimum yield strength, f_y , of 65,000 psi.

2.6 GALVANIZED STEEL DIAPHRAGM

- A. The galvanized steel diaphragm used in the construction of the core wall shall be 26 gauge with a minimum thickness of 0.017 in. conforming to the requirements of ASTM A653/A653M. Weight of zinc coating shall be not less than G 90 of Table 1 of ASTM A653/A653M.
- B. The diaphragm shall be formed with re-entrant angles and erected so that a mechanical key is created between the shotcrete and diaphragm.
- C. The diaphragm shall be continuous from bottom to top of wall; horizontal joints or splices will not be permitted.
- D. All vertical joints in the diaphragm shall be rolled seamed, crimped and sealed watertight using epoxy injection.
- E. In all tanks designed to use a waterstop at the floor/wall joint, the steel shell diaphragm shall be epoxy bonded to the waterstop.

2.7 PVC WATERSTOPS, BEARING PADS AND SPONGE FILLER

- A. Plastic waterstops shall be extruded from an elastomeric plastic material of which the base resin is virgin polyvinyl chloride.
- B. The profile and size of the waterstop shall be suitable for the hydrostatic pressure and movements to which it is exposed.

- C. Bearing pads used in floor/wall joints shall consist of neoprene, natural rubber or polyvinyl chloride.
- D. Sponge filler at the floor/wall joint shall be closed-cell neoprene.

2.8 EPOXY

A. Epoxy Sealants:

1. Epoxy used for sealing the diaphragm shall conform to the requirements of ASTM C881/C881M.
2. Epoxy used for sealing the diaphragm shall be, Type III, Grade 1, and shall be a 100% solids, moisture insensitive, low modulus epoxy system.
3. When pumped, maximum viscosity of the epoxy shall be 10 poises at 77°F.
4. The epoxy sealants used in the tank construction shall be suitable for bonding to concrete, shotcrete, PVC and steel.

B. Bonding Epoxy:

1. Epoxy resins used for enhancing the bond between fresh concrete and hardened concrete shall conform to the requirements of ASTM C881/C881M.
2. Epoxy resins shall be a two-component, 100% solids, moisture-insensitive epoxy and shall be Type II, Grade 2.

2.9 SEISMIC RESTRAINT CABLES

- A. When required by design, seismic restraint cables shall be seven-wire strand conforming to ASTM A416/A416M.
- B. The strand shall be protected with a fusion-bonded, grit-impregnated epoxy coating conforming to ASTM A882/A882M.
- C. The minimum yield strength of the seven-wire strand shall be 270,000 psi.

2.10 TANK ACCESSORIES

- A. Minimum of one, 1' 5" x 4' 4" rectangular Type 316 stainless steel wall manhole for access to the interior of the tank. The cover and the bolts shall also be of Type 316 stainless steel. The wall manhole shall be designed to resist hydraulic loading without excessive deflection.
- B. Exterior ladder shall be fabricated from 6061-T6 and 6063-T6 aluminum with Type 316 stainless steel fasteners and shall conform with all applicable OSHA standards. The ladder shall have an aluminum safety cage and lockable security gate and/or a safety climbing device as required to meet applicable OSHA standards.
- C. Interior ladder shall be fabricated from fiberglass with Type 316 stainless steel fasteners and shall conform with all applicable OSHA standards. The ladder shall have a safety

climbing device manufactured from Type 316 stainless steel as required to meet applicable OSHA standards.

- D. Roof hatch cover, roof ventilator, and liquid level indicator shall be fabricated from fiberglass with Type 316 stainless steel fasteners.
- E. Through-wall pipe sleeves shall be Type 316 stainless steel sleeves with neoprene modular seal units using stainless steel tightening bolts.
- F. 1,900 gpm aerator
- G. 25" fiberglass ventilator with curbs (2 required)
- H. Stainless pipe bracket for 16" DIP overflow pipe
- I. 8" dome probe curb
- J. Baffle curtain and SS attaching hardware
- K. 3" PVC aerator drain with SS pipe hangers

2.11 COATINGS

- A. Exterior coating system shall consist of one of the following:
 - 1. Two coats Tnemec Series 156 Enviro-Crete Modified Waterborne Acrylate.
 - 2. Two coats Thoroseal Waterproof Cement-Based Coating.

PART 3 EXECUTION

3.1 EXAMINATION

- A. All subgrade elevations shall be verified prior to starting tank construction.

3.2 INSTALLATION

- A. Floor:
 - 1. The subgrade shall be prepared by fine grading to ensure proper placement of reinforcing steel with proper bottom cover.
 - 2. A 6-mil polyethylene vapor-barrier shall be placed after subgrade preparation has been completed.
 - 3. Form and screed boards shall be of proper thickness and sufficiently braced to ensure that the floor is constructed within proper thickness tolerances.
 - 4. Plate bolsters shall be used to support reinforcing steel in the construction of the floor to ensure positive control of placement of reinforcing steel.
 - 5. The floor shall be vibratory screeded to effect consolidation of concrete and proper encasement of floor reinforcing steel.
 - 6. The floor shall be water cured for a minimum of 7 days after casting.

7. The floor shall receive a light broom finish.

B. Core Wall:

1. The wall shall be constructed in a predesigned manner utilizing diaphragm and layers of shotcrete with each conforming to the following:
 - a. Diaphragm Erection:
 - (1) The diaphragm shall be protected against damage before, during, and after erection. Nail or other holes shall not be made in the diaphragm for erection or other purposes except for inserting wall pipes or sleeves, reinforcing steel, bolts, or other special appurtenances. Such penetrations shall be sealed with an epoxy sealant which complies with Section 2.8 Epoxy.
 - b. Shotcrete:
 - (1) All shotcrete shall be applied by or under direct supervision of experienced nozzle men certified by the American Concrete Institute (ACI) as outlined in ACI certification publication CP-60.
 - (2) Each shotcrete layer shall be broomed prior to final set to effect satisfactory bonding of the following layer.
 - (3) No shotcrete shall be applied to reinforcing steel or diaphragm that is encrusted with overspray.
 - (4) No less than 1/8" thick shotcrete shall separate reinforcing steel and prestressing wire.
 - (5) The diaphragm shall be encased and protected with no less than 1" of shotcrete in all locations.
 - (6) The interior shotcrete shall receive a light broom finish.
 - c. Curing:
 - (1) Interior and exterior portions of the shotcrete wall shall be water cured for a minimum of 7 days or until prestressing is completed.

C. Epoxy Injection:

1. Epoxy injection shall be carried out from bottom to top of wall using a pressure pumping procedure.
2. Epoxy injection shall proceed only after the diaphragm has been fully encased, inside and outside, with shotcrete.

D. Dome:

1. All concrete shall be consolidated by means of a vibrator for proper encasement of reinforcing steel and welded wire fabric.
2. All surfaces at the joint between the wall and the dome shall be coated with bonding epoxy which complies with Section 2.8 Epoxy.
3. Plastic bolsters shall be used to support reinforcing steel and welded wire reinforcement to ensure positive control on placement of steel.
4. The exterior surface of the dome shall receive a light broom finish.
5. The dome shall be water cured for a minimum 7 days after casting or until dome band prestressing is completed.

E. Prestressing:

1. The initial tension in each wire shall be read and recorded to verify that the total aggregate force is no less than that required by the design. Averaging or estimating the force of the wire on the wall shall not be considered satisfactory evidence of correct placement of prestressing wires.
2. Placement of the prestressing steel wire shall be in a continuous and uniform helix of such pitch as to provide in each lineal foot of core wall height an initial force and unit compressive force equal to that shown on the design drawings. Splicing of the wire shall be permitted only when completing the application of a full coil of wire or when removing a defective section of wire.
3. Shotcrete shall be used to completely encase each individual wire and to protect it from corrosion. To facilitate this encasement, the clear space between adjacent wires is to be no less than one wire diameter.
4. Prestressing shall be accomplished by a machine capable of continuously inducing a uniform initial tension in the wire before it is positioned on the tank wall. Tension in the wire shall be generated by methods not dependent on cold working or re-drawing of the wire. In determining compliance with design requirements, the aggregate force of all tensioned wires per foot of wall shall be considered rather than the force per individual wire, and such aggregate force shall be no less than that required by the design and as shown on approved drawings.
5. The tank construction company shall supply equipment at the construction site to measure tension in the wire after it is positioned on the tank wall. The stress measuring equipment shall include: electronic direct reading stressometer accurate to within 2%, calibrated dynamometers and a test stand to verify the accuracy of the equipment.
6. After circumferential prestressing wires have been placed, they shall be protected by encasement in shotcrete. This encasement shall completely encapsulate each wire and permanently bond the wire to the tank wall.
7. When multiple layers of wire are required, shotcrete cover between layers shall be no less than 1/8" thick.

F. Covercoat:

1. After all circumferential prestressing wires have been placed, a shotcrete cover having a thickness of no less than 1" shall be placed over the prestressing wires.
2. Horizontal sections of the wall shall form true circles without flat areas, excessive bumps or hollows.
3. The covercoat shall receive a sliced trowel finish.

G. Wall Openings:

1. All wall pipes, sleeves and manholes passing through the wall shall be sealed to the steel shell diaphragm by epoxy injection.

H. Coatings:

1. All coatings shall be applied a minimum of 28 days after final application of concrete or shotcrete.
2. All application procedures for coatings shall be in accordance with manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

A. Inspection and Testing:

1. Concrete and Shotcrete Testing:

a. Compression Tests:

- (1) Compression test specimens shall be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as selected by the Engineer to insure continued compliance with these Specifications. At least one set of test specimens shall be made for each 50 yards of concrete/shotcrete placed. Each set of test specimens shall be a minimum of 5 cylinders.
- (2) Compression test specimens for concrete/shotcrete shall conform to ASTM C172/C172M for sampling and ASTM C31/C31M for making and curing test cylinders. Test specimens shall be 6-inch diameter by 12-inch high or 4-inch diameter by 8-inch high cylinders.
- (3) Compression test shall be performed in accordance with ASTM C39/C39M. Two test cylinders will be tested at 7 days and two at 28 days. The remaining cylinder will be held to verify test results, if needed.

b. Air Content Tests:

- (1) Air content tests shall conform to ASTM C231/C231M (Pressure Method for Air Content).
- (2) Tests for air content shall be made prior to concrete placement and whenever compression test specimens are made.

c. Slump Tests:

- (1) Slump tests shall be made in accordance with ASTM C143/C143M.
- (2) Slump tests shall be made whenever compression test specimens are made.

2. Hydrostatic Testing:

a. The tank shall be tested for watertightness upon completion.

b. The testing for watertightness shall be completed as follows:

- (1) Fill the tank with water to the maximum water level and let it stand for a minimum of 24 hours.
- (2) Inspect the exterior of the tank wall and footing for damp spots. Damp spots shall be defined as spots where moisture can be picked up on a dry hand, the source of which is from inside the tank.
- (3) Leakage through the wall or wall-base joint shall be repaired and the tank shall be retested using the above procedure.

c. **See Appendix A and drawings for notes about loading and settlement. Final piping connections shall not be made until settlement and consolidation has**

occurred. Settlement shall be allowed to occur with the tank full of water for a minimum of 3 weeks.

3.4 CLEANING AND DISINFECTION

- A. The interior of the tank shall be cleaned to remove debris, construction items, and equipment prior to testing and disinfection.
- B. The following disinfection procedure shall be used to disinfect storage tanks used for potable water:
 - 1. Method 2 or 3 will be used for disinfection of the tank in accordance with ANSI/AWWA C652.
 - 2. When Method 3 is used, the disinfection plan required by Section 1.4 H. shall address any compatibility issues with the form of chlorine used for disinfecting the storage tank with the type of disinfectant used in the normal production of the water used to fill the tank.

END OF SECTION

SECTION 13201 FABRIC BAFFLE WALL

PART 1 – GENERAL

1.01 WORK INCLUDED

- 1.01.1 This specification covers the design, fabrication, and erection of tension-fabric baffle systems composed of NSF 61 compliant geo-membrane 8130 XR-3-PW as manufactured by the Seaman Corporation of Wooster, Ohio for the storage tank as shown on the contract drawings and specified herein.
- 1.01.2 The tank contractor shall furnish all labor, materials, and equipment required to design, fabricate, deliver and install the tensioned-fabric baffle system.

1.02 SHOP DRAWINGS AND SUBMITTALS

- 1.02.1 Before executing any of the work in this section, prints or drawings shall be submitted to the ENGINEER showing dimensions, sizes, thickness, gauges, materials, finishes, joints, attachment, anchorage, and erection procedures.

1.03 EXPERIENCE REQUIREMENTS

- 1.03.1 The baffle fabricator shall have furnished and had in satisfactory service for a period of not less than 5 years, at least 10 baffle systems with dimensions and quantities similar to the one specified for this project. The fabricator shall submit evidence of such with his submittal.

1.04 GUARANTEE

- 1.04.1 The baffle system shall be guaranteed for a period of 5 years from final acceptance against defective materials and workmanship.

1.05 WARRANTY

- 1.05.1 The geo-membrane manufacturer shall confirm in writing, that the material to be furnished will be free of defects in materials and workmanship at the time of the sale, and against deterioration due to effects of ozone, ultraviolet or other normal weathering on a pro-rated basis for up to 10 years from the date of completed installation. Manufacturer shall furnish a sample warranty for review and approval prior to shipment.

PART 2 – PRODUCTS

2.01 DESIGN REQUIREMENTS

2.01.1 The baffles shall conform to the specified dimensions and shall be designed for installation in potable water with chlorine and ammonia present in the tank. The baffle system shall be suitable for expected water levels with daily fluctuations and shall have adequate strength to resist 0.5 inch of water depth difference across the baffle.

2.01.2 The baffles shall be erected and anchored to the floor, walls, and roof as shown in the plans and positioned to provide a flow path for maximum contact time for potable water in the tank.

2.02 FABRIC

2.02.1 The fabric shall be listed by NSF61 as being acceptable for use in potable water. The fabric shall have a knitted polymer coated polyester fabric with a 6.5 oz. /sq. yd. minimum weight.

2.02.2 The fabric shall be of good appearance and free of all defects such as holes, tears, blisters and any other defects that may affect its serviceability.

2.02.3 The coated fabric shall not be less than 30 mils thickness with a +10 percent allowable variation. There shall be not less than 7 mils thickness of polymer coating over the base fabric.

2.02.4 The polyester fabric shall be non-wicking.

2.02.5 The coated fabric shall be UV stable (either black or black/white) in order to possess maximum UV resistance when exposed to the atmosphere for extended periods of time.

2.02.6 The fabric shall meet or exceed the following minimum physical properties:

8130 XR®-3PW fabric	Standard	Metric
Base Fabric Type	Polyester	
Base Fabric Weight (nominal)	6.5 oz/yd ²	220 g/m ²
Thickness ASTM D 751	30.0 mils min	0.75 mm min
Weight	30.0 ± 2 oz/yd ²	1020 ± 70 g/m ²

ASTM D 751		
Tear Strength ASTM D 751, Trapezoid Tear	35/35 lb min	155/155 N min
Breaking Yield Strength ASTM D 751, Grab Tensile Procedure A	550/550 lb min	2450/2450 N min
Low Temperature ASTM D 2136, 4 hr - 1/8" mandrel	Pass @ -30°F	Pass @ -35° C
Dimensional Stability ASTM D 1204, 212°F - 1 hr	1.5% max each direction	1.5% max each direction
Adhesion Heat Sealed Seam ASTM D 751, Dielectric Weld	35 lb/2 in min	150 N/5 cm min
Dead Load Seam Shear Strength ASTM D 751, 4 hr test	2 in seam, 1 in strip 210 lb @ 70°F 105 lb @ 160°F	5 cm seam, 2.5 cm strip 935 N @ 21°C 465 N @ 70°C
Bursting Strength ASTM D 751, Ball Tip	650 lb min 800 lb typical	2890 N min 3560 N typical
Hydrostatic Resistance ASTM D 751, Method A	800 psi min	540 N/sq cm min
Blocking Resistance ASTM D 751, 180°F/82°C	#2 Rating max	
Adhesion - Ply ASTM D 413, Type A	15 lb/min or Film Tearing Bond	65 N/2.5 cm min or Film Tearing Bond
Bonded Seam Strength ASTM D 751, Grab Test Method, Procedure A	550 lb min	2450 N min
Abrasion Resistance ASTM D 3389, H-18 Wheel 1000 g load	2000 cycles (min) before fabric exposure 50 mg/100 cycles max weight loss	
Weathering Resistance ASTM G 153 (Carbon-Arc)	8000 hrs (min) - No appreciable changes or stiffening or cracking of coating	
Water Absorption ASTM D 471, Section 12 7 Days	0.025 kg/m ² max @ 70°F/21°C 0.14 kg/m ² max @ 212°F/100°C	

Wicking ASTM D 751	1/8 in max	0.3 cm max
Puncture Resistance ASTM D 4833	250 lb min	1110 N min
Coefficient Of Thermal Expansion/Contraction ASTM D 696	8×10^{-6} in/in/°F max	1.4×10^{-5} cm/cm/°C max

**Seaming: Thermal welding methods are recommended.
No Sewing, glues, or solvents are suggested.**

2.03 FASTENERS AND HARDWARE

- 2.03.1 All bolts, washers, nuts, and expansion anchors shall be type 316 stainless steel, minimum 3/8-inch diameter.
- 2.03.2 Batten connection shall be shall be type 316 stainless steel or fiberglass flat bar, minimum ¼-inch thickness by 2 inches wide.
- 2.03.3 Floor and Wall connection shall be type 316 stainless steel or fiberglass angle, minimum ¼-inch thickness by 2 inches wide by 2 inches wide.
- 2.03.4 Suspension and Tension for the top and open ends of the curtain(s) shall be type 316 stainless steel 3/16" diameter cable with type 316 stainless steel 3/16" cable clamps and thimbles.

PART 3 – EXECUTION

3.01 COORDINATION

- 3.01.1 The baffle manufacturer shall coordinate with the Engineer and the tank manufacturer concerning loading on the reservoir, attachment details, and the sequence of construction. Installation details are shown on the plans are provided as a guide for the contractor and baffle manufacturer.
- 3.01.2 The tank contractor shall provide thickened areas beneath the membrane slab as required for securing the base of the baffle walls.

3.02 PREPARATION AND FABRICATION

- 3.02.1 Prior to factory seaming, all roll goods shall be inspected. All factory seams shall be made by thermal fusion methods. All factory seams shall have a minimum scrim-to-scrim overlap of one and one-half inches (1-1/2") when fabricated.

Fabricated seams found to have less than the specified minimum overlap shall be repaired by adding an overlap or cap strip that provides the minimum specified overlap or will be rejected. All seams shall be made so that thermal fusion bond extends fully along the width of the sheet so that no loose edges are present.

3.02.2 Prior to installation, all unnecessary material and equipment shall be removed from the tank and the floor slab installation areas shall be swept clean.

3.03 INSPECTION

3.03.1 All sheets and seams shall be 100% visually inspected during fabrication. No defective seams or exposed scrim will be allowed. All indicated repairs shall be made by the geomembrane fabricator before the panels are packaged for shipment.

3.03.2 In addition to visual inspection, a 48-inch (1.2m) weld sample shall be made with each factory seam welding unit used in this work at the beginning of every work shift and every four hours of production thereafter. Sample shall be taken from a seam specifically made for quality testing and not taken from the fabricated panel itself. Test specimens shall be cut at quarter points from each 48-inch seam sample (a total of three places) and tested for seam strength and peel adhesion. The shear seam strength shall be tested in accordance with ASTM D751 as modified in Annex A of ANSI/NSF 54. The peel adhesion shall be tested in accordance with ASTM D 4437 as modified in Annex A of ANSI/NSF 54.

3.03.2.1 A log shall be maintained showing the date, time, panel number and test results. Failure of the material and/or seams to meet all the requirements of these specifications may be cause for rejection of the material and/or seams as appropriate. The Fabricator shall provide the test results to the Owner or Engineer upon request.

3.03.3 Upon completion of baffle wall installation, contractor shall visually inspect the baffle walls for damage from ground level. Any repairs shall be made with newly manufactured material cut with rounded corners extending 4-inches in each direction from the damaged area. The entire repair shall be completely welded to the baffle wall.

3.04 INSTALLATION

3.04.1 CONTRACTOR shall field verify dimensions and provide the field dimensions to the baffle curtain fabricator prior to fabrication of the baffle curtains.

- 3.04.2 All work shall be fabricated and erected in accordance with the approved submittal drawings. For those baffles requiring widths greater than the coated fabric available from the manufacturer, a thermal fusion heat seam nominal 2 inches wide shall be used at those locations to join multiple widths of fabric together. The strength of the seam shall be as great as or greater than the parent material in shear strength.
- 3.04.3 Baffle shall be secured to the floor and walls with type 316 stainless steel or fiberglass angles with type 316 stainless steel expansion anchors. All baffle penetrations shall be punched. Provide 3/8-inch polypropylene rope in the 4" wide, double hem on the perimeter of the baffle curtain(s). The 3/8-inch polypropylene rope inside the 4" wide hem shall be behind the stainless steel plates at floor and wall locations.
- 3.04.4 Provide stainless stainless steel or fiberglass angle plates or flat plates sandwiching the baffle curtain on the top edge and open end of the baffle wall with 3/8-inch bolts for attaching the baffle to the top and the open end wall of the tank as shown on the drawings.
- 3.04.5 Provide fiberglass or stainless steel 1/4" x 2" x 2" x 2" angle plates to be attached to the ceiling and the open end wall of the tank for securing the type 316 stainless steel 3/16" diameter cable from the tank wall to the top edge or open end of the baffle curtain to tension or suspend the baffle curtain. The type 316 stainless steel 3/16" diameter cable shall be secured using type 316 stainless steel 3/16" cable clamps.
- 3.04.6 Hardware and fasteners shall be made of type 316 stainless steel.

3.05 START-UP AND TRAINING

Not applicable.

END OF SECTION

SECTION 15000
GENERAL MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This Section includes requirements that expand the requirements specified in Division 1 and applies to all Division 15 Specification Sections.

1.02 RELATED SECTIONS

- A. Drawings, Contract, including General and Supplementary Conditions, and Division 1 Specification Sections apply to this and all other Division 15 Specification Sections.

1.03 DEFINITIONS

- A. Furnish: To purchase and deliver products to the project site and prepare for installation.
- B. Install: To assemble, erect, secure, connect, and place furnished product into operation.
- C. Provide: To furnish and install.
- D. Products: Includes materials, systems, parts, and equipment.
- E. Concealed: Embedded in or installed behind walls, within partitions, above suspended ceilings, in trenches, in tunnels and crawl spaces.
- F. Exposed: Not installed underground or "concealed" as defined above.
- G. Specifications: These specifications plus the Codes and Standards referenced herein.

1.04 CONTRACTOR QUALIFICATIONS

- A. General: The firms that perform the installation of the work under this Division 15 of specifications shall be one that maintains an established, experienced organization with a permanent, manned office within a radius of 150 miles of Glynn County, Georgia.
- B. Mechanical Firm's Proficiency: The firm's proficiency in the installation, start-up, adjustment and maintenance of air conditioning systems shall have been demonstrated by the successful performance of work as specified herein on at least three systems for pump well houses heating and ventilation. The firm shall have trained personnel, instruments, tools, and equipment to perform the installation and maintenance service specified. The firm shall have been in business performing services as specified herein for at least three years.

1.05 QUALITY CONTROL

- A. Comply with manufacturers' instructions, including each step in sequence.
- B. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- D. Conform to reference standard by date of issue current on date of Contract Documents date for receiving bids, except where a specific date is established by code.

1.06 SUBMITTALS

- A. Quantity: Submit one electronic copy of each submittal for review. Submit one electronic copy and 3 bound and indexed hard copies of the Operation & Maintenance Manual as described in paragraph Maintenance Documents and Instructions.
- B. Completeness of Submittals: All submittal data shall be submitted at one time unless unavailable drawings would delay job progress. In such a case long lead time items may be submitted individually ahead of the completed submittal. Each submittal shall have the project title, Architect, Engineer, and Contractor's names and Section number correlating to Division 15 specification sections. Submittals not prepared as specified herein will be returned to the Contractor for resubmittal.
- C. Contractor Review: The Contractor shall check data carefully to insure compliance with these specifications prior to submitting. For product data describing two or more variants of the same model product, clearly mark the selected product and all included accessories and options. Stamp and sign each submittal section indicating review and approval and provide notes indicating any variances that exist.
- D. Submittal data for Section 15000 – General Mechanical Requirements:
 - 1. Electrical Requirements List: Provide typed on 8-1/2 x 11 inch plain bond paper a list indicating the electrical requirements for each piece of mechanical equipment. The list shall include all of the information shown on the sample list at the end of this section. All of the information contained in the sheet shall be coordinated between the mechanical and electrical contractors so that the data reflects actual requirements for the submitted mechanical equipment. Submittals for electrically powered equipment shall not be reviewed until this sheet is received by the Engineer completed and signed. See sample Electrical Requirements List at the end of this Section.
- E. Submittal data for other Division 15 Sections: Provide data as required in each individual Division 15 Section. Submittal data types are as follow:

1. Compliance Data: Published literature, certificates, and lists indicating the product's compliance with standards referenced in these specifications.
2. Published Literature: Indicate dimensions, weights, capacities, ratings, horsepower, gages, and finishes of materials, and electrical characteristics and connection requirements.
3. Performance Data: Performance data including fan curves, pump curves, and equipment output capacities complete with rating conditions as scheduled on contract drawings. As a minimum submitted data shall include all performance data scheduled or noted on contract drawings.
4. Sound Power Level Data: Equipment sound power level at 63, 125, 250, 500, 1000, 2000, 4000, and 8000 Hz octave band center frequencies plus db A weighted sound level. Data shall include distance from equipment to test equipment.
5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
6. Samples and Color Selection Charts.
7. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
8. Manufacturer's Instructions: Include installation instructions.
9. Certificates: Signed letters certifying compliance with specified requirements.
10. Calculations: Design and/or design calculations.

1.07 SUBSTITUTIONS

- A. Basis of Design: Model numbers indicated in other Division 15 Sections or shown on the drawings are the Basis of Design. The Contractor may substitute equal and approved equipment from manufacturers listed in this specification or set forth in an addendum provided said equipment meets all requirements of the plans and specifications, has like electrical characteristics (e.g., same voltage, phase, fusing/circuit breaker requirements, single or multiple points of connection as indicated on the electrical drawings), and will fit in the available spaces in the building as shown.
- B. If the Contractor chooses to provide equipment which meets all of the aforementioned requirements, but has different electrical characteristics, he shall bear all costs associated with that substitution including, but not limited to, breakers, fuses, disconnects, wiring, conduits, panels, starters, contactors, and the like. All electrical connections shall be coordinated with the Engineer and with the electrical subcontractor.
- C. Substitutions: Substitutions of specified items will be considered until 10 days prior to bid opening. Each request shall include a description of the proposed substitute, the name of material or equipment for which it is to be substituted, drawings, cuts, performance and test data for an evaluation and a statement from the equipment manufacturer's representative that the items to be substituted meet or exceed the specifications of the item substituted for.

- D. A request for substitution constitutes a representation that the Contractor:
1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
 2. Will provide the same warranty for the Substitution as for the specified Product.
 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
 4. Waives claims for additional costs or time extension which may subsequently become apparent.
 5. Will reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities.
- E. The Engineer will notify Contractor in writing of decision to accept or reject request.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping: Deliver Products to the project in manufacturer's original shipping packaging, properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
- B. Acceptance at Site: Comply with the following requirements:
1. Inspect shipments and immediately report any damage to the carrier and to the Construction Manager so that job progress will not be delayed.
 2. All items received by the Contractor shall be left in their original containers, or as shipped with dust caps, packing materials, and weather proof covers until installed in final locations.
- C. Storage and Protection: During construction maintain all delivered materials and equipment in an orderly manner and protect from damage by complying with the following minimum requirements:
1. Products stored outside or in unheated spaces shall be covered with waterproof drop cloths or tarpaulins, and provided with blocking to raise the base of each item at least 6 inches above ground and water levels.
 2. Store electrical items that would be damaged by cold weather or condensation in a heated, enclosed space until placed into service.
 3. Products stored inside shall be protected from dirt, construction debris, welding and cutting spatters, paint dropping etc. either by original packaging or Contractor provided covers.
 4. All installed materials and equipment shall be in a like new condition. Damaged equipment or materials shall be repaired to like new conditions or replaced at no cost to the Owner.

1.09 SEQUENCING AND SCHEDULING

- A. Carefully examine the site, architectural, HVAC, and electrical drawings and specifications. Coordinate all work with other disciplines to avoid conflicts and delay of installation schedule.

- B. The Contractor shall install mechanical work so as not to interfere with the work of other disciplines or trades. If work is installed that does interfere, the work shall be corrected at no additional cost to the Owner. Occupation of a work space by any trade or discipline does not give the right of priority to the space.
- C. Tests: Test requirements shall be as specified in other Division 15 Sections. Provide the engineer 48 hours notification in advance of any test. Engineer, at his option, may witness test. Complete tests prior to insulating or otherwise covering work. Leaks shall be repaired, defective materials replaced, and system shall be retested. Conduct test prior to connecting to equipment or isolate equipment from system.

1.10 UTILITY CONNECTIONS AND PERMITS

- A. Contractor shall pay all costs and fees and obtain all permits as required prior to beginning the work.

1.11 COMPLETION OF WORK

- A. Execute final cleaning prior to final inspection.
- B. Final Cleaning: Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- C. Clean construction debris from roof.
- D. Remove waste and surplus materials, rubbish, and construction facilities from the site.
- E. Adjust operating products and equipment to ensure smooth and correct operation.
- F. At the completion, an inspection shall be made and the entire system shall be shown to be in specified working condition. The following shall be available during the inspection:
 - 1. Owner's Representative.
 - 2. Contractor representative.
 - 3. Mechanic with hand tools, ladder and flash light.
 - 4. Test and Balance Report.
 - 5. Complete specifications and drawings with all addenda and revisions.

1.12 GUARANTEE AND WARRANTIES

- A. All Division 15 warranty periods begin upon Owner's acceptance of project. The contractor shall make provisions so that manufacturer's warranties begin on that date regardless of when equipment is delivered to the project site.
- B. Warranties: Provide manufacturer's equipment warranties prior to final inspection. Length of warranty period shall be as specified in individual Division 15 Specification Sections.
- C. Guarantee: All equipment and materials furnished and all work performed under this Division 15 of specifications shall be guaranteed to be free of defective materials and

workmanship for a period of one year from the date specified in A above. Upon notice from the Owner of failure of any part of the guaranteed equipment during the guarantee period, the affected part or parts shall be promptly replaced with new parts by the Contractor at no additional cost to the Owner. All labor required to perform guarantee shall be included as part of the complete guarantee warranty.

1.13 MAINTENANCE AND SERVICE

- A. Maintenance: The Contractor shall maintain all systems installed under this Section of specifications from date of start-up to Owner's acceptance of project .
- B. Inspections:
Not Used
- C. Parts: Provide repair parts during maintenance period per manufacturer recommendation.

1.14 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed Shop Drawings.
 - 6. Product Data.
 - 7. Samples.
 - 8. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.

1.15 MAINTENANCE DOCUMENTS AND INSTRUCTIONS

- A. Maintenance Manuals: Contractor shall prepare and submit one electronic copy and 3 bound and indexed hard copies of the Operation & Maintenance Manual to the Engineer for approval prior to delivery to operating personnel. Each manual shall contain the following information, data and drawings:
 - 1. List of contents. Insert under front cover.
 - 2. Copy of approved submittals, equipment, and materials.
 - 3. Installation, operating, and maintenance instructions for each item of equipment.
 - 4. Wiring schematics for each item of equipment.

5. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.
 6. Manufacturer's equipment warranties.
 7. Copy of Test and Balance Reports including list of instruments and description of methods employed.
- B. Framed Instructions:
1. Wall mount framed sequence of operations and control system schematic under glass in each mechanical room.
 2. Wall mount piping schematic showing equipment and valve locations in each mechanical room. Wall mount valve chart description next to each piping schematic.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 ROUGH-IN

- A. Final Locations: Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Coordinate mechanical systems, equipment, and materials installation with other building components.
- B. Prepare for Installation: Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
- C. Deviation From Drawings: Drawings are schematic and show approximate location of equipment and materials, however, the Contractor shall obtain the Engineer's/Architect's approval before deviating from the drawings.

3.02 MECHANICAL INSTALLATIONS

- A. General: Installation shall be as specified in individual Division 15 Specification Sections and in accordance with approved manufacturer's installation instructions. Conflict between manufacturer's printed instructions and these specifications shall be brought to the attention of the Engineer/Architect.
- B. Installation: Install systems, materials, and equipment to conform to approved submittal data, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect/Engineer.

1. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 2. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
 3. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 4. Install systems, materials, and equipment level and plumb parallel and perpendicular to other building systems and components, following the building lines, where installed exposed in finished spaces.
 5. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
 6. Provide access panels or doors where units are concealed behind finished surfaces.
- C. Cleaning: Comply with the following cleaning requirements:
1. Upon completion of installation, piping, ducts, and equipment shall be thoroughly cleared of dirt, grease, rust and oil, primed where necessary, and left ready for painting. Vacuum clean the inside and outside of plenums and equipment cabinets.
 2. Clean gages, thermometers, traps, strainers, fittings, and lavatory aerators.
- D. Painting and Finishing: Comply with the following finishing requirements:
1. Contractor shall clean, spot prime with zinc chromate and entirely repaint, with original color any factory finished equipment which has rusted or been damaged.
 2. Insulation coverings shall be cleaned, sized if necessary, and left ready for service identification.
 3. Ferrous metal shall be cleaned and primed, ready for painting.
- E. Lubrication and Packing: Comply with the following requirements:
1. Lubricate equipment with correct grade, type, and quantity of lubrication before placing equipment into service. Damages caused by not providing proper lubrication shall be repaired at Contractor's expense.
 2. Each shaft or valve stem containing a packing gland shall be checked for condition and examined for proper grade, amount, and type of packing by backing packing gland off.
 3. Maintain all lubrication and packing seals during construction, and assure that all are operating properly at the time of final acceptance. Replace worn gaskets and packing.
 4. When filling systems initially for hydrostatic pressure tests, adjust valve packing glands to finger tight, and allow packing to absorb water for five minutes prior to tightening packing nuts.

5. All rotating pieces of equipment shall be properly lubricated prior to start-up. Damage to shafts, bearings, seals, etc., caused by lack of proper lubrication or over lubrication shall be repaired by the Contractor at no cost to the Owner.

3.03 CUTTING AND PATCHING

A. General: If cutting and patching, the following requirements apply:

1. In new construction areas, avoid cutting of concrete, masonry, and other finished work by use of sleeves and inserts.
2. Cut holes through concrete, brick, tile, etc., when necessary, by rotary core drilling.
3. During cutting and patching operations, protect adjacent installations.
4. Perform at no expense to the Owner, cutting, fitting, and patching of mechanical equipment and materials required to:
 - a. Uncover Work to provide for installation of ill-timed Work.
 - b. Remove and replace defective Work.
 - c. Remove and replace Work not conforming to requirements of the Contract Documents.
 - d. Remove samples of installed Work as specified for testing.
 - e. Install equipment and materials in existing structures.
 - f. Upon written instructions from the Engineer, uncover and restore Work to provide for Architect's/Engineer's observation of concealed Work.
5. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
6. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
7. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched. Repaired or patched surface finishes and components will match existing finishes. Use new materials.

3.04 SAMPLE SUBMITTAL FORMS

A. Sample Electrical Requirements List

SAMPLE

CONTRACTOR COMPANY NAME

HVAC ELECTRICAL DATA SHEET

JOB TITLE

JOB LOCATION

To be completed by Mechanical Contractor ← → To be completed by Electrical Contractor

Unit Tag	Volts	Phase	Minimum circuit amps, KW, or HP	MOC PD* (maximum over current protective device)	Maximum fuse size (if req'd)	Panel Tag	Circuit Number	Circuit Breaker Amps and Poles**	Integral Disconnect Yes or No

To be completed by Mechanical Contractor ← → To be completed by Electrical Contractor

* MOC PD as listed per equipment manufacturer submittal data

** Must comply with equipment manufacturer submittal data

Mechanical Contractor Name & Signature: _____

Electrical Contractor Name & Signature: _____

General Contractor Name & Signature: _____

END OF SECTION

**SECTION 15094
PIPE SUPPORTS AND HANGERS**

PART 1 GENERAL

1.01 SUMMARY

- A. Design, furnish and install pipe hangers, supports and brackets necessary to install piping furnished under these Contract Documents. All materials provided must be resistant to corrosion unless otherwise noted on the drawings. Provide all foundation, shims, hangers, clamps, supplemental steel, fasteners, anchor bolts and other hardware required for the complete installation as shown on the Drawings and/or specified herein.
- B. The Drawings do not show every pipe hanger location, but are intended to provide a guide to type and usage of pipe supports intended under this Contract. The Contractor shall provide all pipe supports required to securely support all piping in accordance with the referenced standards.

1.02 RELATED SECTIONS

Section 09900 Painting

1.03 REFERENCES

- A. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)
Standards

SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture

SP-69 Pipe Hangers and Supports - Selection and Application

SP-89 Pipe Hangers and Supports - Fabrication and Installation Practices
- B. American National Standards Institute (ANSI) Standards

B31.1 Coded for Pressure piping - Power Piping
- C. American Institute of Steel Construction (AISC)

M011 Steel Construction Manual

1.04 SUBMITTALS

- A. Submit shop drawings and product data according to the General Conditions.
- B. Submit pipe support arrangement and materials, locations, wall/ceiling connections,

miscellaneous hardware and PVC coating procedure for materials that are not stainless steel.

1.05 QUALITY ASSURANCE

- A. Work shall be installed by workers experienced in the design, selection, fabrication and installation of pipe support systems.
- B. Selection, fabrication and installation of pipe hangers and supports shall conform to the requirements of ANSI B31.1, MSS SP-58, SP-69 and SP-89, except as supplemented or modified by the requirements of these Specifications.
- C. Weight balance calculations shall be made to determine the required supporting force at each hanger location and the pipe weight load at each equipment connection.
- D. Pipe support system shall utilize standard manufactured hangers and supports wherever possible.
- E. Pipe support materials in contact with piping shall be compatible with the piping materials such that neither shall have a deteriorating action on the other.
- F. Supplemental steel shall be designed per AISC Steel Construction Manual.

1.06 PROJECT CONDITIONS

- A. Building structure shall be erected under other sections of these Specifications and should be essentially complete prior to starting work under this Section.
- B. The Contractor shall be given copies of the Structural Drawings for use in developing pipe support shop drawings. The Contractor shall be responsible for field verifying existing dimensions prior to fabrication of pipe support systems.

1.06 SEQUENCING AND SCHEDULING

The Contractor shall coordinate scheduling of pipe support installation with piping system installation to prevent any damage to installed piping due to lack of pipe supports.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Pipe supports and hangers shall be manufactured by Grinnell, B-Line, or approved equal.

2.02 CORROSION RESISTANCE

- A. All materials provided in this section shall be corrosion resistant unless otherwise noted on the drawings.

- B. Where stainless steel materials or PVC coating is not supplied by the material manufacturer, the Contractor shall have the materials shop coated with a 20 mil PVC coating by RobRoy Industries, Permacoat or approved equal.
- C. Contractor shall touch up materials in the field with coating provided by the shop coating supplier.

2.03 CHANNELS

- A. Channels shall be non-metallic polyester resin material.
- B. Channels shall be used to support channel brackets, horizontal pipes, and vertical pipes where required. Channels shall be attached to walls with stainless steel expansion bolts.
- C. Provide BFP-22 or BFP-22A channel by B-Line or approved equal.

2.04 CHANNEL BRACKETS

- A. Channel brackets shall be fiberglass manufactured with glass reinforced polyester resin.
- B. Channel brackets shall be used to support horizontal pipes that are attached to CMU walls. Channel brackets shall be attached to walls with stainless steel expansion bolts.
- C. Provide BFP 409 brackets by B-Line or approved equal as shown on the drawings.

2.05 PIPE STANCHION SADDLE

- A. Pipe stanchion saddles shall be carbon steel with carbon steel yoke and black finish.
- B. Stanchion saddles shall be used to support horizontal pipe on rooftops, horizontal pipes from the floor where support at the wall is not practical, and where shown on the drawings. Pipe stanchion saddles will be installed by slipping saddle base into riser pipe.
- C. Provide Grinnell figure 259 or approved equal.
- D. NOTE: Contractor shall have pipe stanchion saddles shop coated with PVC according to paragraph 2.02 of this section.

2.06 PIPE CLAMPS, WELD-LESS EYE NUTS, HANGER RODS, AND CONCRETE ROD ATTACHMENT PLATES.

- A. Pipe clamps shall be galvanized carbon steel. Weld-less eye nuts shall be forged steel with galvanized finish. Hanger rods shall be galvanized carbon steel threaded on both ends. Rod size will be adequate to support pipe as installed. Concrete rod attachment plates will

be carbon steel with black finish.

- B. Clamps shall be used in conjunction with weld-less eye nuts, hanger rods, and concrete rod attachment plates to support horizontal pipes from the ceiling. Attachment plates shall be attached to ceiling with stainless steel expansion bolts.
- C. Provide the following or approved equal:

Pipe clamp - Grinnell figure 212
Hanger rod - Grinnell figure 140/253
Weld-less eye nut - Grinnell figure 290
Concrete rod attachment plate - Grinnell figure 52.
- D. NOTE: Contractor shall have clamps, eye nuts, hanger rods, and concrete rod attachments shop coated with PVC according to paragraph 2.02 of this section.

2.07 TRAPEZE HANGERS

- A. All materials shall be fiberglass.
- B. Strut channel trapeze hangers shall be used to support parallel piping. Pipe racks or stanchions fabricated with strut channel shall be used in areas of multiple pipe runs. Strut clamps and straps will be used to maintain proper alignment. Strut shall be B-Line Systems, Inc. BFP22 or heavier as required or equal. Clamps and straps shall be B-Line Systems, Inc. BFP2000N series, or equal.

2.08 CHANNEL CLAMPS

- A. Channel Clamps shall be non-metallic manufactured from glass reinforced polyester resin with nylon hardware.
- B. Clamps shall be used to attach horizontal and vertical pipes to channels and channel brackets.
- C. Provide BFP 2000N series clamps by B-Line or approved equal.

2.09 ONE HOLE STRAPS

- A. One hole straps shall be type 316 stainless steel or PVC coated.
- B. One hole straps shall be used to support single horizontal and vertical pipes on walls and in trenches. Attach straps to wall or trench with stainless steel expansion bolts.
- C. Provide B-Line one hole straps or equal.

2.10 CHANNEL NUTS AND HARDWARE

- A. Channel nuts and hardware shall meet the physical and chemical requirements of ASTM A307, physical and chemical requirements of ASTM A307, SAE J429, and ASTM A563 and have unified inch screw threads. Finish shall be electro-plated zinc.
- B. Channel Nuts and Hardware shall be installed as required to connect channels, brackets, clamps and other appurtenances.
- C. Provide B-Line channel nuts and hardware or approved equal.

2.11 SUPPLEMENTAL STEEL AND MISCELLANEOUS HARDWARE

- A. Use standard steel shapes fabricated in accordance with ASTM A 36.
- B. Prime and paint supplemental steel support pipes, brackets, and assemblies after all fabrication procedures are complete.
- C. U-bolts shall be steel with four finished hex nuts, galvanized. Provide Grinnell figure 137 or equal.

2.12 EXPANSION BOLTS

- A. Provide type 316 stainless steel expansion bolts as required to attach supports to ceilings, walls, and floors.
- B. Provide Kwik Bolt II or approved equal.

2.13 FIELD CUTTING SEALANT

- A. Provide sealant to seal exposed fiberglass fibers after field cutting.
- B. Sealant shall be supplied by same manufacturer as pipe supports.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Pipe hangers and supports shall be installed in complete conformance with the manufacturers recommendations and the Contract Documents.
- B. Pipe hangers shall be capable of supporting the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping, and prevent excessive stress resulting from transferred weight being induced into the pipe or connected equipment.
- C. Adequate supports shall be provided so that there is no movement or visible sagging between supports.
- D. If vibration is encountered after the piping system is in operation, appropriate vibration control equipment shall be installed at the direction of the Engineer.
- E. Hangers shall be designed so that they cannot become disengaged by movements of the supported pipe.
- F. Supports shall be installed at intervals recommended for a specific application by the piping system manufacturer.
- G. Building plumbing shall be supported at intervals no greater than that specified by the Standard Plumbing Code.
- 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. At least one support shall be provided per pipe section or at every other joint, whichever is closer.
- I. All threaded connections installed loose, such as hanger rods and U-bolts, shall have a double nut installation.
- J. Vertical piping shall be supported as shown or required to prevent buckling or swaying.
- K. Provide a support within 18-inches of each elbow or tee and within 24-inches of each equipment connection.
- L. Pipe passing through non-loading bearing walls and partitions shall not bear on building construction. Pipes shall not be supported from bar joists or ceiling suspension systems unless approved by the Engineer.
- M. Following installation all PVC coated and fiberglass pipe supports shall be touched up as required or directed by the Engineer.
- N. 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.
- O. No pipe supports shall be anchored to or supported from floor grating.
- P. 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.

3.02 SUPPLEMENTAL STEEL

- A. All supplemental steel shall be fabricated in accordance with the requirements of the AISC Manual of Steel Construction and the Standard Building Code.
- B. No flame cutting of galvanized steel members will be permitted.
- C. All galvanized surfaces damaged or exposed by cutting or drilling shall be resurfaced in accordance with ASTM A 780.
- D. All non-galvanized steel shall be primed and painted prior to installation.

3.03 SURFACE PREPARATION AND 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 the requirements of Section 09900.

3.04 FIELD PAINTING

Field painting shall be in accordance with the requirements of Section 09900.

3.05 CLEANING

Prior to acceptance of the work of this Section, thoroughly clean all installed materials, equipment and related areas in accordance with the General Conditions.

END OF SECTION

**SECTION 15170
MOTORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Common requirements for electric motors furnished on equipment specified in other Sections, including single phase and three phase electric motors.

1.02 DEFINITIONS

- A. Motor Manufacturers: The manufacturers who assemble the motors specified in this Section.
- B. Equipment Manufacturers: The manufacturers of equipment specified in other Sections of these specifications and into which the motors specified in this Section are installed.

1.03 RELATED SECTIONS

- A. Section 15000 – General Mechanical Requirements.
- B. Division 16 – Electrical: Equipment wiring and electrical characteristics and wiring connections.

1.04 REFERENCES

- A. ABMA 9 – (Current Edition) Load Ratings and Fatigue Life for Ball Bearings.
- B. NEMA MG 1 – (Current Edition) Motors and Generators.
- C. NFPA 70 - (Current Edition) National Electrical Code.
- D. UL 674 – (Current Edition) Standard for Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations.

1.05 SUBMITTALS

- A. Submit with the powered equipment, i.e., fan, pump, boiler, etc.

1.06 WARRANTY

- A. All warranty periods begin as indicated in Section 15000 - General Mechanical Requirements.
- B. Provide three year manufacturer's warranty for motors larger than 1 horsepower.

1.07 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacture of electric motors specified in this Section with minimum three years documented product development, testing, and manufacturing experience.

1.08 REGULATORY REQUIREMENTS

- A. Conform to UL Component Recognition for appropriate sizes.
- B. Conform to NFPA 70 and applicable energy code.

1.09 DELIVERY, STORAGE, AND PROTECTION

- A. Section 15000 - General Mechanical Requirements: Transport, handle, store, and protect products.
- B. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof covering. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Motors shall only be provided by equipment manufacturers. Subject to compliance with requirements specified in this Section, the motor manufacturers and models furnished shall be at the discretion of the equipment manufacturers.

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Motors Less Than 250 Watts, for Intermittent Service: Equipment manufacturer's standard and need not conform to these specifications.
- B. Single Phase Motors: PSC where available.
- C. Electrical Service: Refer to Division 16 – Electrical for required electrical characteristics.
- D. Open drip-proof type except where specifically noted otherwise.
- E. Design for continuous operation in 40 degrees C environment.
- F. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
- G. Explosion-Proof Motors: UL 674 approved for hazardous classification.

- H. Visible Nameplate: Indicating manufacturer's name and model number, motor horsepower, RPM, frame size, voltage, phase, cycles, full load amps, insulation system class, service factor, maximum ambient temperature, temperature rise at rated horsepower, minimum efficiency.
- I. Wiring Terminations:
 - 1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
 - 2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 SINGLE PHASE POWER - SPLIT PHASE MOTORS

- A. Starting Torque: Less than 150 percent of full load torque.
- B. Starting Current: Up to seven times full load current.
- C. Breakdown Torque: Approximately 200 percent of full load torque.
- D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA service factor, prelubricated sleeve or ball bearings.
- E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 service factor, prelubricated ball bearings.

2.04 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

- A. Starting Torque: Exceeding one fourth of full load torque.
- B. Starting Current: Up to six times full load current.
- C. Multiple Speed: Through tapped windings.
- D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 service factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.05 SINGLE PHASE POWER - CAPACITOR START MOTORS

- A. Starting Torque: Three times full load torque.
- B. Starting Current: Less than five times full load current.
- C. Pull-up Torque: Up to 350 percent of full load torque.
- D. Breakdown Torque: Approximately 250 percent of full load torque.

- E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
- F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA service factor, prelubricated ball bearings.
- G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 service factor, prelubricated ball bearings.

2.06 THREE PHASE POWER - SQUIRREL-CAGE MOTORS

- A. Starting Torque: Between 1 and 1-1/2 times full load torque.
- B. Starting Current: Six times full load current.
- C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.
- D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.
- E. Insulation System: NEMA Class B or better.
- F. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
- G. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid-state control relay with wiring to terminal box.
- H. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt centerline at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
- I. Sound Power Levels: To NEMA MG 1.
- J. Part Winding Start Where Indicated: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.
- K. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.
- L. Nominal Efficiency: To NEMA MG 1, energy efficient for motor sizes 10 hp and larger.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Motors shall be installed in equipment by the equipment manufacturer either at the factory or at the project site.
- B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- C. Check line voltage and phase and ensure agreement with nameplate.
- D. HVAC system safety devices such as smoke detectors, fire thermostats, freeze protection thermostats, duct pressure protection switch, condensate pan float switch, and fire alarm system contact shall be hard wired.

END OF SECTION

SECTION 15835
TERMINAL HEAT TRANSFER UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Unit heaters.
- B. Electric heaters.

1.02 RELATED SECTIONS

- A. Section 15000 - General Mechanical Requirements.
- B. Section 15170 - Motors.
- C. Section 16100 - Electrical

1.03 REFERENCES

- A. NFPA 70 - (Current Edition) National Electrical Code.
- B. UL – Underwriters Laboratories.

1.04 SUBMITTALS

- A. Submit all data in accordance with Section 15000 - General Mechanical Requirements.
- B. Include complete and signed electrical coordination sheet in submittal binder. Submittal not accompanied by electrical coordination sheet will not be reviewed.
- C. Provide the following data:
 - 1. Compliance Data.
 - 2. Published Literature.
 - 3. Performance Data.
 - 4. Sound Power Level Data.
 - 5. Electrical Requirements.
 - 6. Shop Drawings.
 - 7. Manufacturer's Instructions.

1.05 WARRANTY

- A. All warranty periods begin as indicated in Section 15000 - General Mechanical Requirements.
- B. Provide five year manufacturer's warranty for unit heater and motors.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this Section with minimum three years documented experience.

1.07 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, manufacturers which may be incorporated in the work are as listed in the following paragraphs.
- B. Multiple Sources Not Permitted: All products and materials of one type shall be the product of a single manufacturer, i.e., unit heaters shall be the product of one manufacturer, etc. Mixing of similar products from more than one manufacturer shall not be permitted.
- C. Substitutions are permitted per Section 15000 - General Mechanical Requirements.

2.02 ELECTRIC UNIT HEATERS

- A. Manufacturers:
 - 1. Chromolox. Model as scheduled.
 - 2. Berko. Equal to scheduled model.
 - 3. Raywall. Equal to scheduled model.
 - 4. Markel. Equal to scheduled model.
- B. Assembly: UL listed and labeled assembly with terminal box and cover, and built-in controls.
- C. Junction Box: NEMA 4X molded fiberglass junction box shall house built in controls which shall include two power contactors, motor contactor, and fused transformer for 120V control circuit.
- D. Wall Mounting Bracket: Stainless steel swivel brackets for ceiling or wall mounting.
- E. Heating Elements: Enclosed 316 stainless steel tube, with 316 stainless steel finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material. Elements shall be attached to junction box with leak-proof threaded fittings for maximum corrosion resistance.
- F. Cabinet: 0.0375 inch thick stainless steel.

- G. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.
- H. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard.
- I. Thermal Fan Delay: Epoxy sealed thermal fan delay to allow fan motor to continue to operate after heating thermostat has been satisfied.
- J. Motor: Totally enclosed, permanently lubricated ball bearings, and resistant to moisture and corrosion.
- K. Control: Separate fan speed switch and thermostat heat selector switch, factory wired, with switches built-in behind cover. Provide thermal overload.
- L. Capacity: As scheduled.
- M. Electrical Characteristics: See Division 16 - Electrical.

2.03 ELECTRIC WALL HEATERS

- A. Manufacturers:
 - 1. QMark. Model as scheduled.
 - 2. Chromolox. Equal to scheduled model.
 - 3. Berko. Equal to scheduled model.
 - 4. Raywall. Equal to scheduled model.
 - 5. Markel. Equal to scheduled model.
- B. Assembly: UL listed and labeled assembly with terminal box and cover, and built-in controls.
- C. Heating Elements: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material.
- D. Cabinet: 0.0478 inch steel with easily removed front panel with integral air outlet and inlet grilles.
- E. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.
- F. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard.
- G. Motor: Permanently lubricated, sleeve bearings for horizontal models, ball bearings for vertical models.
- H. Control: Separate fan speed switch and thermostat heat selector switch, factory wired, with switches built-in behind cover. Provide thermal overload.

- I. Capacity: As scheduled.
- J. Electrical Characteristics: See Division 16 - Electrical.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.
- C. Protection: Provide finished cabinet units with protective covers during balance of construction.
- D. Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.
- E. Install electric heating equipment including devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal. Install electrical wiring in accordance with manufacturer's submittals and Division 16 - Electrical.

3.02 CLEANING

- A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.
- B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION

**SECTION 15865
AXIAL FANS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Propeller fans.
- B. Motors and drives.
- C. Accessories.

1.02 RELATED SECTIONS

- A. Section 15000 - General Mechanical Requirements.
- B. Section 15170 - Motors.
- C. Division 16 – Electrical: Electrical characteristics and wiring connections.

1.03 REFERENCES

- A. ABMA 9 - (Current Edition) Load Ratings and Fatigue Life for Ball Bearings.
- B. ABMA 11 - (Current Edition) Load Ratings and Fatigue Life for Roller Bearings.
- C. AMCA 99 - (Current Edition) Standards Handbook.
- D. AMCA 210 - (Current Edition) Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.
- E. AMCA 300 - (Current Edition) Reverberant Room Method for Sound Testing of Fans.
- F. AMCA 301 - (Current Edition) Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- G. NEMA MG 1 - (Current Edition) Motors and Generators.
- H. NFPA 70 - (Current Edition) National Electrical Code.
- I. SMACNA DCS - (Current Edition) HVAC Duct Construction Standards - Metal and Flexible.

1.04 SUBMITTALS

- A. Submit all data in accordance with Section 15000 - General Mechanical Requirements.

- B. Include complete and signed electrical coordination sheet in submittal binder. Submittal not accompanied by electrical coordination sheet will not be reviewed.
- C. Provide the following data:
 - 1. Compliance Data.
 - 2. Published Literature.
 - 3. Performance Data.
 - 4. Sound Power Level Data.
 - 5. Electrical Requirements.
 - 6. Shop Drawings.
 - 7. Manufacturer's Instructions.

1.05 WARRANTY

- A. All warranty periods begin as indicated in Section 15000 - General Mechanical Requirements.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this Section with minimum three years documented experience.

1.07 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND PROTECTION

- A. Section 15000 - General Mechanical Requirements: Transport, handle, store, and protect products.
- B. Protect motors, shafts, and bearings from weather and construction dust.

1.09 EXTRA MATERIALS

- A. Supply two sets of belts for each fan.

PART 2 PRODUCTS

2.01 PROPELLER FANS

- A. Manufacturers: Subject to compliance with requirements manufacturers which may be incorporated in the work are as follow:
 - 1. Loren Cook. Model as scheduled.
 - 2. Greenheck. Equal to Scheduled Model

3. Penn Ventilator Co., Inc. Equal to Scheduled Model
 4. ACME Engineering. Equal to Scheduled Model
 5. American Coolair. Equal to Scheduled Model
- B. Multiple Sources Not Permitted: All propeller fans provided for a specific purpose under these specifications shall be the product of only one manufacturer. For example all propeller exhaust and supply fans shall be the product of one manufacturer.
- C. Substitutions permitted per Section 15000 - General Mechanical Requirements.
- D. Performance:
1. Air Flow: As scheduled. Select fan to perform at the scheduled air flow and total static pressure with no more than 10 percent variation from the fan's peak efficiency.
 2. Motor:
 - a. Electrical characteristics and power as specified or noted in Division 16 - Electrical.
 - b. Type: Refer to Section 15170 - Motors.
 - c. Motor horsepower not to exceed scheduled horsepower. Provide motor of sufficient horsepower to accommodate a 10 percent increase over scheduled flow with corresponding 21 percent increase in total pressure.
- E. Impeller: Shaped steel or steel reinforced aluminum blade with heavy hubs, statically and dynamically balanced, keyed and locked to shaft, and directly connected to motor or provided with V-belt drive.
- F. Frame: One piece, square steel with die formed venturi orifice, and mounting flanges and supports with baked enamel finish.
- G. Accessories:
1. Backdraft Damper: Multiple blade with offset hinge pin and blades linked.
 2. Outlet Damper: Multiple blade with offset hinge pin, blades linked, line voltage motor drive, power open, and spring return.
 3. Safety Screens: Expanded galvanized metal over inlet, motor, and drive and outlet; to comply with OSHA regulations.
 4. Hood: Weathershield to exclude rain and snow.
 5. Controller: Solid-state speed controller.

2.02 FIBERGLASS PROPELLER FANS (CHLORINE ROOM EXHAUST)

- A. Manufacturers: Subject to compliance with requirements manufacturers which may be incorporated in the work are as follow:
1. Hartzell. Model as scheduled.
 2. Swartwout. Equal to Scheduled Model

3. Harrington. Equal to Scheduled Model
- B. Multiple Sources Not Permitted: All propeller fans provided for a specific purpose under these specifications shall be the product of only one manufacturer. For example all propeller exhaust and supply fans shall be the product of one manufacturer.
- C. Substitutions permitted per Section 15000 - General Mechanical Requirements.
- D. Performance:
 1. Air Flow: As scheduled. Select fan to perform at the scheduled air flow and total static pressure with no more than 10 percent variation from the fan's peak efficiency.
 2. Motor:
 - a. Electrical characteristics and power as specified or noted in Division 16 - Electrical.
 - b. Type: Refer to Section 15170 - Motors.
 - c. Motor horsepower not to exceed scheduled horsepower. Provide motor of sufficient horsepower to accommodate a 10 percent increase over scheduled flow with corresponding 21 percent increase in total pressure.
- E. Unit Construction:
 1. Fan Housing: One piece molded fiberglass fan housing with solid fiberglass motor support base. Fan housing shall include venturi orifice to increase efficiency and seal propeller tips.
 2. Motor Mounting Base: Base shall be fabricated of solid fiberglass, designed to maximize strength and minimize restriction to air flow.
 3. Propellers: One piece fiberglass airfoil construction, electronically balanced on unit at operating speed.
- F. Accessories:
 1. Backdraft Damper: Solid fiberglass, multiple blade with offset hinge pin and blades linked.
 2. Solid fiberglass mounting boot.
 3. Solid fiberglass front and rear guards.
 4. Stainless steel hardware.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Follow manufacturer's instructions.
- B. Install with resilient mountings and with flexible electrical leads.

- C. Provide fixed sheaves required for final air balance.
- D. Provide safety screen where inlet or outlet is exposed.
- E. Provide backdraft dampers on discharge of exhaust fans and as indicated.
- F. Do not operate fans in normal operation until bearings are lubricated and fan has been test run under observation.

END OF SECTION

**SECTION 16100
ELECTRICAL**

1. SCOPE

- A. General: Provide a complete electrical system as described herein and as shown on the drawings.
- B. Items Included: Items under Division 16 shall include but not be limited to:
 - 1. Power and lighting distribution complete beginning with secondary service and extending through all branch circuits.
 - 2. Lighting fixtures and lamps.
 - 3. Panelboards, breakers, and switches.
 - 4. Dry type transformers.
 - 5. Emergency generator and transfer switch.
 - 6. Power wiring for all electrically operated equipment.

2. CODES, ORDINANCES AND PERMITS

- A. General: Where requirements of these specifications exceed specified codes and ordinances conform to these specifications. Materials and equipment included in Underwriters' Label Service shall bear that label. Electrical equipment shall be UL approved as installed, unless noted otherwise herein.
- B. Permits: General Conditions. Permits or Inspections included in Completion of Work
- C. Codes: The work covered under this section of specifications shall conform to the following Codes and Standards as applicable.
- C. Codes: The work covered under this section of specifications shall conform to the following Codes and Standards as applicable.
 - 1. All applicable state and local codes and amendments
 - 2. American National Standards Institute - ANSI
 - 3. Institute of Electrical and Electronic Engineers - IEEE C2, National Electrical Safety Code (Current Edition)
 - 4. International Code Council – ICC IBC International Building Code (Current Edition)
 - 5. International Code Council – ICC IFC International Fire Code (Current Edition)

6. Insulated Cable Engineer's Association – ICEA
7. National Electrical Manufacturer's Association - NEMA
8. National Fire Protection Association - NFPA 70 National Electrical Code (Current Edition)
9. National Fire Protection Association - NFPA 72 National Fire Alarm Code (Current Edition)
10. National Fire Protection Association - NFPA 79 Electrical Standard for Industry Machinery (Current Edition)
11. National Fire Protection Association - NFPA 101 Life Safety Code (Current Edition)
12. National Fire Protection Association - NFPA 110 Standard for Emergency and Standby Power Systems (Current Edition)
13. Underwriters Laboratories, Inc. Publications
14. Brunswick-Glynn Joint Sewer & Water Commission Standards

3. COMPLETION OF WORK

- A. Testing: At the completion of work, a test shall be made, and the entire system shall be shown to be in perfect working condition. The following shall be made available to personnel conducting the test:
 1. Electrician with hand tools.
 2. Accurate voltmeter.
 3. Clamp-on ammeter.
 4. Test lamp.
 5. Phase rotation indicator.
 6. Complete electrical specifications and drawings with addenda and revisions.
- B. Submittal: Upon completion of work, submit for approval three bound copies of the Certificate of Final Inspection from local authorities.
- C. Instructions: After completion and at a time convenient to the Owner, qualified mechanics shall thoroughly familiarize the Owner's personnel with the operation and the maintenance of the items listed under "Submittal".

- D. Guarantee: All equipment and materials furnished and all work performed under this section of specifications shall be guaranteed to be free of defective materials and workmanship for a period of one year (unless a longer period is specified elsewhere herein) after final acceptance of the work by the Owner. Upon notice from the Owner of failure of any part of the guaranteed equipment or failure of systems to operate properly during the guarantee period, the affected part or parts shall be promptly replaced with new parts by the Contractor at no additional cost to the Owner. All labor required to perform guarantee shall be included as part of the complete guarantee warranty.
- E. Warranties: Provide manufacturer's equipment warranties prior to final inspection.
- F. Record Drawings: Furnish to the General Contractor one set of as-built drawings with all changes to the project neatly drafted. Cost of the drawings and drafting shall be included under this Division.

4. SPACE CONDITIONS

- A. All apparatus shall fit into the available spaces in the building and must be introduced into the building so as not to cause damage to the structure. All equipment requiring service shall be accessible.

5. DRAWINGS

- A. Drawings are diagrammatic and show generally the location of the lighting, lamps, wiring, raceways, switches and accessories and are not to be scaled. All dimensions shall be verified at the building site. Prefabrication of work from drawings shall be at Contractor's risk.

6. WORKMANSHIP AND MATERIALS

- A. Workmanship: All work necessary to complete the project shall be executed in a thorough, neat, and workmanlike manner.
- B. Materials: All materials shall be new, and equipment included in Underwriters Label Service shall bear that label.
- C. Substitutions:
 - 1. Basis of Design: Model numbers indicated herein or shown on the drawings are the Basis of Design. The Contractor may substitute equal and approved equipment provided said equipment meets all requirements of the plans and specifications and will fit in the available spaces in the building as shown. The approval or disapproval of any submitted item will be considered only if submitted before beginning work. Each request shall include a description of the proposed substitute, the name of material or equipment for which it is to be substituted, drawings, cuts, performance and test data for an evaluation and a statement from the equipment manufacturer's representative that the items to be substituted meet or exceed the specifications of the item substituted for.

2. Costs: If the contractor chooses to provide equipment which meets all the aforementioned requirements but has different characteristics which causes any additional costs, he shall bear all costs associated with that substitution. All changes shall be coordinated with the architect, owner and general contractor.

7. SHOP DRAWINGS AND CUTS

- A. Contractor's Approval: Each copy of shop drawings and cuts shall be signed and dated by Contractor as evidence of checking to ensure compliance with plans and specifications. Unsigned drawings will be returned.
- B. Submittals: Shall be assembled, bound in a 3-ring binder with an index sheet showing general and subcontractor's name, address, phone number, and contact person and shall be submitted at one time unless unavailable drawings would delay project. Any electrical equipment serving mechanical equipment will not be reviewed unless accompanied by a completed and signed HVAC and/or plumbing electrical data sheet in Section 15000. Electrical contractor shall coordinate with the mechanical contractor(s) to fill out data sheet and make necessary modifications to electrical submittal. Electrical equipment which serves mechanical equipment will not be reviewed until mechanical equipment is approved. Submittal shall include but not be limited to:
 1. Panelboards
 2. Transformers
 3. Circuit Breakers
 4. Disconnect Switches
 5. Starters and Contactors
 6. Wiring Devices and Plates
 7. Lighting Fixtures
 8. Conduit and Wire
 9. Emergency Generator
 10. Transfer Switch
 11. Surge Suppression

8. APPARATUS UNDER OTHER SECTIONS

- A. General: No roughing shall be done until roughing drawings are furnished.

- B. Mechanical Equipment (Division 15):
1. Provide all power wiring through disconnects, starters, contactors, freezestats, firestats and other control devices.
 2. Provide conduit, fuses, wiring, and disconnect switches where not factory installed.
 3. Provide all starters and contactors under this section except starters integral with equipment or specifically specified in Division 15.
 4. Firestats, freezestats, aquastats, and other electrical control devices and wiring are furnished and mounted under Division 15. All control wiring is furnished under Division 15 but shall be installed in accordance with the requirements of Division 16.
- C. Other Equipment (Water treatment equipment, etc.): Connect for operation and provide any appurtenances required for operation. Refer to appropriate sections of these specifications and shop drawings for more details.

9. CONDUIT

- A. General: Conduit shall be galvanized rigid conduit or electrical metallic tubing. Conduits 1 ½" and larger; exposed below 5'-0"; branch conduit to motors 2 hp and larger; or exposed to weather shall be rigid. Only rigid galvanized conduit shall be installed underground and in or under concrete slab on grade. Elsewhere conduit shall be EMT.
- B. Connectors and Couplings: Same material and finish as raceway. Rigid shall be threaded. EMT shall be split-ring compression type. Indenter or setscrew types are not acceptable.
- C. Threads: Cut clean and remove rough edges. Running threads shall not be used.
- D. Pullboxes: Specified in NEC Article 370.
- E. Insulating Bushings: On all conduits entering raceways, pullboxes, cabinets, stubs, panelboards, switchboard, and motor control centers.
- F. Insulated Throat Connectors: On all EMT connections.
- G. Connections to Motors: Where over 18" from walls or column, a vertical conduit, minimum size ¾" attached to ceiling and floor with wiring into and from this conduit with flexible conduit and condulets.
- H. Conduits in Contact with Ground: Coat complete with two coats of asphaltic paint or use conduit with 20 mil-bonded coat of PVC. All joints shall be recoated after installation.

- I. Expansion Fittings: Appleton, Crouse-Hinds or O.Z. at all expansion joints.
- J. Capping: Cap conduits exposed during construction to prevent entrance of moisture or foreign matter, use T&B Push-Pennies.
- K. Plugging: All conduit runs which extend from interior to exterior of building and those that enter and leave refrigerated spaces shall be sealed to prevent the circulation of air. This shall be done by stuffing the conduit ends with wicking where the conduit run terminates inside the building or outside the refrigerated spaces in the outlet box or panel, as the case may be.
- L. Manufacturers: Allied, LTV, Triangle or Wheatland.
- M. Conduit Routing:
 - 1. Clearances: Maintain 3" crossing hot piping and 12" paralleling.
 - 2. Concealed: Where possible.
 - 3. Exposed Routings: Run parallel or at right angles to the building lines.
 - 4. Supports: Individual runs shall be anchored in place within 3' of changes in direction and at intervals not over 8' by means of straps or clamps specifically designed for the purpose. Wire, hanger iron, nails, and other means shall not be used. Do not strap to the piping. Multiple runs shall be supported by assemblies or trapeze type hangers to provide a rigid installation. Anchor supports by means of toggle bolts on hollow masonry units, expansion anchors on solid masonry units and machine screws in steelwork. Conduit shall not be supported from ceiling system.
 - 5. Firestopping: Seal conduit penetrations in fire rated walls, partitions, floors and ceilings with Dow Corning, Silicone RTV or 3M fire barrier compounds.
- N. All raceways shall have an insulated copper system ground conductor.
- O. Raceways which do not have conductors furnished under this Division of the specifications shall be left with an approved pullcord in raceway.
- P. Conduit Installed Below Grade:
 - 1. Bury conduit minimum 24" below finished grade beneath parking areas and drives. Bury conduit minimum 12" elsewhere.
 - 2. Install 6" wide detectable Extra Strength Terratape within 6" of finished grade above all conduits and/or duct banks installed below grade.

10. FLEXIBLE METAL CONDUIT

- A. General: Conduit shall be steel. Short lengths for connection to rotating or vibrating machinery or equipment, 6' lengths maximum for connection to lighting troffers. B-X cable is not acceptable. Flexible connections to motors shall not be less than four diameters nor more than 24" in length and shall be liquid-tight neoprene-coated for motor connections and where subjected to moisture. Provide separate grounding conductor in flexible conduits.
- B. Connectors: Steel, zinc or cadmium plated. Fittings that anchor the conduit by means of setscrews are not acceptable.

11. CONDUCTORS (50 to 600 VOLTS)

- A. General: Minimum size AWG 12 copper with minimum conductance of 98% unless noted otherwise, stranded, installed in continuous conduit system.
- B. Taps and Joints: Mechanically and electrically sound. Use 3M Skotch-loks or Ideal Wing Nut for #10 and smaller. Burndy Hydent or T&B Color-Keyed on #8 and larger.
- C. Tape: All joints shall be covered with gum tape and taped over with friction tape. Vinyl plastic tape may be used in lieu of gum and friction tape.
- D. Terminal Lugs: Use for connecting conductors larger than #10 and for all multiple connections to terminals. Burndy Hydent to T&B Color-Keyed.
- E. Lacing: All wiring in cabinets, panels, pullboxes, junction boxes are to be neatly laced and held with T&B Ty-Raps.
- F. Lubricants: Electro Y-ER-EAS, Ideal Wire-Lube or Minerallac 100.
- G. Color Code: Use 3/4" tape bands corresponding to color code on all wire not available with factory applied color-coding. Color code shall be as follows:

<u>Phase</u>	<u>208Y/120</u>	<u>480Y/277</u>
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
N	White	Gray
G	Green	Green

The color-coding shall be permanently posted at each panelboard in accordance with NEC 210-4(d).

- H. Wire Pulling: Not until conduit system is complete.
- I. Conductor Insulation, Unless Noted Otherwise:

1. No. 8 and Smaller: Type "THWN-THHN"
 2. No. 6 and Larger: Type "XHHW", "THW"
- J. Manufacturers: Carol, Collyer, Essex, Guardian, Manhattan, Okonite, Pirelli, Rome, Royal, or Triangle.

12. OUTLET BOXES

- A. General: Provide metal outlet boxes for lighting fixtures, wall switches, wall receptacles, etc., of such form and dimensions as to be adapted to their specific usage, location and size and number of conduits connecting thereto.
- B. Concealed:
1. Boxes and covers shall be not less than 1/16" thick and firmly anchored in place and shall be provided with approved 3/8" fixture studs for fixtures. Except as otherwise specified, ceiling outlet boxes need not be provided with plaster rings and shall be 2" deep or more. Junction boxes shall be provided with blank covers painted to match surroundings.
 2. Ceiling outlet boxes shall be 4" octagonal or 4- 11/16" square as specified in NEC due to number of wires; switch and wall receptacles outlet boxes in plastered walls shall be 4" square with standard switch covers. In exposed masonry or tile walls, Steel City Series "GW" boxes in slabs shall be concrete type and where slab is not to be plastered, the plaster covers shall be omitted.
- C. Exposed: Boxes shall be corrosion resistant cast iron.
- D. Pullboxes: Shall be constructed of code gauge welded and galvanized steel. Such boxes shall be sized in accordance with NEC requirements and shall be furnished without knockouts; holes for raceways shall be drilled on the job.
- E. Manufacturers:
1. Concealed: Steel City, Appleton, NEPCO, Raco or Sprague.
 2. Exposed: Crouse-Hinds Condulets, Appleton or Pyle.
- F. Location:
1. The approximate locations of outlets are shown on the drawings. The exact locations shall be determined at the building. The right is reserved to change without additional cost the location of any outlet a maximum of 10' before it is permanently installed.

2. Unless otherwise indicated or directed, wall outlet boxes shall be placed with centerline at distances above the finished floor as follows:
 - a. Convenience Outlets 1'-4"
 - b. Switches 4'-0"
3. Where outlets of different levels are shown adjacent, they shall be installed in one vertical line.
4. At locations where two or more devices are shown adjacent and at the same mounting height, they shall be installed in one outlet box and covered with one faceplate.
5. Where outlets are installed in unfinished block or tile partitions, they shall be installed at the joints in the tile to permit the faceplate to cover the rough openings. The horizontal and vertical locations indicated may be altered slightly to permit doing this. However, the Contractor shall check the architectural drawings to prevent conflicts when shifting location.
6. Where outlets are installed in woodwork, the outlets shall be shifted as required to miss trim, etc. Contractor shall check woodwork shop drawings before roughing in any outlet.
7. Outlets on each side of walls shall not be mounted back-to-back.
8. Switch Outlets for lighting shall be located inside the space on the latch side of the door. Coordinate with architectural drawings before roughing any electrical.

13. NAMEPLATES

- A. General: Provide for all panels, circuit breakers, safety switches, VFDs, starters, push buttons, and control switches. Mount on exterior of door on all surface panels, interior of flush panels, or on cover plate for push buttons and control switches.
- B. Designation: The usage of each device or circuit shall be etched in 1/4" letters and mounted on device cover except flush panels shall be nameplate mounted inside panel.
- C. Type: White core black Bakelite for 208Y/120 volts and white core orange Bakelite for 480Y/277 volts, adhered with epoxy glue.

14. WOOD BACKBOARDS

- A. General: Provide wood backboards for mounting of surface panels, starters, relays, disconnect switches, intercom/clock/ program, MATV, and surface electrical equipment.

- B. Type: 3/4" thick Grade 1 plywood supported by 3/4 x 3/4 x 1/8 angle iron frame attached to wall with 1/4" toggle bolts if backboard is greater than 2' by 2'.
- C. Finish: Frame and board with two coats light gray enamel.

15. SERVICE

- A. General: Contact the utility company, make all arrangements, and pay all costs in connection with the new service and disconnection of the existing services.
- B. Voltage: 480Y/277V, 3-phase, 4-wire.
- C. Metering: As required by utility company.
- D. Fault Current: The Contractor shall verify the available fault current and submit documentation with the submittal package.

16. FUSES

- A. General: Provide in all fused devices, switches, etc. This shall include equipment of other trades. Fuse sizes on drawings are based on design equipment. Contractor shall verify equipment nameplate data and size fuses accordingly.
- B. 600 Amps or Less - Class RK-1 Bussmann LPN-RK-SP (250V) or LPS-RK-5P (600V).
- C. Manufacturers: Bussmann as specified or by Reliance, General Electric or Ferraz Shawmut.
- D. Spare Fuses: Prior to Final Inspection, provide minimum three (3) spare fuses for each type of fuse used on project.

17. STARTERS AND CONTACTORS

- A. General: All line voltage motor and heater control starters and contactors except as specified in Division 15, are to be provided under this section. No IEC type starters will be accepted.
- B. Three Phase, Single Speed Motors: Magnetic across-the-line starter. Square D Class 8536.
- C. Single Phase, One Speed Motors: Manual starter; Square D Class 2510.
- D. Single Phase, One Speed Motors Operated from Wall Switch: Manual starter with stainless steel flush plate and red pilot light; Square D Class 2510.
- E. Single Phase Motors 1/2 HP and Larger and/or Interlock Controlled: All single-phase motors 1/2 HP and larger and/or interlock controlled shall have magnetic starters.

- F. Overload Elements: All legs of multi-phase starters shall be protected with overload elements. Overload elements shall be sized in accordance with National Electrical Code.
- G. Contactors: Shall be rated for resistance load and shall be similar to three phase multi-speed motors with overload elements.
- H. Coils: The maximum allowable control voltage is 120 volts. All holding coils shall operate on 120 volts. On 208-volt starters, coil voltage shall be obtained by neutral conductor. On higher voltages, control transformers or separate 120V control circuits shall be utilized.
- I. Pilot Lights: Provide a pilot light with green jewel in cover, lit when starter is closed, for all magnetic fan and pump motor starters.
- J. H-O-A Switches: Provide on cover of all starters.
- K. Combination Starter/Motor Circuit Protector Units: Unless indicated otherwise, all motors shall be protected by motor circuit protectors. MCP shall be toggle handle type with quick-make, quick-break mechanism. Units shall have molded cases with sealed trip units. Each pole shall provide instantaneous short circuit protection by means of an adjustable magnetic only element. RMS symmetrical ampere at 600-volts of the combination MCP-starter shall be not less than 22,000 amperes. The combination starter/motor circuit protector shall be in one integral unit.
- L. Phase Loss Protection: Provide a three-phase power monitor with adjustable trip delay, automatic reset and isolated N.C. and N.O. contacts to shut-off power in case of phase loss, low voltage, phase reversal or phase unbalance for all motors 5 hp and larger.
- M. Manufacturers: Square D, class as specified, General Electric, Cutler-Hammer, Allen-Bradley or Joslyn-Clark

18. PANELBOARDS

- A. General: Provide automatic circuit breaker type panelboards, factory assembled with thermal magnetic molded case circuit breakers of trip ratings as shown on drawings.
- B. Boxes: NEMA 1, general purpose and shall have code size side and end gutters, 4" minimum, constructed of galvanized code gauge steel, 20" width x 5-3/4" depth minimum. Provide without knockouts.
- C. Fronts: Flush or surface type as scheduled, constructed of code gauge steel, finished with rust inhibiting prime coat and manufacturer's standard light gray enamel. Trim shall be completed with adjustable trim clamps and directory of glass or clear plastic. Directory to be typewritten and shall indicate room number of service as well as use, such as: "Lights - CR 101". Trim on all flush mounted 29" wide panels shall have trim clamps and hinges completely concealed when door is closed.

- D. Bus Assembly Arrangement: Distribution phase sequence type vertically numbered so that no two consecutively numbered single poles and/or spaces shall be connected to the same phase for all branch circuit breakers. All current carrying parts shall be plated. See schedules for special arrangements (i.e., split bus, R/C switches).
- E. Circuit Breakers: Thermal and magnetic molded case, quick-make, quick-break, toggle operated, bolted bus bars, internal common trip, with all load side connections of the same breaker in the same gutter for multi-pole breakers. All breakers shall have interrupting capacity (UL and NEMA) as scheduled on the plans or not less than 10,000 amperes symmetrical if not noted otherwise. Series rated circuit breakers used to obtain higher than normal interruption capacities shall not be used.
- F. Type: Square D as scheduled, General Electric or Cutler Hammer.
- G. Location: Contractor shall coordinate with architectural, mechanical and all other trades to insure adequate mounting space and clearance before beginning work. Contractor shall provide scaled drawings showing panels and other electrical equipment coordinated with mechanical equipment and ductwork using dimensions of equipment to be furnished for the project before roughing any electrical.

19. SAFETY SWITCH, HEAVY DUTY

- A. General: Provide heavy-duty safety switches having the electrical characteristics, ratings and modifications shown on the drawings. All switches shall have NEMA 1 general purpose enclosures indoor or NEMA 3R where exposed to weather unless noted otherwise; handle whose position is easily recognizable that is integral with the switch base and is padlockable in the "OFF" position; visible blades, reinforced fuse clips; non-teasible, positive, quick-make, quick-break mechanisms and switch assembly plus operating handle as an integral part of the enclosure base. All switches shall be UL listed, HP rated, shall have defeatable door interlocks that prevent the door from opening when the operating handle is in the "ON" position and shall have line terminal shields.
- B. Manufacturer: General Electric, Square D or Cutler Hammer.
- C. Nameplates: Label each device as specified under "Nameplates".

20. DRY TYPE TRANSFORMERS

- A. General: Provide where shown on the plans for 208Y/120V, 3-phase, 4-wire, requirements. Transformers shall be rated 480-volt delta, primary with kVA rating as indicated on plans. Scott or Tee connected transformers and all autotransformers are not acceptable.
- B. Taps: Single phase transformers through 10 kVA will not require taps, single phase transformers 15 kVA through 25 kVA and three phase transformers 6 kVA through 15 kVA shall have two 5% full capacity taps below normal rated primary voltage; all transformers 30 kVA and larger shall have two 2-1/2% full capacity taps above and four 2-1/2% full capacity taps below normal rated primary voltage.

- C. Insulation: Transformer 25 kVA and above: Transformers 25 kVA and above shall be 115°C rise transformers shall be capable of carrying a 15 percent continuous overload without exceeding a 150°C rise in a 40°C ambient. All insulating materials to be in accordance with NEMA ST20 standards for a 220°C component recognized insulation system.
- D. Coils:
1. Transformer coils must be vacuum impregnated with nonhygroscopic, thermosetting varnish and shall have a final wrap of electric insulating material designed to prevent injury to the magnet wire. Transformers having coils with magnetic wire visible will not be acceptable.
 2. The core and coil shall be completely isolated from the enclosure by means of vibration absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure. The vibration isolating system shall be so designed as to provide for continual securement of the core and coil unit to the enclosure. Sound isolating systems requiring the removal of all tie-down facilities will not be acceptable. Sound levels should not exceed 45 decibels.
- E. Enclosures:
1. All transformers mounted outside shall be totally enclosed non-ventilated type.
 2. Lifting eyes or provisions should be provided on all transformer enclosures, holes in the enclosure requiring the use of spreader bars will not be acceptable. The transformer enclosure shall be degreased, cleaned and phosphatized with one coat of zinc chromate primer and one coat of baked enamel.
 3. The core and coils shall be visible grounded to the frame of the transformer cubicle by means of a flexible grounding strap of adequate size. A maximum case temperature shall not exceed 35°C rise above ambient at its warmest point.
- F. Mounting: Provide manufacturers wall mount support.
- G. Manufacturers: Acme, Federal Pacific, GE, Heavi-Duty, Jefferson, Square D, Van Tran or Cutler Hammer.

21. MOTOR VOLTAGES

- A. Unless specified otherwise, all motors shall conform to the following voltages:
1. Smaller than 1/2 HP: 120 volts.
 2. 1/2 HP and over: 200 volts for 208-volt systems. 230/460 volts for 480-volt systems.

- B. The motor horsepowers, voltages and phases are the estimated power requirements of all equipment furnished under other sections of these specifications. If the contractor selects equipment with larger horsepowers, different voltages, or phases, the circuits (wire and conduit) and protective devices (circuit breakers or switches and starters), both size and poles, shall be changed for the ampacity, voltage, and phase actually to be installed. In no case shall the circuit kVA be less than that specified. The contractor shall coordinate with trades to this end at no additional cost to the contract.

22. GROUNDING

- A. General: Provide grounding for the following items as required by National Electrical Code and as indicated and specified herein:
1. Conduit and other conductor enclosure.
 2. Neutral or grounded conductor of interior wiring system.
 3. All panelboards, safety switches, non-current carrying parts of fixed equipment, such as motor and starters.
 4. Provide a separate grounding conductor in all conduits.
 5. Provide a grounding conductor for ground pole on each receptacle and toggle switch.
 6. The building electrical system shall be a solid grounded wye supplemented with equipment grounding systems. Where possible, ground electrical system to building steel and metal water service.
 - a. Ground rods shall be 3/4" copper weld rods 10'-0" in length. Not more than four 10'-0" rods shall be required and these shall be installed not less than ten feet apart.
 - b. Top of ground rods shall be twelve inches below finished grade. Connections to ground rods shall be made by chemical weld process.
 - c. Resistance to ground shall not exceed twenty-five ohms.
 - d. Upon completion of the ground rod installation, the Contractor shall test the installation. Ground resistance readings shall not be taken within forty-eight hours of rainfall.
 - e. Each ground rod installation shall be tested after all connection to ground rods are made but before grounding conductor connection is made to the building cold water system. Ground rod installations shall be tested by "fall of potential" measuring method using ground resistance test meter and two auxiliary electrodes driven into the earth, interconnected through the meter with the ground rod installation being tested. Placement of

auxiliary electrodes shall be in accordance with operating instructions of test meter, but in no case shall auxiliary current electrodes be placed within seventy feet of the grounding system being tested. Test data shall indicate placement of auxiliary electrodes with respect to system being tested; date readings were taken and lowest resistance recorded.

- f. Three (3)-typewritten copies of the test shall be submitted to the Engineer for approval.
- g. If the resistance to ground is above twenty-five ohms after installation of four ground rods, provide test information to engineer.

23. WIRING DEVICES

A. General: Provide devices as specified herein and as shown on the drawings. Receptacles not specified herein nor scheduled on drawings but shown on the drawings shall be of similar construction and NEMA configuration.

B. Devices:

- 1.

<u>Switches:</u>	<u>Arrow Hart</u>
SPST	1991-I
Three-Way	1993-I
Motor Rated (Surface)	6808GDAC
Motor Rated (Flush)	6808FDAC
- 2.

<u>Convenience Outlets:</u>	<u>Arrow Hart</u>
Duplex	5362-I
(20A-120V)	
Receptacles on dedicated circuit shall be 20 AMP rated	
Ground Fault	GF5342-I

C. Alternate Manufacturers: Leviton, Hubbell, Pass & Seymour.

24. DEVICE PLATES

A. General: Provide suitable plate for all outlets and install with all edges in contact with finished wall. Mount plates vertically.

B. Gangs: Where two or more devices are shown adjacent, they shall be mounted in ganged boxes and covered with one faceplate.

C. Size: Plates shall be standard size, except where necessary to cover masonry openings jumbo plates shall be used.

D. Finish:

- 1. Device plates on exposed boxes shall be galvanized steel.

2. Weatherproof covers shall be Tay Mac 20310.
3. All other device plates shall be satin stainless steel.

25. LIGHTING FIXTURES

- A. General: Provide lighting fixtures of types and sizes as indicated on drawings complete with plaster frames, supports and mounting accessories. Fixtures shall be left clean at completion of project.
 1. Fluorescent: Electronic, rapid start, high power factor (.99 min.), Class P as manufactured by Motorola or approved equal. Ballast shall have total harmonic distortion of less than 10 percent and third harmonic distortion of less than 6 percent.
 2. Ballasts in luminaries installed out of doors or in cooler/freezers shall have ambient temperature rating of -20°F .
- B. Lenses: All flat plastic lenses shall be one hundred percent virgin acrylic with minimum thickness of 0.125 inches (not nominal 0.125).
- C. Suspension:
 1. Surface and Recessed Incandescent: For ceiling support systems with members 2' on center, use fixture support brackets supplied by manufacturer. Where no bracket is supplied by manufacturer and where span exceeds 2', provide two 1-5/8" x 7/8" x 12 gauge minimum channels spanning ceiling supports except as noted. Secure fixture supports to ceiling supports with 18 gauge stainless steel wire ties.
- D. Structural System Attachments:
 1. Poured-in-Place Concrete or Precast Solid Masonry: Concrete expandable anchors unless otherwise noted.
 2. Steel Bar Joists or Steel Beams: 1-5/8" x 3/4" x 12 gauge channel bolted to top chords. Drill channel and secure threaded rods to channel with nut and locknut unless otherwise noted.
 3. Along Bar Joist or Steel Beam Center Line: F&M Fig. 255, Grinnell Fig. 88 or Elcen Fig. 29 beam clamps unless noted otherwise.
- E. Fixture Ceiling Compatibility: Fixture numbers scheduled are for general design only (i.e. size, number of lamps, lens, etc.). Contractor is to verify type ceiling system (plaster, sheetrock, grid, spline, etc.) to be used and order appropriate fixtures complete with all necessary accessories as required for ceiling system.

F. Manufacturer: As scheduled on drawings.

26. MAIN DISCONNECT

A. General: Contractor shall coordinate location of main disconnect with local authorities before beginning work.

27. SURGE SUPPRESSORS

A. General: Provide transient voltage surge suppressors (TVSS) for the protection of all AC electrical circuits from the effects of lightning induced currents, substation switching transients and internally generated transients resulting from inductive and/or capacitive load switching on the main service equipment and on panels as indicated.

B. Primary Service Suppressors (Main Service Equipment):

1. Suppressors shall be listed in accordance with UL 1449, UL 1283 and CSA listed.
2. For 3-phase, 4-wire configurations, suppressors shall provide suppression elements between each phase conductor and the system neutral, including neutral and ground.
3. Suppressor shall provide certified test data confirming a fail short failure mode.
4. Visible indication of proper suppressor connection and operation shall be provided.
5. Suppressors shall be close-nipped to the equipment being protected. The mounting position of the suppressor shall permit a straight and short lead length connection between the suppressor and the point of connection to the equipment.
6. Connections utilizing conduit between suppressors and equipment will not be accepted.
7. Suppressors shall meet or exceed the following criteria:
 - a. Maximum surge current rating: 100,000 amperes
 - b. Life Cycle Testing: 20 KV, 10KA, IEEE C62-41. Category C3 surge current with less than 5% degradation of clamping voltage. 1250 occurrences (minimum).

- c. Suppressors shall have turn-on and turn-off times of less than .5 nanosecond.
 - d. Suppressors shall be constructed using multiple surge current diversion modules utilizing metal oxide varistors (MOV).
- 8. Suppressor shall be installed on the load side of the first disconnecting point of the service.
 - 9. Conductors between suppressor and point of attachment shall be kept as short and straight as possible.
 - 10. Provide a five-year warranty to include one free replacement of surge suppressor if destroyed by lightning during warranty period.
 - 11. Suppressors shall be Leibert S277/480 Y11 or by Current Technology, LEA Dynatech, APT or Tycor.

END OF SECTION

SECTION 16310
PACKAGED ENGINE GENERATOR SYSTEMS

PART 1 GENERAL

1.1 SCOPE

- A. Furnish and install complete and operable system(s) including but not limited to; generator, enclosure, silencer, batteries and charger to automatically provide emergency power when the normal power is interrupted.

1.2 REFERENCES

- A. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. NEMA MG 1 Motors and Generators.
- C. NFPA 30 Flammable and Combustible Liquids Code.
- D. NFPA 37 Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines.
- E. NFPA 70 - National Electrical Code
- F. NFPA 110 Standard for Emergency and Standby Power Systems.
- G. UL 142 Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids.

1.3 SUBMITTALS

- A. Provide seven complete sets of Engineering Submittal for approval, prior to production release, showing all components. In addition to the engine and generator, submittals shall include complete system interconnection wiring diagrams, specifications and manufacturer's warranty form indicating compliance with these specifications.
- B. Submit product data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, etc.

1.4 DESCRIPTION OF THE SYSTEM

- A. Provide standby power systems as shown on the drawings for supply of power in event of failure of normal supply, consisting of a liquid cooled engine, an AC

alternator and system controls with all necessary accessories for a complete operating system, including but not limited to the items as specified hereinafter.

- B. Provide automatic operation via dry contact from the automatic transfer switch described elsewhere in these specifications. The system shall come on line fully automatically, and on restoration of utility automatically retransfer load to normal power, shut down the generator and return to readiness for another operating cycle.
- C. Provide natural gas connection, including regulator, as shown on the drawings for natural gas powered generators.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

- A. The electric generating system consists of an engine, generator, governor, coupling and all controls that must have been tested as a complete unit on a representative engineering model as required by NFPA 110. The tests, being potentially damaging to the equipment tested, must not be performed on the equipment to be sold, but on a separate prototype model.
- B. Conform to N.E.C. and applicable inspection authorities.

1.6 MANUFACTURER QUALIFICATIONS

- A. This system shall be supplied by a manufacturer who has been regularly engaged in the production of engine-alternator sets, automatic transfer switches, and associated controls for a minimum of ten years, so there is one source of supply and responsibility.
- B. To be classified as a manufacturer, the builder of the generator set must manufacture at least the engine or alternator.
- C. The manufacturer shall have printed literature and brochures describing the standard series specified, not a one-of-a kind fabrication.
- D. Acceptable Manufacturers: Cummins-Onan, Caterpillar, and Generac.

PART 2 PRODUCTS

2.1 ENGINE

- A. The engine shall be a liquid cooled, 4-cycle design, diesel or natural gas fueled engine, as specified on the drawings. It shall provide the KW/KVA rating at an operating speed of 1800 RPM.

- B. The engine is to be cooled with a unit mounted radiator, fan, water pump, and closed coolant recovery system providing visual diagnostic means to determine if the system is operating with a normal engine coolant level. The radiator shall be designed for operation in 122 Degrees Fahrenheit (50 Degrees Celsius) ambient temperature.
- C. The intake air filter with replaceable element must be mounted on the unit. A positive displacement lube oil pump shall supply full pressure lubrication. The engine shall have a replaceable oil filter with internal bypass. Engine coolant and oil drain extension must be provided to outside the mounting base for cleaner and more convenient engine servicing. A fan guard must be installed for personnel safety.
- D. The engine shall have a battery charging DC alternator with an electronic voltage regulator.
- E. An electronic governor to maintain alternator frequency within 0.5% from no load to full load alternator output shall govern engine speed. Steady state regulation is to be +/- 0.33%.
- F. The engine fuel system for diesel engines shall be designed for operation on No. 2 diesel fuel. A secondary fuel filter, water separator, manual fuel priming pump and fuel shut-off solenoid and all piping must be installed at the point of manufacture.
- G. Sensing elements to be located on the engine for low oil pressure shutdown, high coolant temperature shutdown, low coolant level shutdown, over-speed shutdown, and over-crank shutdown. These sensors are to be connected to the control panel using a wiring harness with the following features: wire number labeling on each end of the wire run for easy identification, a molded rubber boot to cover the electrical connection on each sensor to prevent corrosion and all wiring to be run in flexible conduit for protection from the environment and any moving objects.
- H. The engine shall have an engine mounted, thermostatically controlled block heater to aid in quick starting. It will be of adequate wattage as recommended by the engine manufacturer. The contractor shall provide proper branch circuit as shown on the drawings.
- I. Muffler: Critically damped, internal to the enclosure.

2.2 ALTERNATOR

- A. The alternator shall be a 4-pole revolving field type, with a brushless exciter. Photosensitive components will not be permitted in the rotating exciter. The generator shall meet temperature rise standards for class "H" insulation and

conform to NEMA MG1-1.66. All leads must be extended into the AC connection panel. The alternator shall be protected by internal thermal overload protection and an automatic reset field circuit breaker.

- B. One-step load acceptance shall be 100% of nameplate kW rating and meet the requirements of NFPA 110 paragraph 5-13.2.6. The engine-generator set shall be so designed that voltage dip upon application of nameplate kW/kVA shall not exceed 12.5% with recovery to stable operation within 2 seconds. The generator set and regulator must sustain at least 90% of no load voltage for 30 seconds with 250% of rated load at near zero power factor connected to its terminals.
- C. A solidstate voltage regulator designed and built by the engine-generator set manufacturer must be used to control output voltage by varying the exciter magnetic field to provide + or - 1% regulation during stable load conditions. Should an extremely heavy load drop the output frequency, the regulator shall have a voltage drop of 4 volts/hertz to maximize motor starting capability. The frequency at which this droop operation begins must be adjustable, allowing the generator set to be properly matched to the load characteristics ensuring optimum system performance.
- D. The voltage regulator must contain a limiting circuit to prevent output voltage surges. On a loss of the sensing signal, the voltage regulator must shutdown to prevent an over-voltage condition from occurring. A voltage regulator that can go into a full field condition is unacceptable. LED indication will be provided on the regulator to monitor the sensing (yellow), excitation (green), and output circuit (red). A rheostat shall provide a minimum of + or - 10% voltage adjustment from the rated value.
- E. A panel that is an integral part of the generator set must be provided to allow the installer a convenient location in which to make electrical output connections. An isolated neutral lug must be included by the generator set manufacturer, ensure proper sizing.
- F. The engine-generator set shall be mounted with vibration isolators on a welded steel base that shall permit suitable mounting to any level surface.
- G. The generator shall be provided with a properly sized main output circuit breaker capable of providing the full rated output of the generator indefinitely. Thermal magnetic circuit breakers meeting the full load output current of the generator do NOT meet this requirement.

2.3 CONTROLS

- A. All engine alternator controls and instrumentation shall be designed, built, wired, and tested by the manufacturer. The controller shall be mounted to the engine-

generator set via vibration isolation system. All control circuits shall be 24 volt DC.

- B. The engine-generator set shall contain a complete engine start-stop control, which shall start the engine on closing contacts and stops the engine on opening contacts. An automatic preheat circuit that can also be operated in a manual mode must be provided. A cyclic cranking limiter shall be provided to open the starting circuit after eight attempts if the engine has not started within that time. Engine control modules must be solid-state plug-in type for high reliability and easy service. The engine controls shall also include a 3-position selector switch with the following positions: RUN/OFF/AUTO.
- C. Safety shutdown monitoring system shall include solid state engine monitor with individual lights and one common external alarm contact indicating the following conditions: Over-crank shutdown, Over-speed shutdown, High Coolant Temperature Shutdown, Low Coolant Level Shutdown, Low Oil Pressure Shutdown. Monitoring system shall include lamp test switch for manual reset of tripped conditions. Engine RPM is to be monitored by an independent permanent magnet sensor. If there is a failure in this circuit, the engines must shutdown immediately and illuminate a Loss of RPM Sensor shutdown.
- D. Engine instrumentation shall consist of an oil pressure gauge, coolant temperature gauge, DC ammeter and an engine run hour meter located on the unit control panel. Alternator instrumentation must include analog meters to indicate output voltage, amperage and frequency.
- E. Provide the following items installed at the factory:
 - 1. Pre-alarms indicators for auxiliary/multifunction must be provided to anticipate possible problems before the system becomes inoperative. A red light labeled on the control panel will illuminate should the associated parameters be exceeded.
 - 2. Engine battery voltage is to be monitored by a special printed circuit board to detect abnormal voltage levels. Red lights labeled on the control panel will illuminate should a high or low voltage condition be experienced.
 - 3. Provide an automatic dual rate battery charger manufactured by the engine-generator set supplier. The automatic equalizer system shall monitor and limit the charge current as required. The output voltage is to be determined by the charge current rate. The charger must have a maximum open circuit voltage of 35 volts DC and be protected against a reverse polarity connection. The battery charger is to be factory installed on the generator set.

2.4 MISCELLANEOUS EQUIPMENT

- A. The following equipment is to be installed at the engine-generator set manufacturer's facility or at their approved fabricator:
 - 1. Weather protective enclosure: The engine-generator set shall be factory enclosed in a heavy gauge (minimum 14 gauge) steel enclosure constructed with corner posts, coated with electrostatically applied zinc and finished with baked enamel paint. The enclosure is to have large, easily opened doors to allow access to the engine, alternator and control panel. Each door is to be fitted with stainless steel, lockable hardware with identical keys. Padlocks do not meet this specification.
- B. Generator Certification:
 - 1. The Contractor shall comply with the provisions of all Federal and State regulations pertaining to the removal or modification of existing systems or installation of the new systems.
 - 2. The Contractor shall obtain all permits and pay all fees required by the State and local jurisdictions.

2.5 FACTORY TESTING

- A. Before shipment of the equipment, the engine-generator set shall be tested under rated load and power factor for performance and proper functioning of control and interfacing circuits. Tests shall include:
 - 1. Verifying all safety shutdowns are functioning properly.
 - 2. Single step load pick-up per NFPA 110.
 - 3. Transient and voltage dip responses and steady state voltage and speed (frequency) checks.

2.6 OWNER'S MANUAL

- A. Three (3) sets of owner's manuals specific to the product supplied must accompany delivery of the equipment. General operating instructions, preventative maintenance, wiring diagrams, schematics and parts exploded views specific to this model must be included.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Contractor shall install the complete electrical generating system including all fuel connections in accordance with the manufacturer's recommendations as reviewed by the Engineer.
- B. Supplier shall have permanent service facilities in this trade area. These facilities shall comprise a permanent force of factory trained service personnel on 24 hour call, experienced in servicing this type of equipment, providing warranty and routine maintenance service to afford the owner maximum protection. Delegation of this service responsibility for any of the equipment listed herein will not be considered fulfillment of these specifications. Service contracts shall also be available.

3.2 WARRANTY

- A. The manufacturer shall warrant against defective materials and factory workmanship of the standby electric generating system components, complete engine-generator, instrumentation panel, and all appurtenances for a period of one year. Such defective parts shall be repaired or replaced at the manufacturer's option, free of charge for travel and labor. The warranty period shall commence when the standby power system is first placed into service. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided. Also, in the judgment of the specifying authority, the manufacturer supplying the warranty for the complete system must have the financial strength and technical expertise with all components supplied to provide adequate warranty support.

3.3 INSPECTION AND STARTUP

- A. The supplier of the electric generating plant and associated items covered herein shall provide factory-trained technicians to inspect the completed installation and perform an initial startup inspection to include: insuring the engine starts (both hot and cold) within the specified time.
 - 1. Verification of engine parameters within specifications.
 - 2. Set no load frequency and voltage.
 - 3. Test all automatic shutdowns of the engine-generator.
 - 4. Perform a 1-hour load test, ensuring full load frequency and voltage is within specification by using a contractor furnished resistive load set and

test exerciser. Test shall be performed at 100% of generator capacity (full load).

END OF SECTION

SECTION 16496
ENCLOSED AUTOMATIC TRANSFER SWITCH

PART 1 GENERAL

1.1 SCOPE

- A. Provide enclosed automatic transfer switch (ATS) as described herein and shown on the drawings.

1.2 REFERENCES

- A. IEC 61000-4-2 Electromagnetic Compatibility (EMC) – Part 4-2: Testing and Measurement Techniques – Electrostatic Discharge Immunity Test.
- B. IEC 61000-4-4 Electromagnetic Compatibility (EMC) – Part 4-4: Testing and Measurement Techniques – Electrical Fast Transient/Burst Immunity Test.
- C. IEC 6100-4-5 Electromagnetic Compatibility (EMC) – Part 4-5: Testing and Measurement Techniques – Surge Immunity Test.
- D. IEEE C37.90.1 Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus.
- E. MIL STD 461E – Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment.
- F. NEMA ICS 1 Industrial Control and Systems: General Requirements
- G. NEMA ICS 10 Industrial Control and Systems: AC Transfer Switch Equipment
- H. NETA ATS Standard for Acceptance Testing Specifications.
- I. NFPA 70 - National Electrical Code
- J. UL 1008 Standard for Transfer Switch Equipment.

1.3 SUBMITTALS FOR REVIEW

- A. Product Data: Provide catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, display features, dimensions and enclosure details.

1.4 SUBMITTALS FOR INFORMATION

- A. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.5 SUBMITTALS FOR CLOSEOUT

- A. Operation Data: Instructions for operating equipment under emergency conditions when engine generator is running.
- B. Maintenance Data: Routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

1.6 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications:
 - 1. Company specializing in manufacturing the Products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of Project.
 - 2. The ATS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.
 - 3. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.
- C. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.
- D. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.7 MAINTENANCE SERVICE

- A. Provide service and maintenance of transfer switches for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Cummins-Onan
- B. Generac
- C. Caterpillar

2.2 AUTOMATIC TRANSFER SWITCH

- A. Description: NEMA ICS 10, automatic transfer switch suitable for use as service equipment.
- B. Configuration:
 - 1. Electrically operated, mechanically held transfer switch.
 - 2. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a single-solenoid mechanism, momentarily energized. Main operators which include overcurrent disconnect devices will not be accepted. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal and emergency.
 - 3. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for a maximum reliability and operating life.
 - 4. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand current capability and be protected by separate arcing contacts.
 - 5. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.
 - 6. ATS designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty,

repetitive switching or transfer between two active power sources are not acceptable.

7. Neutral conductors are to be solidly connected. A neutral conductor terminal plate with fully rated AL-CU pressure connectors shall be provided.

2.3 SERVICE CONDITIONS

- A. Service Conditions: NEMA ICS 10.

2.4 PRODUCT OPTIONS AND FEATURES

- A. Microprocessor Control Panel:

1. The control panel shall direct the operation of the transfer switch. The panel's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, and inherent serial communications capability. The control panel shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the control panel to be disconnected from the transfer switch for routine maintenance.
2. The control panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. Sensing and control logic shall be provided on printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers.
3. The control panel shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
 - a. Ring Wage Test per IEEE C37.90.1.
 - b. Electrostatic Discharge Immunity - IEC 61000-4-2.
 - c. Electrical Fast Transient Immunity - IEC 61000-4-4.
 - d. Surge Immunity - IEC 6100-4-5.
 - e. Electromagnetic Interference - Mil Std 461, Class 3C.

- B. Voltage and Frequency Sensing:

1. The voltage of each phase of the normal source shall be monitored, with pickup adjustable from 85% to 100% of nominal and dropout adjustable from 75% to 98% of pickup setting.
2. Single-phase voltage sensing of the emergency source shall be provided, with pickup voltage adjustable from 85% to 100% of nominal and independent frequency sensing with pickup adjustable from 90% to 100% of nominal.
3. Repetitive accuracy of all settings shall be within +/- 2% over an operating temperature range of -20°C to 70°C.
4. Voltage and frequency settings shall be field adjustable in 1% increments without the use of tools, meters or power supplies. Actual settings shall be clearly defined in the operator's manual.

C. Time Delays:

1. A time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Adjustable from 0 to 6 seconds.
2. A time delay shall be provided on transfer to emergency, adjustable from 0 to 5 minutes for controlled timing of transfer of loads to emergency.
3. A time delay shall be provided on retransfer to normal, adjustable from 0 to 30 minutes. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.
4. A time delay shall be provided on shutdown of engine generator for cool down, adjustable from 0 to 60 minutes.
5. All time delays shall be fully field adjustable without the use of tools.

D. Additional Features:

1. A set of DPDT gold-flashed contacts rated 10 amps, 32 VDC shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred. Also, provide a "commit/no commit to transfer" selector switch to select whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.

2. A momentary-type test switch shall be provided to simulate a normal source failure.
3. Auxiliary contacts, rated 10 amps, 480 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact closed, when the ATS is connected to the emergency source.
4. Indicating lights shall be provided, one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).
5. Engine Exerciser - An engine generator exercising timer shall be provided, including a selector switch to select exercise with or without load transfer. The exerciser shall be programmable to enable exercise for 1 minute to 24 hours per day in 1 minute increments for 1 to 7 days per week.
6. In-phase Monitor - An In-phase monitor or programmed transition shall be inherently built into the controls. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The in-phase monitor shall be specifically designed for and be the product of the ATS manufacturer.
7. An Inhibit-to-Transfer auxiliary switch shall be included with each Automatic Transfer Switch. When switched to the "Disable" position the switch will disable transfer but allow for the generator to start. Manual operation of this switch to the "Enable" position will re-enable all automatic transfer functions.
8. ATS control panel shall be capable of displaying phase-to-neutral and phase-to-phase voltage, phase current, frequency, watts and volt-amps. Provide instrumentation, terminals, current transformers (CTs), and CT shorting terminals as required.
9. An integral TVSS shall be supplied on the load side of the transfer switch. TVSS shall have AIC ratings matching or exceeding the ATS. See Section 16100 - Electrical.

2.5 ADDITIONAL REQUIREMENTS

- A. Withstand and Closing Ratings: The ATS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 1-1/2 and 3 cycle, long-time ratings. ATSs that are not tested and labeled with 1-1/2 and 3 cycle

(any breaker) ratings and have series, or specific breaker ratings only are not acceptable.

B. Tests and Certification:

1. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage and frequency are in compliance with the specification requirements.
2. The transfer switch and control panel shall be subjected to a dielectric strength test per NEMA ICS 1-109.21.
3. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.
4. The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation, and servicing in accordance with ISO 9001.

2.6 ENCLOSURE

- A. Enclosure: NEMA 1 as specified on the drawings.
- B. Finish: Manufacturer's standard.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surface is suitable for transfer switch installation.

3.2 PREPARATION

- A. Provide concrete equipment pads as required.

3.3 INSTALLATION

- A. Manufacturer's instructions

- B. Provide engraved plastic nameplates under the provisions of Section 16100 - Electrical.

3.4 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.22.3.
- C. Programmable functions shall be configured per Owner's direction.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems.
- B. Check out transfer switch connections and operations and place in service.

3.6 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation of transfer switch in normal and emergency modes.

END OF SECTION



Ellis & Associates inc.

Geotechnical ■ Materials Testing ■ Environmental ■ CEI Services
Integrated Engineering Services



**REPORT OF
GEOTECHNICAL EXPLORATION
WATER PRODUCTION FACILITIES – JWSC - RIDGEWOOD
GLYNN COUNTY, GEORGIA
E&A PROJECT NO. 4338-0001**

Prepared for:

Elmo A. Richardson, Jr., PE, LLC
4875 Riverside Drive, Suite 101
Macon, Georgia 31210

Prepared by:

Ellis & Associates, Inc.
7064 Davis Creek Road
Jacksonville, Florida 32256

May 19, 2014

May 19, 2014

Mr. Garry Garretson, P.E.
Elmo A. Richardson, Jr., PE, LLC
4875 Riverside Drive, Suite 101
Macon, Georgia 31210

Reference: Report of Geotechnical Exploration
Water Production Facilities – JWSC – Ridgewood
Glynn County, Georgia
E&A Project No. 4338-0001

Dear Mr. Garretson:

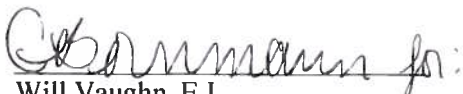
Ellis & Associates, Inc. has completed the requested geotechnical exploration in general accordance with our proposal dated January 24, 2014. The exploration was performed to evaluate the general subsurface conditions within the proposed building and storage tank areas and to provide recommendations for site preparation, and foundation support. A summary of our findings and related recommendations is provided below for your convenience; however, this report should be considered in its entirety.

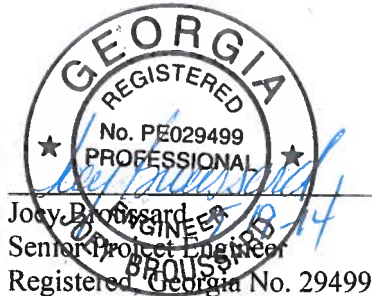
In general, we consider the soils at this site adaptable for support of the proposed structures. We do note that the borings encountered sands with significant organic material to a depth of approximately 4 feet below the existing ground surface. Based on the samples obtained from the borings, this material does not appear suitable for direct support of the planned structures, and we recommend their removal from within and at least 5-feet beyond the structures periphery. Further, the borings encountered soft compressible clays below 35-feet. Our settlement evaluation indicates that settlement on the order of 9.5 inches will occur once the tank is constructed and loaded. We recommend either flexible plumbing connections be utilized or a preloading program be implicated to endure the expected settlements prior to affixing the connections.

We appreciate the opportunity to be your geotechnical consultant on this phase of the project and look forward to providing the materials testing and observation that will be required during the construction phase. If you have any questions, or if we may be of any further service, please contact us.

Very truly yours,

ELLIS & ASSOCIATES, INC.


Will Vaughn, E.I.
Staff Engineer


Jody Broussard
Senior Project Engineer
Registered Georgia No. 29499

Distribution: Mr. Garry Garretson, P.E. – Elmo A. Richardson, Jr., PE, LLC

1 pdf

TABLE OF CONTENTS

Subject	Page No.
1.0 PROJECT INFORMATION	1
1.1 Site Location and Project Description	1
2.0 FIELD EXPLORATION.....	1
2.1 SPT Borings.....	1
3.0 LABORATORY TESTING	1
4.0 GENERAL SUBSURFACE CONDITIONS.....	2
4.1 General Soil Profile	2
4.2 Groundwater Level.....	2
4.3 Normal Seasonal High Groundwater Level.....	2
4.4 Seismic Information	2
5.0 DESIGN RECOMMENDATIONS.....	3
5.1 General	3
5.2 Above Ground Tank Recommendations	3
5.3 Single Story Structure Design Recommendations.....	4
5.4 Pavement Considerations	5
6.0 SITE PREPARATION AND EARTHWORK RECOMMENDATIONS.....	6
6.1 Clearing and Stripping.....	6
6.2 Organic Removal/Replacement	7
6.3 Temporary Groundwater Control	7
6.4 Compaction.....	7
6.5 Structural Backfill and Fill Soils	7
6.6 Foundation Areas.....	8
6.7 Pavement Areas	8
7.0 QUALITY CONTROL TESTING	8
8.0 REPORT LIMITATIONS	8

FIGURES

Figure 1	Site Location Plan
Figure 2	Field Exploration Plan
Figure 3	Generalized Subsurface Profiles

APPENDICES

Appendix A	Soil Boring Logs Field Exploration Procedures Key to Soil Classification
Appendix B	Laboratory Data Laboratory Test Procedures

1.0 PROJECT INFORMATION

1.1 Site Location and Project Description

The project site is located near the northeast corner of the intersection of Perry Lane Road and Jessica Lane in Glynn County, Georgia. The general site location is shown on Figure 1.

At the time of our exploration, the site was developed with small buildings located on the property, with surface cover consisting of mostly grass and some trees. The site was relatively level and surface water was not observed near planned structural areas at the time of our exploration.

We were provided project information via several discussions and emails. We were provided with a copy of an undated preliminary site plan for the subject site, prepared by Elmo A. Richardson, Jr., PE, LLC. This plan indicates the boundary limits for the property, the existing roadways adjacent to the site, the layout of the proposed construction, and the requested boring locations.

We anticipate the proposed pump building includes a one-story structure approximately 24 feet by 30 feet in plan dimensions and will consist of load bearing masonry or wood framed walls and interior columns with slab-on-grade floors. We were not provided detailed structural loading and grading information. For the purposes of this report, we expect maximum column, wall, and floor loads of 30 kips, 3 kips per linear foot (klf) and 150 pounds per square foot (psf), respectively. We also expect that less than 2 feet of fill will be required to achieve final grades in structural areas.

We understand the proposed tank will be a prestressed concrete structure approximately 45 feet in diameter and approximately 21 feet in height and will bear at or near the existing ground surface. We were not provided detailed structural loading and grading information. For the purposes of this report, we expect maximum floor loads of 1500 pounds per square foot (psf). We also expect that less than 2 feet of fill will be required to achieve final grades in structural areas.

We should be contacted if any of the above project information is incorrect so that we may reevaluate our recommendations.

2.0 FIELD EXPLORATION

We performed a field exploration on April 4 and April 7 2014. The approximate boring locations are indicated on the attached Field Exploration Plan (Figure 2). Our personnel determined the boring locations using taped measurements from existing roadways and survey controls adjacent to the site. The boring locations on the referenced Field Exploration Plan should be considered accurate only to the degree implied by the method of measurement used.

2.1 SPT Borings

We located and performed two Standard Penetration Test (SPT) borings, drilled to depths of approximately 100 feet below the existing ground surface to explore the subsurface conditions within the area of the proposed tank and performed one SPT boring, drilled to a depth of approximately 30 feet below the existing ground surface, in general accordance with the methodology outlined in ASTM D 1586 to explore the subsurface conditions within the area of the proposed structure. Split-spoon soil samples recovered during performance of the borings were visually classified in the field and representative portions of the samples were transported to our laboratory for further evaluation.

3.0 LABORATORY TESTING

A geotechnical engineer classified representative soil samples obtained during our field exploration using the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488. A Key to the Soil Classification System is included in Appendix A.

Selected samples of the soils encountered during the field exploration were subjected to quantitative laboratory testing to better define the composition of the soils encountered and to provide data for correlation to their anticipated strength and compressibility characteristics. The laboratory testing determined the Atterberg limits, percent fines, moisture, and organic contents of selected soil samples. The results of the laboratory testing are shown in the Summary of Laboratory Test Data included in Appendix B. Also, these results are shown on the Generalized Subsurface Profiles on Figure 3 and on the Log of Boring records at the respective depths from which the tested samples were recovered.

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 General Soil Profile

A graphical presentation of the generalized subsurface conditions is presented on Figure 3. Detailed boring records are included in Appendix A. It should be understood that the soil conditions will vary between the boring locations.

The boring within the proposed pump building location generally encountered topsoil, loose sand with silt (SP-SM), and fine sand with many wood pieces (PT) in the upper 4 feet of the boring. Below this surficial unsuitable material we encountered loose to medium dense fine sand with silt (SP-SM), loose silty fine sand (SM), and very loose to medium dense clayey fine sand (SC) to the boring termination depth of approximately 30 feet below the existing ground surface.

The borings within the proposed tank location generally encountered topsoil, muck (PT), and fine sands with many organic fines (PT) in the upper 4 feet of the borings. Below this surficial unsuitable material we encountered medium dense fine sand (SP), loose to very dense fine sand with silt (SP-SM), dense fine sand with clay (SP-SC), loose to very dense clayey fine sand (SC), and soft clay (CH) to the boring termination depths of approximately 100 feet below the existing ground surface.

4.2 Groundwater Level

Groundwater was encountered at each boring location and recorded at the time of drilling at depths varying from the ground surface to approximately 2.5 feet below the existing ground surface. We note that groundwater levels will fluctuate due to seasonal climatic variations, surface water runoff patterns, construction operations, and other interrelated factors. The groundwater depth at each boring location is noted on the Generalized Subsurface Profiles and on the Log of Boring records.

4.3 Normal Seasonal High Groundwater Level

The normal seasonal high groundwater level is affected by a number of factors. The drainage characteristics of the soils, land surface elevation, relief points such as drainage ditches, lakes, rivers, swamp areas, etc., and distance to relief points are some of the more important factors influencing the seasonal high groundwater level.

Based on our interpretation of the site conditions, including the boring logs and Web Soil Survey, we estimate the normal seasonal high groundwater level at the site to be approximately 0 to 1.0 feet above the groundwater levels measured at the time of our field exploration. It is possible that groundwater levels may exceed the estimated normal seasonal high groundwater level as a result of significant or prolonged rains.

4.4 Seismic Information

Based on the IBC Section 1613, the results of our borings, and our knowledge of local geologic conditions, it is our opinion that the subject site has a Site Classification of E.

5.0 DESIGN RECOMMENDATIONS

5.1 General

Our geotechnical engineering evaluation of the site and subsurface conditions at the property, with respect to the planned construction and our recommendations for site preparation and foundation support, are based on (1) our site observations, (2) the field and laboratory test data obtained, (3) our understanding of the project information and structural conditions as presented in this report, and (4) our experience with similar soil and loading conditions.

If the stated structural or grading conditions are incorrect, or should the location of the structures or pavement areas be changed, please contact us so that we can review our recommendations. Also, the discovery of any site or subsurface conditions during construction that deviate from the data obtained during this geotechnical exploration should also be reported to us for our evaluation.

The recommendations in the subsequent sections of this report present design and construction techniques that are appropriate for the planned construction. We recommend that E&A be provided the opportunity to review the foundation plans and earthwork specifications to verify that our recommendations have been properly interpreted and implemented.

5.2 Above Ground Tank Recommendations

5.2.1 Foundation Design Recommendations

Based on the results of our exploration, we consider the subsurface conditions at the site adaptable for support of the proposed structure on a properly designed conventional mat foundation system. Provided the site preparation and earthwork construction recommendations outlined in Section 6.0 of this report are performed, the following parameters may be used for foundation design.

5.2.2 Bearing Pressure

The maximum allowable net soil bearing pressure for use in design of the mat foundation system should not exceed 2,500 pounds per square foot (psf). Net bearing pressure is defined as the soil bearing pressure at the foundation bearing level in excess of the natural overburden pressure at that level. The foundations should be designed based on the maximum load that could be imposed by all loading conditions.

5.2.3 Bearing Depth

The mat foundation should bear at a depth of at least 2-feet below the exterior final grades to provide confinement to the bearing level soils. It is recommended that stormwater be diverted away from the tank exterior to reduce the possibility of erosion beneath the footings.

5.2.4 Bearing Material

The foundations may bear in either the compacted suitable natural soils or compacted structural fill. The bearing level soils, after compaction, should exhibit densities equivalent to 95 percent of the Modified Proctor maximum dry density (ASTM D 1557), to a depth of at least 2 feet below the foundation bearing levels.

5.2.5 Settlement Estimates

Post-construction settlements of the tank will be influenced by several interrelated factors, such as (1) subsurface stratification and strength/compressibility characteristics; (2) tank bearing area, bearing level, applied loads, and resulting bearing pressures beneath the tank; and (3) site preparation and

earthwork construction techniques used by the contractor. Our settlement estimate for the tank is based on the site preparation and earthwork recommendations outlined in Section 6.0 of this report.

We performed our settlement analysis using the Settle G software (by Geo Soft). Due to the sandy nature of most of the encountered soils, we expect the majority of settlement to occur in an elastic manner and fairly rapidly after construction. Using the estimated maximum bearing pressure, and the field data that we have correlated to geotechnical strength and compressibility characteristics of the subsurface soils, we estimate the following total and differential post-construction settlements:

Structure	Total Settlements (inches)	Differential Settlements (inches)*
250,000 Gallon Tank	<u>2.5</u>	1.5

*Between center and edge of structure

5.2.6 Other Considerations

We assume the tank will not be filled to capacity until the tank is put into service (i.e. the supporting soils will not endure the full load of the tanks until after construction). Therefore, most of the settlement will not occur until after construction. We note that the total settlement of the tank will occur differentially from any rigid plumbing attachments. Therefore these attachments should be flexible enough to tolerate the estimated total settlements, or repairs at the attachments should be anticipated. Alternatively, the tank can be constructed and filled prior to affixing plumbing attachments to induce the expected settlements. The settlements should be monitored by elevation survey readings. Once the survey data indicates that settlement is complete, the plumbing connection can be affixed. We can prepare a pre-load/settlement monitoring plan at your request if this option is selected.

5.3 Single Story Structure Design Recommendations

Based on the results of our exploration, we consider the subsurface conditions at the site adaptable for support of the proposed structure when constructed on a properly designed conventional shallow foundation system. Provided the site preparation and earthwork construction recommendations outlined in Section 6.0 of this report are performed, the following parameters may be used for foundation design.

5.3.1 Bearing Pressure

The maximum allowable net soil bearing pressure for use in shallow foundation design should not exceed 2,500 pounds per square foot (psf). Net bearing pressure is defined as the soil bearing pressure at the foundation bearing level in excess of the natural overburden pressure at that level. The foundations should be designed based on the maximum load that could be imposed by all loading conditions.

5.3.2 Foundation Size

The minimum widths recommended for any building isolated column footings and continuous wall footings are 24 inches and 18 inches, respectively. Even though the maximum allowable soil bearing pressure may not be achieved, these width recommendations should control the size of the foundations.

5.3.3 Bearing Depth

The exterior foundations should bear at a depth of at least 18 inches below the exterior final grades, and the interior foundations should bear at a depth of at least 18 inches below the finish floor elevation to provide confinement to the bearing level soils. It is recommended that stormwater be diverted away from the building exterior to reduce the possibility of erosion beneath the exterior footings.

5.3.4 Bearing Material

The foundations may bear in either the compacted suitable natural soils or compacted structural fill. The bearing level soils, after compaction, should exhibit densities equivalent to 95 percent of the Modified Proctor maximum dry density (ASTM D 1557), to a depth of at least 2 feet below the foundation bearing levels.

5.3.5 Settlement Estimates

Post-construction settlements of the single story structure will be influenced by several interrelated factors, such as (1) subsurface stratification and strength/compressibility characteristics; (2) footing size, bearing level, applied loads, and resulting bearing pressures beneath the foundations; and (3) site preparation and earthwork construction techniques used by the contractor. Our settlement estimates for the structure are based on the use of site preparation/earthwork construction techniques as recommended in Section 6.0 of this report. Any deviation from these recommendations could result in an increase in the estimated post-construction settlements of the structures.

Due to the sandy nature of the near-surface soils, we expect the majority of settlement to occur in an elastic manner and fairly rapidly during construction. Using the recommended maximum bearing pressure, the assumed maximum structural loads, and the field and laboratory test data that we have correlated to geotechnical strength and compressibility characteristics of the subsurface soils, we estimate that total settlements of the structures could be on the order of one inch or less.

Differential settlements result from differences in applied bearing pressures and variations in the compressibility characteristics of the subsurface soils. Because of the general uniformity of the subsurface conditions and the recommended site preparation and earthwork construction techniques outlined in Section 6.0, we anticipate that differential settlements of the structure should be within tolerable magnitudes.

5.3.6 Floor Slab

The floor slabs can be constructed as a slab-on-ground, provided the unsuitable materials are removed and replaced with compacted structural fill as outlined in Section 6.0. It is recommended that the floor slab bearing soils be covered with an impervious membrane to reduce moisture entry and floor dampness. In addition, we recommend that a minimum separation of 2 feet be maintained between the finished floor levels and the estimated normal seasonal high groundwater level.

5.4 Pavement Considerations

Based on the results of our exploration, we consider the subsurface conditions at the site favorable for support of a flexible pavement section when constructed on properly prepared subgrade soils as outlined in Section 6.0 of this report. Typical pavement sections used in northeast Florida are shown on the following table. If requested, we can prepare a project-specific pavement design if specific traffic data is provided.

TYPICAL PAVEMENT SECTION		
Pavement Layer	Auto Parking & Traffic Lanes	Truck Areas
Asphaltic Concrete Wearing Surface	1.5"	2.0"
Limerock Base	6.0"	8.0"
Stabilized Subgrade	12.0"	12.0"

5.4.1 Wearing Surface

The wearing surface should consist of Florida Department of Transportation (FDOT) Type S asphaltic concrete having a minimum Marshall Stability of 1,500 lbs. Specific requirements for Type S asphaltic concrete wearing surface are outlined in the 2000 edition of the *Florida Department of Transportation, Standard Specifications for Road and Bridge Construction*. As an alternative, the wearing surface may consist of a Type SP-9.5 asphaltic concrete as outlined in the current edition of the *FDOT Standard Specifications* or the current version of the *Georgia Department of Transportation Standard Specifications - Construction of Transportation Systems*

5.4.2 Base and Subgrade

The limerock base course should have a minimum Limerock Bearing Ratio (LBR) of 100 and should be compacted to 100 percent of the modified Proctor maximum dry density (ASTM D 1557) value.

The subgrade material should have a minimum LBR of 40 and be compacted to 98 percent of the modified Proctor maximum dry density (ASTM D 1557) value.

5.4.3 Underdrains

Satisfactory pavement life is dependent on dry/strong pavement support provided by the base and subgrade courses. Accordingly, a minimum clearance of 2 feet must be maintained between the normal seasonal high groundwater table and the bottom of the base layer. Depending on final pavement grades, underdrains may be required to maintain dry base and subgrade materials.

6.0 SITE PREPARATION AND EARTHWORK RECOMMENDATIONS

Site preparation as outlined in this section should be performed to provide more uniform foundation bearing conditions, to reduce the potential for post-construction settlements of the planned structures and to maintain the integrity of a flexible pavement section.

6.1 Clearing and Stripping

Prior to construction, the location of existing underground utilities within the construction area should be established. Provisions should then be made to relocate interfering utilities to appropriate locations. Underground pipes that are not properly removed or plugged may serve as conduits for subsurface erosion, which may subsequently lead to excessive settlement of overlying structures.

The "footprint" of the proposed building and tank plus a minimum additional margin of 5 feet, and of the hardscape areas (parking/driveway) plus a minimum additional margin of 3 feet, should be stripped of all surface vegetation, stumps, debris, organic topsoil, or other deleterious materials. During grubbing operations, roots with a diameter greater than 0.5-inch, stumps, or small roots in a concentrated state, should be grubbed and completely removed.

6.2 Organic Removal/Replacement

The borings encountered sands with significant organic material to a depth of approximately 4 feet below the existing ground surface. Based on the samples obtained from the borings, this material does not appear suitable for direct support of the building, tank, or pavement sections. We recommend a supplemental test pit program be implemented to better delineate the vertical and horizontal extents of this material. Our personnel should observe the test pit program, provide recommendations for removal, and observe the replacement with compacted structural fill. Any topsoils removed from these areas can be stockpiled and used subsequently in areas to be grassed.

6.3 Temporary Groundwater Control

The borings encountered groundwater at depths varying from the ground surface to approximately 2.5 feet below the existing ground surface at the time of our exploration. Because of the need for organic removal and densification of exposed subgrade and backfill, temporary groundwater control measures may be required if the groundwater level is within 2 feet below the stripped and grubbed surface at the time of construction. Should groundwater control measures become necessary, dewatering methods should be determined by the contractor. We recommend the groundwater control measures, if necessary, remain in place until compaction of the existing soils is completed. The dewatering method should be maintained until backfilling has reached a height of 2 feet above the groundwater level at the time of construction. The site should be graded to direct surface water runoff from the construction area.

6.4 Compaction

After completing the clearing and stripping operations, the removal of the organic soils where encountered within and to a distance of 5-feet beyond the structures' periphery, and installing the temporary groundwater control measures (if required), the exposed surface should be compacted with a vibratory drum roller having a minimum static, at-drum weight, on the order of 4 to 6 tons. Typically, the material should exhibit moisture contents within ± 2 percent of the modified Proctor optimum moisture content (ASTM D 1557) during the compaction operations. Compaction should continue until densities of at least 95 percent of the modified Proctor maximum dry density (ASTM D 1557) have been achieved within the upper 2 feet of the compacted natural soils at the site.

Should the bearing level soils experience pumping and soil strength loss during the compaction operations, compaction work should be immediately terminated, and (1) the disturbed soils should be removed and backfilled with compacted structural fill, or (2) the excess moisture content within the disturbed soils should be allowed to dissipate before recompacting.

Care should be exercised to avoid damaging any nearby structures while the compaction operation is underway. Prior to commencing compaction, occupants of adjacent structures should be notified, and the existing conditions of the structures should be documented with photographs and survey (if deemed necessary). Compaction should cease if deemed detrimental to adjacent structures, and Ellis & Associates, Inc. should be contacted immediately. We recommend the vibratory roller remain a minimum of 50 feet from existing structures. Within this zone, use of a track-mounted bulldozer, or a vibratory roller operating in the static mode, is recommended.

6.5 Structural Backfill and Fill Soils

Structural backfill or fill required for site development should be placed in loose lifts not exceeding 12 inches in thickness when compacted by the use of the above described vibratory drum roller. The lift thickness should be reduced to 8 inches if the roller operates in the static mode or if track-

mounted compaction equipment is used. If hand-held compaction equipment is used, the lift thickness should be further reduced to 6 inches.

Structural fill is defined as a non-plastic, inorganic, granular soil having less than 10 percent material passing the No. 200 mesh sieve and containing less than 4 percent organic material. The fine sand and fine sand with silt or fine sand with clay, without roots, as encountered in the upper ten feet of the borings, are suitable as fill materials and, with proper moisture control, should densify using conventional compaction methods. Soils with more than 10 to 12 percent passing the No. 200 sieve will be more difficult to compact, due to their nature to retain soil moisture, and may require drying. Typically, the material should exhibit moisture contents within ± 2 percent of the modified Proctor optimum moisture content (ASTM D 1557) during the compaction operations. Compaction should continue until densities of at least 95 percent of the modified Proctor maximum dry density (ASTM D 1557) have been achieved within each lift of the compacted structural fill.

6.6 Foundation Areas

After satisfactory placement and compaction of the required structural fill, the foundation areas may be excavated to the planned bearing levels. The foundation bearing level soils, after compaction, should exhibit densities equivalent to 95 percent of the modified Proctor maximum dry density (ASTM D 1557) to a depth of one foot below the bearing level. For confined areas, such as the footing excavations, any compactive effort should be provided by a lightweight vibratory sled or roller having a total weight on the order of 500 to 2,000 pounds.

6.7 Pavement Areas

After completing the clearing/stripping operations in the pavement areas, any underlying clayey sands and sandy clays that are within 2 feet of the bottom of the pavement base should be over-excavated from within the pavement areas. Structural backfill and fill required to achieve the finish pavement grades then can be placed and compacted as described in Section 6.3 above. As an exception, densities of at least 98 percent of the modified Proctor maximum dry density (ASTM D1557) should be obtained within the upper one foot of the materials immediately below the proposed base course.

7.0 QUALITY CONTROL TESTING

Ellis & Associates, Inc. should be retained to perform the construction material testing and observations required for this project, to verify that our recommendations have been satisfied. We are the most qualified to address problems that may arise during construction since we are familiar with the intent of our engineering design.

A representative number of field in-place density tests should be made in the upper 2 feet of compacted natural soils, in each lift of compacted backfill and fill, in the upper 12 inches below the bearing levels in the footing excavations, in the upper 12 inches below the base material, and in each lift of base material. Density tests are recommended to verify that satisfactory compaction operations have been performed. We recommend density testing be performed (1) at one location for every lift within the building and tank areas, (2) at 25 percent of any isolated column footing locations, (3) at one location for every 100 linear feet of continuous wall footings, and (4) at one location for every 10,000 square feet of pavement area.

8.0 REPORT LIMITATIONS

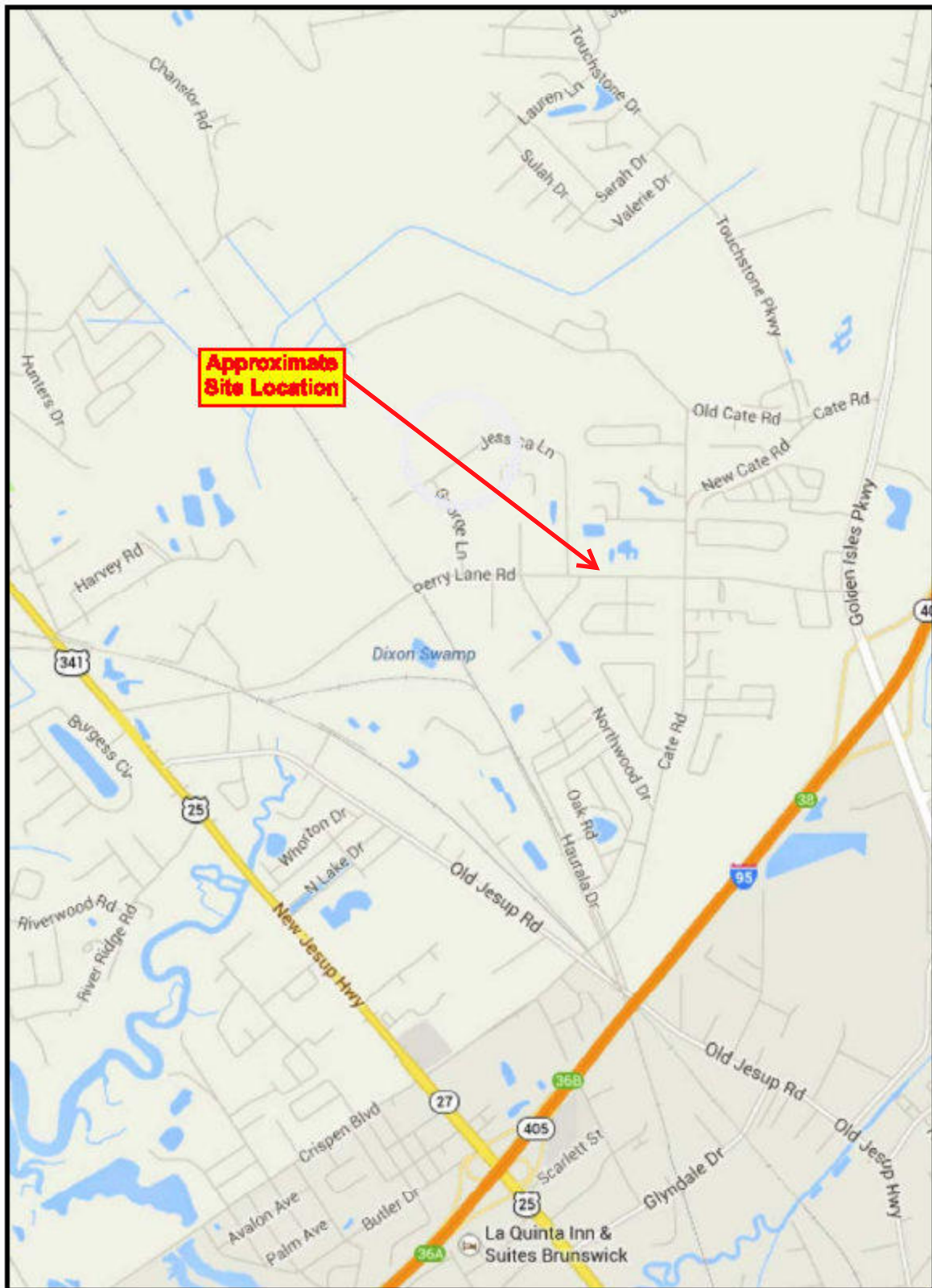
Our geotechnical exploration has been performed, our findings obtained, and our recommendations prepared, in accordance with generally accepted geotechnical engineering principles and practices.

Ellis & Associates, Inc. is not responsible for any independent conclusions, interpretation, opinions, or recommendations made by others based on the data contained in this report.

Our scope of services was intended to evaluate the soil conditions within the zone of soil influenced by the foundation and pavement systems. Our scope of services does not address geologic conditions, such as sinkholes or soil conditions existing below the depth of the soil borings.

This report does not reflect any variations that may occur adjacent to or between soil borings. The discovery of any site or subsurface condition during construction that deviates from the data obtained during this geotechnical exploration should be reported to us for our evaluation. Also, in the event of any change to the assumed structural conditions or the locations of the structures or pavement areas, please contact us so that we can review our recommendations. We recommend that we be provided the opportunity to review the foundation plans and earthwork specifications to verify that our recommendations have been properly interpreted and implemented.

FIGURES



Geotechnical ■ Materials Testing ■ Environmental
Integrated Engineering Services EB: 988
 7084 Davis Creek Road Jacksonville, FL 32256
 p: 904-660-0880 f: 904-660-0670 email: info@ellisassoc.com
 Serving the Southeast since 1970
 Offices: Jacksonville, FL - Brunswick, GA

Site Location Plan
Water Production Facilities, JWSC - Ridgewood
 Glynn County, Florida

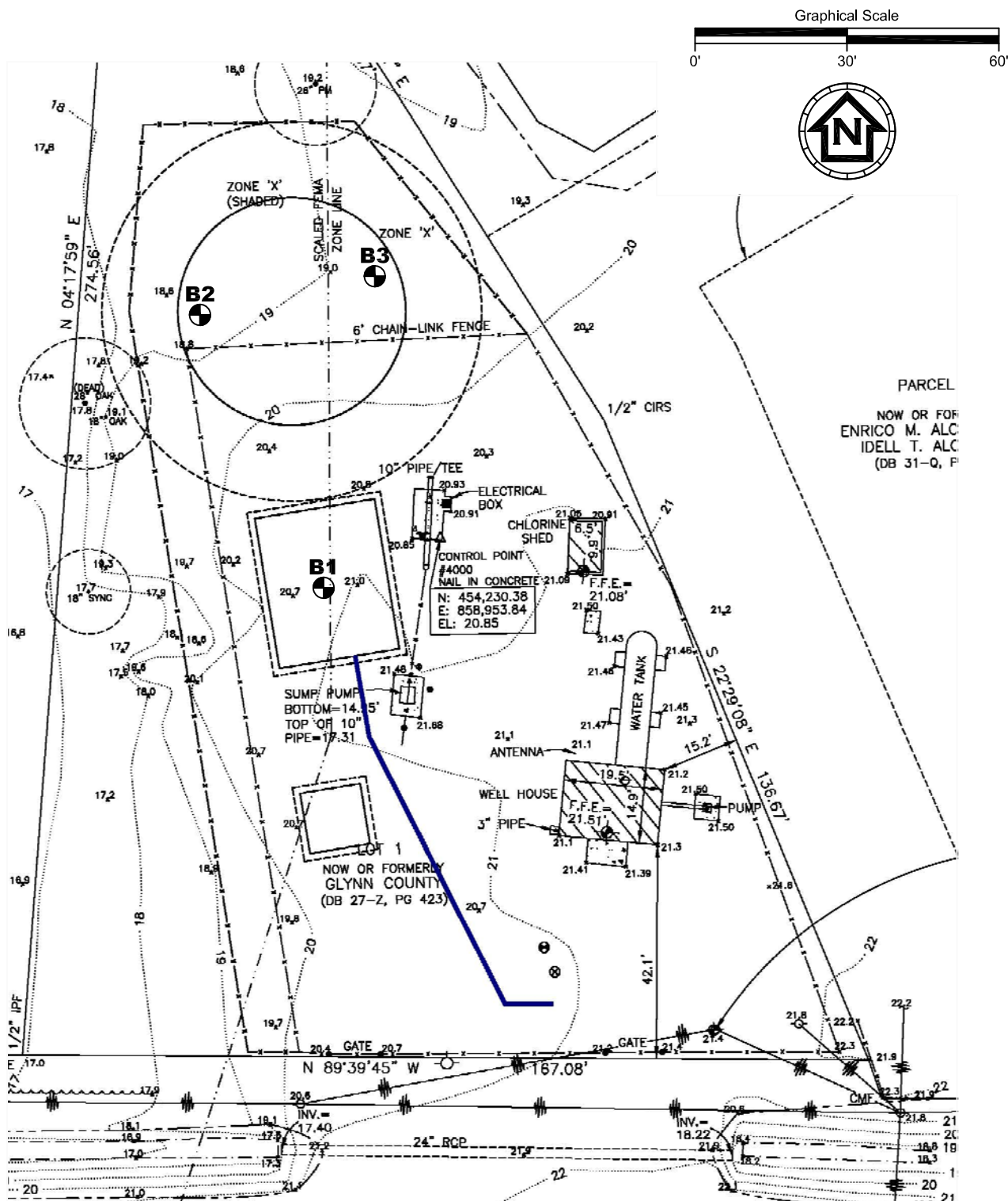


Date: 04/15/14

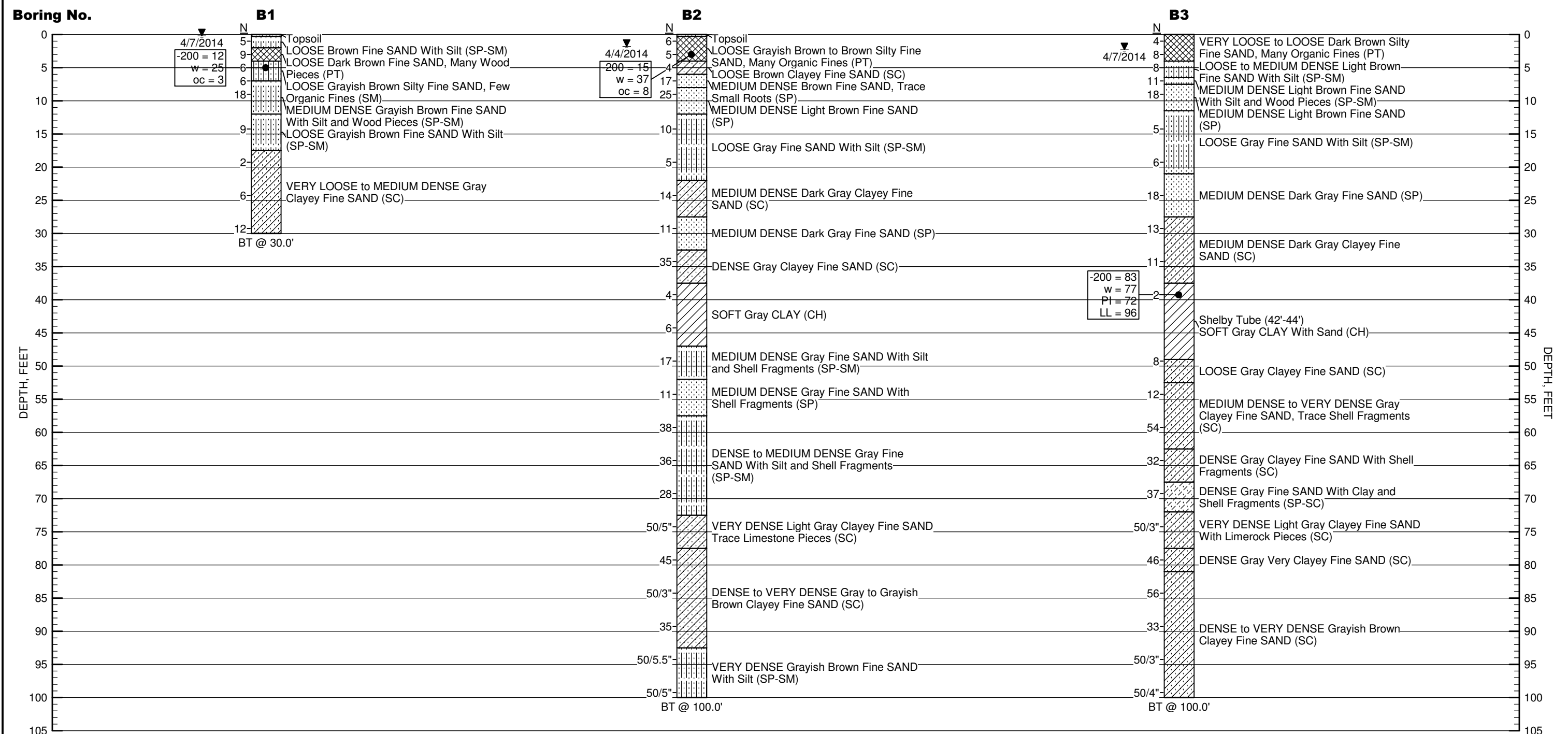
Project No.: 4338-0001

Figure 1

JAS - 43380001



Boring No.



LEGEND



Topsoil



Fine SAND With Silt (SP-SM)



Silty Fine SAND (SM)



CLAY (CH)



Fine SAND (SP)



Fine SAND With Clay (SP-SC)



Clayey Fine SAND (SC)



Silty Fine SAND, Many Organic Fines (PT)

N Standard Penetration Resistance, Blows/Foot

SP Unified Soil Classification System

▼ Groundwater Level at Time of Drilling

50/5" Number of Blows to Drive Split Spoon Sample in Inches

BT Boring Terminated at Depth Below Grade

-200 % Passing No. 200 U.S. Standard Sieve

w Natural Moisture Content (%)

oc Organic Content (%)

PI Plasticity Index

LL Liquid Limit

Generalized Subsurface Profiles
**Water Production Facilities,
JWSC - Ridgewood**
Glynn County, Florida



Ellis & Associates inc.

DATE: 4/30/14

PROJ. NO.: 4338-0001

Figure 3

APPENDIX A

SOIL BORING LOGS
FIELD EXPLORATION PROCEDURES
KEY TO SOIL CLASSIFICATION



Ellis & Associates inc.

LOG OF BORING

Project No.: 4338-0001
Boring No.: B1
Sheet 1 of 2

Project: Water Production Facilities, JWSC - Ridgewood Client: Elmo A. Richardson, Jr. P.E., LLC
Boring Location: See Field Exploration Plan Drill Rig: ATV Driller: C. Morgan
Groundwater Depth: 0.2 ft Time: Drilling Date: 4/7/14 Drill Rod: AWJ Drill Mud: Super Gel-X
Casing Size: Length of Casing: Boring Begun: 4/7/14 Boring Completed: 4/7/14

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT	MOISTURE CONTENT (%)	LIQUID LIMIT	SHEAR STRENGTH (ksf)
1	0		Topsoil	1							
			LOOSE Brown Fine SAND With Silt (SP-SM)	2	5						
				3							
2			LOOSE Dark Brown Fine SAND, Many Wood Pieces (PT)	4							
				5							
				6							
3	5		LOOSE Grayish Brown Silty Fine SAND, Few Organic Fines (SM)	4	9						
				5							
				6							
4			LOOSE Grayish Brown Silty Fine SAND, Few Organic Fines (SM)	2	6	3	12		+		
				3							
				3							
5			MEDIUM DENSE Grayish Brown Fine SAND With Silt and Wood Pieces (SP-SM)	2	6						
				2							
				3							
6	10		LOOSE Grayish Brown Fine SAND With Silt (SP-SM)	7	18						
				11							
				12							
7	15		LOOSE Grayish Brown Fine SAND With Silt (SP-SM)	4	9						
				5							
				4							
8	20		VERY LOOSE to MEDIUM DENSE Gray Clayey Fine SAND (SC)	1	2						
				1							
				1							
	25			3	6						
				3							
				3							

Remarks



Ellis & Associates inc.

LOG OF BORING

Project No.: 4338-0001
Boring No.: B1
Sheet 2 of 2

Project: Water Production Facilities, JWSC - Ridgewood Client: Elmo A. Richardson, Jr. P.E., LLC
Drill Rig: ATV Driller: C. Morgan
Boring Location: See Field Exploration Plan Drill Rod: AWJ Drill Mud: Super Gel-X
Casing Size: Length of Casing:
Groundwater Depth: 0.2 ft Time: Drilling Date: 4/7/14 Boring Begun: 4/7/14 Boring Completed: 4/7/14

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT	MOISTURE CONTENT (%)	LIQUID LIMIT	SHEAR STRENGTH (ksf)	
											POCKET PENETROMETER UNDISTURBED SAMPLE	POCKET PENETROMETER DISTURBED SAMPLE
9	25		VERY LOOSE to MEDIUM DENSE Gray Clayey Fine SAND (SC) (Continued)									
	30		Boring Terminated @ 30 ft.	4 7 5	12							
	35											
	40											
	45											
	50											

Remarks



Ellis & Associates inc.

LOG OF BORING

Project No.: 4338-0001
Boring No.: B2
Sheet 1 of 4

Project: Water Production Facilities, JWSC - Ridgewood Client: Elmo A. Richardson, Jr. P.E., LLC
Boring Location: See Field Exploration Plan Drill Rig: ATV Driller: C. Morgan
Groundwater Depth: 1.8 ft Time: Drilling Date: 4/4/14 Drill Rod: AWJ Drill Mud: Super Gel-X
Casing Size: Length of Casing:
Boring Begun: 4/4/14 Boring Completed: 4/4/14

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT	MOISTURE CONTENT (%)	LIQUID LIMIT	SHEAR STRENGTH (ksf)
1	0		Topsoil	1							
			LOOSE Grayish Brown Silty Fine SAND, Many Organic Fines (PT)	3	6						
				3							
				3							
2			LOOSE Brown Silty Fine SAND, Many Organic Fines (PT)	3							
				3							
				2	5	8	15				
				4							
			LOOSE Brown Clayey Fine SAND (SC)	3							
3	5			2	4						
				2							
				1							
			MEDIUM DENSE Brown Fine SAND, Trace Small Roots (SP)	2							
4				7	17						
				10							
				11							
			MEDIUM DENSE Light Brown Fine SAND (SP)	7							
5				12	25						
				13							
				14							
	10										
			LOOSE Gray Fine SAND With Silt (SP-SM)								
				2							
6				6	10						
	15			4							
				4							
7				2	5						
	20			3							
			MEDIUM DENSE Dark Gray Clayey Fine SAND (SC)								
				2							
8				7	14						
	25			7							

Remarks



Ellis & Associates inc.

LOG OF BORING

Project No.: 4338-0001
Boring No.: B2
Sheet 2 of 4

Project: Water Production Facilities, JWSC - Ridgewood Client: Elmo A. Richardson, Jr. P.E., LLC
Boring Location: See Field Exploration Plan Drill Rig: ATV Driller: C. Morgan
Groundwater Depth: 1.8 ft Time: Drilling Date: 4/4/14 Drill Rod: AWJ Drill Mud: Super Gel-X
Casing Size: Length of Casing:
Boring Begun: 4/4/14 Boring Completed: 4/4/14

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT	MOISTURE CONTENT (%)	LIQUID LIMIT	SHEAR STRENGTH (ksf)
9	25		MEDIUM DENSE Dark Gray Clayey Fine SAND (SC) (Continued)								
	30		MEDIUM DENSE Dark Gray Fine SAND (SP)	3 6 5	11						
	35		DENSE Gray Clayey Fine SAND (SC)	4 8 27	35						
11	40		SOFT Gray CLAY (CH)	1 2 2	4						
12	45			2 3 3	6						
13	50		MEDIUM DENSE Gray Fine SAND With Silt and Shell Fragments (SP-SM)	1 8 9	17						
Remarks											



Ellis & Associates inc.

LOG OF BORING

Project No.: 4338-0001
Boring No.: B2
Sheet 3 of 4

Project: Water Production Facilities, JWSC - Ridgewood Client: Elmo A. Richardson, Jr. P.E., LLC
Boring Location: See Field Exploration Plan Drill Rig: ATV Driller: C. Morgan
Groundwater Depth: 1.8 ft Time: Drilling Date: 4/4/14 Casing Size: Drill Rod: AWJ Drill Mud: Super Gel-X
Boring Begun: 4/4/14 Boring Completed: 4/4/14

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT	MOISTURE CONTENT (%)	LIQUID LIMIT	SHEAR STRENGTH (ksf)
14	50		MEDIUM DENSE Gray Fine SAND With Silt and Shell Fragments (SP-SM) (Continued)								
	55		MEDIUM DENSE Gray Fine SAND With Shell Fragments (SP)	3 6 5	11						
	60		DENSE to MEDIUM DENSE Gray Fine SAND With Silt and Shell Fragments (SP-SM)	15 17 21	38						
16	65			14 19 17	36						
	70			13 14 14	28						
	75		VERY DENSE Light Gray Clayey Fine SAND Trace Limestone Pieces (SC)	14 50/5"	50/5"						

Remarks



Ellis & Associates inc.

LOG OF BORING

Project No.: 4338-0001
Boring No.: B2
Sheet 4 of 4

Project: Water Production Facilities, JWSC - Ridgewood Client: Elmo A. Richardson, Jr. P.E., LLC
Boring Location: See Field Exploration Plan Drill Rig: ATV Driller: C. Morgan
Groundwater Depth: 1.8 ft Time: Drilling Date: 4/4/14 Drill Rod: AWJ Drill Mud: Super Gel-X
Casing Size: Length of Casing: Boring Begun: 4/4/14 Boring Completed: 4/4/14

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT	MOISTURE CONTENT (%)	LIQUID LIMIT	SHEAR STRENGTH (ksf)
	75		VERY DENSE Light Gray Clayey Fine SAND Trace Limestone Pieces (SC) (Continued)								
			DENSE Gray Clayey Fine SAND (SC)	8 22 23	45						
19	80										
			VERY DENSE to DENSE Grayish Brown Clayey Fine SAND (SC)	18 38 50/3"	50/3"						
20	85										
				14 17 18	35						
21	90										
			VERY DENSE Grayish Brown Fine SAND With Silt (SP-SM)	32 50/5.5"	50/5.5"						
22	95										
				33 50/5"	50/5"						
23	100										
Boring Terminated @ 100 ft.											
Remarks											



Ellis & Associates inc.

LOG OF BORING

Project No.: 4338-0001
Boring No.: B3
Sheet 1 of 4

Project: Water Production Facilities, JWSC - Ridgewood Client: Elmo A. Richardson, Jr. P.E., LLC
Boring Location: See Field Exploration Plan Drill Rig: ATV Driller: C. Morgan
Groundwater Depth: 2.3 ft Time: Drilling Date: 4/7/14 Drill Rod: AWJ Drill Mud: Super Gel-X
Casing Size: Length of Casing:
Boring Begun: 4/7/14 Boring Completed: 4/7/14

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT	MOISTURE CONTENT (%)	LIQUID LIMIT	SHEAR STRENGTH (ksf)
1	0		VERY LOOSE to LOOSE Dark Brown Silty Fine SAND, Many Organic Fines (PT)	1							
				3							
				1	4						
				3							
				1							
2				3							
				5	8						
				6							
			LOOSE Light Brown Fine SAND With Silt (SP-SM)	6							
3	5			4							
				4	8						
				8							
				4							
4			MEDIUM DENSE Light Brown Fine SAND With Silt and Wood Pieces (SP-SM)	5							
				6	11						
			MEDIUM DENSE Light Brown Fine SAND (SP)	10							
5				7							
				9	18						
				9							
	10			8							
			LOOSE Gray Fine SAND With Silt (SP-SM)								
6				2							
				2							
	15			3	5						
7				1							
				2							
	20			4	6						
			MEDIUM DENSE Dark Gray Fine SAND (SP)								
8				6							
				9							
	25			9	18						

Remarks



Ellis & Associates inc.

LOG OF BORING

Project No.: 4338-0001
Boring No.: B3
Sheet 2 of 4

Project: Water Production Facilities, JWSC - Ridgewood Client: Elmo A. Richardson, Jr. P.E., LLC
Boring Location: See Field Exploration Plan Drill Rig: ATV Driller: C. Morgan
Groundwater Depth: 2.3 ft Time: Drilling Date: 4/7/14 Casing Size: Drill Rod: AWJ Drill Mud: Super Gel-X
Boring Begun: 4/7/14 Boring Completed: 4/7/14

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT	MOISTURE CONTENT (%)	LIQUID LIMIT	SHEAR STRENGTH (ksf)
	25		MEDIUM DENSE Dark Gray Fine SAND (SP) (Continued)								
9	30		MEDIUM DENSE Dark Gray Clayey Fine SAND (SC)	385	13						
10	35			565	11						
11	40		SOFT Gray CLAY With Sand (CH)	111	2		83				
12	45		Shelby Tube (42'-44')								
13	50		LOOSE Gray Clayey Fine SAND (SC)	135	8						
Remarks											



Ellis & Associates inc.

LOG OF BORING

Project No.: 4338-0001
Boring No.: B3
Sheet 3 of 4

Project: Water Production Facilities, JWSC - Ridgewood Client: Elmo A. Richardson, Jr. P.E., LLC
Boring Location: See Field Exploration Plan Drill Rig: ATV Driller: C. Morgan
Groundwater Depth: 2.3 ft Time: Drilling Date: 4/7/14 Casing Size: Drill Rod: AWJ Drill Mud: Super Gel-X
Boring Begun: 4/7/14 Boring Completed: 4/7/14

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT	MOISTURE CONTENT (%)	LIQUID LIMIT	SHEAR STRENGTH (ksf)
14	50		LOOSE Gray Clayey Fine SAND (SC) (Continued)								
	55		MEDIUM DENSE to VERY DENSE Gray Clayey Fine SAND, Trace Shell Fragments (SC)	4 6 6	12						
15	60			19 24 30	54						
	65		DENSE Gray Clayey Fine SAND With Shell Fragments (SC)	17 19 13	32						
17	70		DENSE Gray Fine SAND With Clay and Shell Fragments (SP-SC)	19 21 16	37						
	75		VERY DENSE Light Gray Clayey Fine SAND With Limerock Pieces (SC)	8 17 50/3"	50/3"						
Remarks											



Ellis & Associates inc.

LOG OF BORING

Project No.: 4338-0001
Boring No.: B3
Sheet 4 of 4

Project: Water Production Facilities, JWSC - Ridgewood Client: Elmo A. Richardson, Jr. P.E., LLC
Boring Location: See Field Exploration Plan Drill Rig: ATV Driller: C. Morgan
Groundwater Depth: 2.3 ft Time: Drilling Date: 4/7/14 Casing Size: Drill Rod: AWJ Drill Mud: Super Gel-X
Boring Begun: 4/7/14 Boring Completed: 4/7/14

SAMPLE NO.	DEPTH, FEET	SAMPLE TYPE	DESCRIPTION	BLOWS PER 6 IN.	N Value	PERCENT ORGANIC MATERIAL	PERCENT PASSING NO. 200 SIEVE	PLASTIC LIMIT	MOISTURE CONTENT (%)	LIQUID LIMIT	SHEAR STRENGTH (ksf)
	75		VERY DENSE Light Gray Clayey Fine SAND With Limerock Pieces (SC) (Continued)								
			DENSE Gray Very Clayey Fine SAND (SC)	7							
19	80			24	46						
			DENSE to VERY DENSE Grayish Brown Clayey Fine SAND (SC)	22							
20	85			18							
				22							
				34	56						
21	90			12							
				19							
				14	33						
22	95			28							
				50/3"	50/3"						
23				30							
				50/4"	50/4"						
	100										
Boring Terminated @ 100 ft.											
Remarks											

FIELD EXPLORATION PROCEDURES

Standard Penetration Test (SPT) Borings

The Standard Penetration Test (SPT) borings were made in general accordance with the latest revision of ASTM D 1586, "Penetration Test and Split-Barrel Sampling of Soils". The borings were advanced by rotary (or "wash-n-chop") drilling techniques. At 2 ½ to 5 foot intervals, a split-barrel sampler inserted to the borehole bottom and driven 18 inches into the soil using a 140 pound hammer falling on the average 30 inches per hammer blow. The number of hammer blows for the final 12 inches of penetration is termed the "penetration resistance, blow count, or N-value". This value is an index to several in-place geotechnical properties of the material tested, such as relative density and Young's Modulus.

After driving the sampler 18 inches (or less if in hard rock-like material), the sampler was retrieved from the borehole and representative samples of the material within the split-barrel were containerized and sealed. After completing the drilling operations, the samples for each boring were transported to our laboratory where they were examined by our engineer in order to verify the driller's field classification. The retrieved samples will be kept in our facility for a period of six (6) months unless directed otherwise.

KEY TO SOIL CLASSIFICATION

Description of Compactness or Consistency in Relation To Standard Penetration Resistance

COARSE GRAINED SOILS (Sands and Gravels)	
N-Value	Compactness
0 – 3	Very Loose
4 – 10	Loose
11 – 30	Medium Dense
31 – 50	Dense
51 and Greater	Very Dense

FINE GRAINED SOILS (Silts and Clays)	
N-Value	Consistency
0 – 1	Very Soft
2 – 4	Soft
5 – 8	Firm
9 – 15	Stiff
16 – 30	Very Stiff
31 and Greater	Hard

DESCRIPTION OF SOIL COMPOSITION**

(Unified Soil Classification System)

MAJOR DIVISION		Group Symbol	LABORATORY CLASSIFICATION CRITERIA		SOIL DESCRIPTION
			FINER THAN 200 SIEVE %	SUPPLEMENTARY REQUIREMENTS	
Coarse grained (over 50% by weight coarser than No. 200 sieve)	Gravelly soils (over half of coarse fraction larger than No. 4)	GW	<5*	D ₆₀ /D ₁₀ greater than 4, D ₃₀ ² / (D ₆₀ x D ₁₀) between 1 & 3	Well graded gravels, sandy gravels
		GP	<5*	Not meeting above gradation for GW	Gap graded or uniform gravels, sandy gravels
		GM	>12*	PI less than 4 or below A-line	Silty gravels, silty sandy gravels
		GC	>12*	PI over 7 above A-line	Clayey gravels, clayey sandy gravels
	Sandy soils (over half of coarse fraction finer than No. 4)	SW	<5*	D ₆₀ /D ₁₀ greater than 6, D ₃₀ ² / (D ₆₀ x D ₁₀) between 1 & 3	Well graded sands, gravelly sands
		SP	<5*	Not meeting above gradation requirements	Gap graded or uniform sands, gravelly sands
		SM	>12*	PI less than 4 or below A-line	Silty sands, silty gravelly sands
		SC	>12*	PI over 7 and above A-line	Clayey sands, clayey gravelly sands
Fine grained (over 50% by weight finer than No. 200 sieve)	Low compressibility (liquid limit less than 50)	ML	Plasticity chart		Silts, very fine sands, silty or clayey fine sands, micaceous silts
		CL	Plasticity chart		Low plasticity clays, sandy or silty clays
		OL	Plasticity chart, organic odor or color		Organic silts and clays of low plasticity
	High compressibility (liquid limit more than 50)	MH	Plasticity chart		Micaceous silts, diatomaceous silts, volcanic ash
		CH	Plasticity chart		Highly plastic clays and sandy clays
		OH	Plasticity chart, organic odor or color		Organic silts and clays of high plasticity
Soils with fibrous organic matter		PT	Fibrous organic matter; will char, burn or glow		Peat, sandy peats, and clayey peat

* For soils having 5 to 12 percent passing the No. 200 sieve, use a dual symbol such as SP-SM.

** Standard Classification of Soils for Engineering Purposes (ASTM D 2487)

SAND/GRAVEL DESCRIPTION MODIFIERS	
Modifier	Sand/Gravel Content
Trace	<15%
With	15% to 29%
Sandy/Gravelly	>29%

ORGANIC MATERIAL MODIFIERS	
Modifier	Organic Content
Trace	1% to 2%
Few	2% to 4%
Some	4% to 8%
Many	>8%

SILT/CLAY DESCRIPTION MODIFIERS	
Modifier	Silt/Clay Content
Trace	<5%
With	5% to 12%
Silty/Clayey	13% to 35%
Very	>35%

APPENDIX B

LABORATORY DATA
LABORATORY TEST PROCEDURES



SUMMARY OF LABORATORY TEST RESULTS

Project: Water Production Facilities, JWSC - Ridgewood

Client: Elmo A Richardson

Project No.: 4338-0001

[illegible]

LABORATORY TEST PROCEDURES

Percent Fines Content

The percent fines or material passing the No. 200 mesh sieve of the sample tested was determined in general accordance with the latest revision of ASTM D 1140. The percent fines are the soil particles in the silt and clay size range.

Natural Moisture Content

The water content of the sample tests was determined in general accordance with the latest revision of ASTM D 2216. The water content is defined as the ratio of “pore” or “free” water in a given mass of material to the mass of solid material particles.

Atterberg Limits

The Atterberg Limits consist of the Liquid Limit (LL) and the Plastic Limit (PL). The LL and PL were determined in general accordance with the latest revision of ASTM D 4318. The LL is the water content of the material denoting the boundary between the liquid and plastic states. The PL is the water content denoting the boundary between the plastic and semi-solid states. The Plasticity Index (PI) is the range of water content over which a soil behaves plastically and is denoted numerically by the difference between the LL and the PL. The water content of the sample tested was determined in general accordance with the latest revision of ASTM D 2216. The water content is defined as the ration of “pore” or “free” water in a given mass of material to the mass of solid material particles.

Organic Loss on Ignition (Percent Organics)

The organic loss on ignition or percent organic material in the sample tested was determined in general accordance with ASTM D 2974. The percent organics is the material, expressed as a percentage, which is burned off in a muffle furnace at 455 ± 10 degrees Celsius.