Draft Technical Specifications

- **Anti-Graffiti Coating**
- **Surge Tank Building and Control Vault Instrumentation and Controls Requirements**
- **Cable-Concrete Blankets**
- **Public Water Transmission Systems**
- **Water Surge Control Tanks**
- **Water Utility Valves**

SECTION 09 92 00

PROTECTIVE ANTI-GRAFFITI COATINGS

PART 1 GENERAL

1.1 SUMMARY

A. Materials and methods specifications for the following:

1. GRAFFITI PROOFER® GPA-300 (Anti-graffiti top coat)
2. Sealer Prime SCS-002SP (Concrete primer)

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 04 20 00 - Unit Masonry

C. Section 08 11 13 - Steel Doors and Frames

D. Section 08 33 23 - Overhead Coiling Doors

1.3 SUBMITTAL REQUIREMENTS

A. General: Submit in accordance with Division 01 00 00.

B. Before any materials are delivered to the job site, the Contractor shall submit a complete list of all materials proposed to be furnished and applied under this section.

C. For each product, the Contractor shall provide the manufacturer's specific application instructions.

1.4 QUALITY ASSURANCE

A. Schedule of References: To the extent specified elsewhere in this Division, comply with the requirements of the following standards and associations.

1. Steel Structure Painting Council Specifications (SSPC).
2. National Association of Corrosion Engineers Standards (NACE).
3. Applicable Standards of American National Standards Institute, Inc. (ANSI).
4. Occupational Safety and Health Act regulations (OSHA).

B. Painter's Qualifications. The Contractor shall cause the work specified under this section to be performed by or under the supervision of a qualified painter. The Contractor shall be prepared to document the painter's experience, competence and ability to comply with the requirements of these specifications and to complete the work in a timely manner.

C. Standard Products. All materials, supplies and articles provided shall be the standards products of recognized, reputable manufacturers. All coatings shall be the products of a single manufacturer. The Contractor shall also minimize the number of suppliers.

D. The standard products of manufacturers other than those specified will be accepted when it is demonstrated to the satisfaction of the Engineer they are equal in composition, durability, usefulness and convenience for the purpose intended.

1.5 DELIVERY AND STORAGE

A. All materials shall be delivered to the job site in their original, unopened containers bearing the manufacturer's name, brand, batch number, date of manufacture, and any special directions. Only the approved material shall be stored at the job site and stored only in designated areas restricted to the storage of paint materials and related equipment. All coatings shall be stored in enclosed structures and shall be protected from weather and excessive heat or cold. Flammable materials shall be stored to conform with state and local safety codes. Materials shall be protected from freezing. Materials exceeding storage life recommended by the manufacturer will be subject to rejection and, if so rejected, removed from the site.

1.6 MANUFACTURER REPRESENTATION

A. Require the manufacturer to make available a qualified technical representative to visit the job site for technical support if necessary, in order to resolve field problems attributable to or associated with the manufacturer's products furnished under this contract.

1.7 PROTECTION OF SURFACES NOT TO BE COATED

A. Protect surfaces and equipment which are not to receive coatings during surface preparation, cleaning and painting operations.

B. Conduct spraying of coatings under controlled conditions. Promptly repair any damage to adjacent work or adjoining property occurring from spray operations.

PART 2 PRODUCTS

2.1 ANTI-GRAFFITI COATING AND PRIMER

A. Products:

1. Anti-graffiti coating: GRAFFITI PROOFER® GPA-300

a. PERFORMANCE CRITERIA:

1) ASTM D6578 - Graffiti Resistance Test (Level 10)

2) ASTM D4587 - Accelerated Weathering

b. TECHNICAL DATA:

1) STORAGE & HANDLING: Store between 40°F (4°C) to 90°F (32°C) in a cool, dry, well-ventilated area, out of direct sunlight and moisture.

2) Keep unused material tightly closed at all times. KEEP FROM FREEZING

2. Primer: Sealer Prime SCS-002SP
    a. PERFORMANCE CRITERIA:
        1) Water Absorption
            a) ASTM C 67 and 642-90: 4% max. after 24hr./75F
        2) Water Vapor Transmission Rate
            a) ASTM E 96-56:11.82 Perms
        3) Water Vapor Transmission
            a) ASTM D1653-93: 4.97 grains/hr/ft2
        4) Household Chemicals
            a) ASTM D1308-97: Pass
    b. TECHNICAL DATA:
        1) STORAGE & HANDLING: Store between 40°F (4°C) to 90°F (32°C) in a cool, dry, well-ventilated area, out of direct sunlight and moisture.
        2) Keep unused material tightly closed at all times. KEEP FROM FREEZING

B. Manufacturer:
    1. SEI Industrial Chemicals
    2. Substitutions: None

C. Manufacturer Representative:

Randy Andrade
Managing Member
SEI Industrial Chemicals USA
(408) 402-5395 phone
randy@seichemicals.com
www.seichemicals.com

PART 3 EXECUTION

3.1 SYSTEM 1 - COATING OF EXTERIOR METAL

A. Area of Application: All exterior metal doors/metal components on the sides of the pump station buildings (areas susceptible to graffiti).

B. Protective coating required:
    1. Two coats of GRAFFITI PROOFER® GPA-300

3.2 SYSTEM 2 - COATING OF SPLIT FACE CONCRETE BLOCK

A. Area of Application: All exterior exposed split face concrete block surfaces.

B. Protective coatings required:

1. Two coats of Sealer Prime SCS-002SP
2. Two coats of GRAFFITI PROOFER® GPA-300

3.3 SURFACE PREPARATION

A. ALL SURFACES:

1. The surface is to be dry, clean and free of any foreign matter including corrosion, hydrocarbons, moisture, ice, efflorescence, silicones, fluoro-products, etc.
2. Always test the coatings adhesion and performance before a full application.
3. To help achieve greater coverage rates when applying to a porous substrate, first apply SEI Industrial's SCS-002SP in accordance with manufacturers' suggested application guidelines.
4. Allow porous substrates to dry for a minimum of 72 hours after pressure washing.
5. After rain, allow 48 hours to dry.
6. New concrete should be allowed to cure for 28 days.
7. All caulking and finishing should be done before Graffiti Proofer application.
8. Prior to application, protect all glass, vehicles and surrounding surfaces from overspray.
9. Always apply to a test area before proceeding with entire application.

B. SURFACE TEMPERATURE:

1. 40°F (4°C) to 100°F (38°C).
2. Surface should be dry (at least 5°F (3°C) above the dew point) with no damp or frozen moisture within the substrate.
3. This product will cure slower in lower temperatures.

3.4 COATING APPLICATION

A. TYPICAL COVERAGE RATES:

1. Anti-graffiti coating: GRAFFITI PROOFER® GPA-300

Surface	Square Feet per Gallon	Surface	Square Feet per Gallon
Concrete	125 - 200	Wood	150 - 200
Brick	125 - 175	Rough Painted	175 - 225
C.M.U.	125 - 175	Smooth Painted	225 - 300
Split-Faced Block	125 - 150	Metal(s)	225 - 300
Stucco	150 - 225		

2. Primer: Sealer Prime SCS-002SP

Surface	Square Feet per Gallon	Surface	Square Feet per Gallon
CMU - Fluted	35 - 65	Rough Wood	50 - 80
CMU - Split face	30 - 60	Smooth Wood	80 - 125
CMU - Smooth	80 - 100	Wood Shingles	70 - 90
Rough/cracked	30 - 60	Smooth Stone	100 - 125
Exterior Brick	60 - 80	Metal(s)	150 - 300
Concrete	80 - 100	Smooth Painted	150 - 170
Concrete Block	80 - 100	Rough Painted	100 - 150
Stucco	60 - 80		

B. CURING TIMES:

1. Anti-graffiti coating: GRAFFITI PROOFER® GPA-300

a. CURING TIMES @ 75°F (24°C):

1) To Touch: 2 - 3 hours

2) Full Cure: 4 - 5 hours (Full moisture and graffiti protection)

3) To Recoat: 30 min. - 2 hours

2. Primer: Sealer Prime SCS-002SP

1) CURING TIME: 75F (24C):

a) Dry Time: 45min. - 1 hour

b) To Recoat: 30 minutes

C. APPLICATION LIMITATIONS:

1. LIMITATIONS:

a. Product application must not be initiated during inclement weather or when precipitation appears to be imminent.

b. Product must not be applied to wet, frozen or dirty surfaces.

c. Product must not be applied when conditions are windy as over spray is a hazard and environmental contaminants dispersed from windy conditions can land in the coating during curing.

d. Always apply test area before proceeding with entire application.

D. GRAFFITI PROOFER GPA-300

1. GENERAL INFORMATION:

a. For optimum performance, allow individual coats to fully cure before applying the next application.

2. MIXING:

   a. Mix well by shaking the product container. After mixing, ensure the product is clear in appearance, consistent in thickness and that there is no settled/cured material within the container. Any cured or foreign material must be removed, by pouring the product through a paint strainer, prior to application.

3. POT LIFE & THINNING:

   a. Do not thin. Pot life can vary dependent upon temperature and humidity. Application time should not exceed 8 hours after the product has been opened.

4. EQUIPMENT:

   a. Apply via HVLP, airless sprayer, pump sprayer, aerosol can, roller or brush. Use a flood coat and apply liberally.

5. ROLLER:

   a. Use a ½" synthetic nap roller. Apply to porous substrates from the bottom up. To help ensure the product penetrates porous substrates, saturate the roller and apply slowly, allowing excess product to build on top of the roller.

6. SPRAY:

   a. Use a clean, independent line when spraying and use a .011 -.021" spray tip. Apply from top to bottom, chasing runs, and back-roll if needed. This will typically provide a 6 MIL WFT and 2 MIL DFT. Product can be applied wet-on-wet or wet-on-dry. For optimum performance allow the first coat to fully dry and cure before applying the second coat.

7. CLEANUP:

   a. Flush and clean all equipment immediately after use. MEK (Methyl Ethyl Ketone) is the preferred cleaning solvent, but mineral spirits may also be used. If flushing with mineral spirits, extreme care must be taken to ensure that ALL product is removed from spray lines.

8. APPLICATION TIPS:

   a. Ensure primer is fully cured before applying Graffiti Proofer.

   b. Ensure coverage is uniform by standing 2"- 3" away from the substrate while standing parallel to the surface (looking across the substrate at a 180° angle). The applied film should appear shiny across the entire surface. Reapply the Graffiti Proofer to any areas that are visually dull in appearance.

   c. Once cured, use a dry cloth to rub back and forth across the Proofer's surface. If this causes the Proofer to ball up and release from the surface, a second coat should be applied, allowed to cure and retest again. If rubbing the dry film with a dry cloth does not remove the Proofer from the substrate, proceed with the next step to test graffiti removal performance.

The Dry Film Thickness (DFT) must be 2 mils or greater (6 mil WFT) to ensure proper graffiti removal performance.

9. Upon completion of all coating activities, the Contractor shall remove all surplus materials, protective coverings and accumulated rubbish and thoroughly clean all surfaces and repair any overspray or other coating-related damage.

E. SEALER PRIME SCS-002SP

1. GENERAL INFORMATION:

   a. SCS-002SP is designed for above grade use only.

   b. Take special care to saturate joints, cracks and large pores.

   c. When first applied, the emulsified resins appear milky white. The micro emulsions will then coalesce drying clear and colorless. The milky appearance should last no longer than approximately 30 minutes.

   d. When applying the SCS-002SP for use a prime coat, always test an inconspicuous area to determine how fast the sealer is absorbed into the substrate. After the test application, let dry for 30-60 minutes and then feel the dry film on the substrate. Press your thumb firmly against the dry film and pull back slowly; one should feel a sticky sensation. If this is not experienced the SCS-002SP has not provided a sufficient film and an additional coat should be applied.

2. WATER BEAD TEST:

   a. Spray water onto the dry film with a trigger spray bottle. Water will either bead on the surface or darken/wet out the underlying substrate, which indicates absorption and an additional coat should be applied. If the water beads and does not absorb or darken the substrate the film is providing some moisture protection. For further and more in depth technical testing use a Rilem Tube to test the film's moisture resistance. If the SCS-002SP has passed the Water Bead and/or Rilem Tube test(s), the coating is intact and ready for an application of a topcoat.

3. MIXING:

   a. Mix well by shaking the product. Ensure there is no settled/cured material on the film or within the container. Cured or foreign matter must be removed prior to application.

4. POT LIFE & THINNING:

   a. Do not thin. Pot life can vary depending temperature and humidity but typically open product can be used for up to 1 month if sealed and stored according to specification.

5. APPLICATION EQUIPMENT:

   a. Mix or shake well before application. Ensure product is consistent in thickness after stirring. Apply via HVLP, airless sprayer, pump sprayer, roller or brush. Use a flood coat and apply liberally.

b. Roller:

1) Use ½" synthetic nap roller. To a porous substrate apply from the bottom up. Excess buildup of product can accumulate on roller. Allow the product to saturate and flood the top of the roller and apply slowly as this will allow product to penetrate the substrate.

c. Spray:

1) Apply with low pressure using a tip size ranging from .011-.021". Back roll if needed. Apply from top to bottom chasing runs. Product can be applied wet on wet or wet on dry. For optimum performance allow the first coat to fully dry and cure before applying the second coat.

2) Hold spray tips 4-12 inches from the surface depending on application and substrate, start at the top and work down the substrate chasing the run with an overlapping horizontal spray pattern.

6. CLEAN UP:

a. Flush and clean all equipment immediately after using warm soapy water.

7. STORAGE & HANDLING:

a. Must be stored and handled in compliance with all current local regulations for flammable liquids. Store in cool, dry, well-ventilated areas, out of direct sunlight and moisture.

8. GENERAL APPLICATION NOTES:

a. Allow a minimum of 2 hours to cure before proceeding with water-bead testing as described below.

b. Spray water via a hand-pump or trigger sprayer onto the application area to determine if any substrate darkening occurs. If a sufficient amount of SP has been used, the substrate should not darken and the water will bead up on the surface. Water may also be sprayed onto an uncoated area to determine the highest level of darkening to compare against. If an unacceptable amount of darkening occurs on the SP applied area, and water does not simply bead up and run off the surface, an additional coat of SP should be applied, allowed to cure and the surface should be retested for darkening via the same water test method. If a second coat of SP prevents the substrate from darkening when using the water test method, it may be possible to decrease the coverage rates for the first coat of SP to alleviate the need for applying a second coat.

c. Substrate areas that have received concrete patching material may have increased absorbency and may require more SP to be applied while carrying out the initial product application.

9. Upon completion of all coating activities, the Contractor shall remove all surplus materials, protective coverings and accumulated rubbish and thoroughly clean all surfaces and repair any overspray or other coating-related damage.

3.5 TESTING

A. GRAFFITI PROOFER GPA-300

1. A minimum of 24 hours curing time is ideal before testing graffiti removal performance.
2. When testing the Proofer's cured film for graffiti removal performance, apply spray paint to a small inconspicuous area and allow the spray paint to fully cure before proceeding with its removal.
    a. Not allowing the spray paint to fully cure before removing it, may damage the Proofer's film.
3. A dry cloth is an acceptable means of testing for removing graffiti from the cured film; however, dampening the cloth with water will allow it to slide across the protective coating much easier. If the coating film is of proper thickness, spray paint should be easily removed.

3.6 REMOVAL OF GRAFFITI

A. Remove graffiti as soon as possible after surface has been vandalized.

B. If the coating has been damaged or removed, make sure the surface is clean and dry and reapply as described in the Application section.

C. Always test chemical cleaners before moving into a full application.

D. Options for removing graffiti:

1. Dry rag or cloth
    a. To remove markers always use a dry cloth first.
2. Pressure washer with pressure setting of less than 1000 psi.
3. Water and no more than 10% detergent with a rag or cloth.
4. SEI's TWL-200 Graffiti Remover Towels
5. SEI's Graffiti Remover GR-SYS-P

E. Flush the coating with water after chemical cleaning to ensure the integrity of the coating.

F. For removing graffiti over large areas, or for removing graffiti from rough surfaces:

1. Use a cold-water pressure washer with a 25 - 40° nozzle and a pressure setting of 1,000 psi or less.
2. Start the flow of water away from the removal area and then reposition the nozzle at a slight angular distance of 4"- 6" from the Graffiti Proofer coated surface.
3. Move the pressure washing wand in a continuous back and forth motion, so as not to focus the nozzle in one location during the graffiti removal.
    a. Focusing the nozzle in one location may damage the Proofer's film.

END OF SECTION

SECTION 26 27 34

SURGE TANK BUILDING AND CONTROL VAULT
INSTRUMENTATION AND CONTROLS REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Water Surge Control Tanks, Section 33 12 15.

C. Water Utility Valves, Section 33 12 16.

1.2 SUMMARY

A. This section provides General Requirements applicable to Division 26.

B. Materials and methods specifications for the following:

1. Instrument Specifications.

2. Miscellaneous Electrical Items.

C. Testing, Startup, and Commissioning Requirements.

1.3 SUBMITTAL REQUIREMENTS

A. General: Submit in accordance with Division 01 00 00.

B. Shop Drawings: Submit shop drawings with arrangement and construction drawings for control panels for field installation. Include location of equipment and physical routing of the wiring. Include dimensions and identification of all components. Include I/O point terminations. Show grounding layout for enclosures.

C. Catalog Data and Details: Submit catalog literature and data sheets for equipment specified in Part 2. Circle or complete manufacturer's part and model numbers; do not use highlighter. Submit data sheets per ISA S20 for each instrument.

1. Flowmeter.

2. Pressure Transducer.

3. Isolation Valves, reducers, unions, elbows, piping, etc., for the pressure transmitter pressure tap piping.

4. Thermostat.

5. Intrusion Switch.

6. RTU’s

7. PLC’s

8. Smoke Detectors

D. Material List/Schedule/Equipment List:

1. Submit list of tools required to calibrate each instrument provided under this section.

E. Installation Instructions/Methods: Submit manufacturer's installation, calibration, and test procedures for equipment provided under this section.

F. Wiring Diagrams/Elementary Diagrams:

1. Show wiring schematics together with circuit terminations, terminal numbers, and IDs associated with the control equipment, including field devices, termination locations, surge suppressors, and relays as required.

2. Show grounding diagram for each instrument or device as applicable.

1.4 OPERATION AND MAINTENANCE SUBMITTALS

A. Maintenance and operating instructions/data: Submit Operations and Maintenance manuals for the following equipment:

1. Flowmeter.

2. Pressure Transducer.

3. Isolation Valves, reducers, unions, elbows, piping, etc., for the pressure transmitter pressure tap piping.

4. Thermostat.

5. Intrusion Switch.

6. RTU’s

7. PLC’s

8. Smoke Detectors

B. Field test results/logs/surveys/records: Submit certification that equipment supplied under this section is calibrated over specified range per manufacturer's specifications and site conditions.

C. Spare parts list: Submit list of parts with manufacturer and model number.

D. Warranties and Software Licenses: Submit manufacturer's warranty certificates for items supplied under this Division.

E. Project Record Documents: Submit as-built drawings for control panels, control devices, and field wiring. Include physical layout of equipment in cabinets, wiring diagrams, and physical routing of field wiring. Contractor shall supply DVD of start-up instructions.

1.5 QUALITY ASSURANCE

A. Conform to reference standard by date of issue current on date for receiving bids.

B. Specified reference standards are a minimum for the installation. Where the contract documents exceed the requirements of the reference standards, then the contract documents govern.

C. Schedule of References: To the extent specified elsewhere in this Division, comply with the requirements of the following standards and associations.

OSHA Occupational Safety and Health Administration
U.S. Department of Labor
Occupational Safety & Health Administration
200 Constitution Avenue
Washington, D.C. 20210

ANSI American National Standards Institute
11 West 42nd Street
New York, NY 10036

EIA Electronic Industries Association
2500 Wilson Boulevard
Arlington, VA 22201

FCC Federal Communications Commission
1270 Fairfield Road
Gettysburg, PA 17325

IEEE Institute of Electrical and Electronics Engineers
445 Hoes Lane
PO Box 1331
Piscataway, NJ 08855

ISA Instrument Society of America
67 Alexander Drive
PO Box 12277
Research Triangle Park, NC 27709

MIL Military Specification
Naval Publications and Forms Center
Tabor Avenue
Philadelphia, PA 19120

NEC National Electric Code
1 Batterymarch Park
Quincy, MA 02269

NEMA National Electrical Manufacturers' Association
1300 North 17th Street
Suite 1847
Rosslyn, VA 22209

NFPA National Fire Protection Association
Batterymarch Park
Quincy, MA 02269

UBC Uniform Building Code
International Conference of Building Officials
South Workman Mill Road
Whittier, CA 90601

UL Underwriters' Laboratories, Inc.
333 Pfingston Road
Northbrook, IL 60062

1.6 ABBREVIATION LIST

AC	Alternating Current
AI	Analog Input
AO	Analog Output
AWG	American Wire Gauge
ASCII	American Standard Code for Information Interchange
bps	Bits per Second
CPU	Central Processing Unit
dB	Decibel
dBm	Decibel Referenced to Milliwatt
DC	Direct Current
DI	Digital Input
DO	Digital Output
EMT	Electrical Metallic Tubing
GPM	Gallons per minute
HOA	Hand-Off-Auto switch
IC	Instrument Cabinet
ID	Identification
I/O	Input/Output
mA	milliamperes
MAS	Multiple Address System
MB	Megabyte
MHz	Megahertz
mS	Millisecond
O&M	Operation and Maintenance
PLC	Programmable Logic Controller
PVC	Polyvinyl Chloride
RTU	Remote Terminal Unit.
RGS	Rigid Galvanized Steel
SCADA	Supervisory Control and Data Acquisition
VAC	Volts Alternating Current
VDC	Volts Direct Current

1.7 INSTRUMENTATION OPERATIONS

A. General

1. The surge tank building provides hydraulic surge protection for Reaches 24.1, 24.1JAN, and 25. It also includes a manually-operated butterfly valve to isolate the 24.1JAN line.

2. Instrumentation in the surge tank building consists of:

a. Limit switch on the manual butterfly valve that changes state when the valve is fully open, to warn NTUA if the valve is not fully open. Refer to Section 33 12 16.

b. Magnetic flow meter to measure flow rate through the 24.1JAN main line.

c. Pressure transducer to measure pressure on the 24.1JAN main line.

d. Smoke detector.

e. Intrusion alarm.

f. Differential pressure transducer on surge tank to indicate surge tank fill level (as 0-100% full). Refer to Section 33 12 15.

g. Low temperature alarm.

3. All instrumentation signals are transmitted to the building PLC, which posts them to the PLC's HMI and to SCADA.

4. The PLC includes an algorithm to compare actual measured flow rate to a pre-set maximum allowable flow rate, and generates an alarm if the flow rate exceeds this pre-set maximum, after an adjustable time delay. This alarm is posted to the HMI and to SCADA.

B. Outputs to SCADA (from surge tank building): **Darrell, please review and comment.**

1. Analog:

a. Flow rate (in gpm, 4-20mA analog signal)

b. Pipeline pressure transducer (0-200 psi)

c. Surge tank differential pressure transducer (0-100%)

2. Digital:

a. Flow meter totalizer register calculated from pulse (in US Gallons)

b. Flow meter low battery alarm

c. Pulse module low battery alarm

d. Flow meter tamper alarm

e. Flow meter measurement stopped/no water alarm.

f. Butterfly valve limit switch.

g. Intrusion alarm.

h. Smoke Detection.

i. Low pressure alarm, based on PLC algorithm comparing pressure to flow rate.

j. Low temperature alarm

C. Communications

1. The surge tank building shall communicate with the Counselor Tank Site via proposed unlicensed (Transnet) radio link.

PART 2 PRODUCTS

2.1 FLOWMETER **Darrell, please review and comment, especially the part regarding pulse to analog conversion for SCADA.**

A. Manufacturer:

1. Elster evoQ_4

2. Substitutions: None

B. Supplier:

1. Two meters, one with pulse transmitter and one with AMI/AMR module, shall be supplied and programmed by NTUA.

2. Contractor shall coordinate submittals on flow meter, pulse transmitter, AMI/AMR module, and appurtenant equipment with Engineer and NTUA, and receive Engineer's approval prior to NTUA ordering materials.

3. Contractor shall coordinate installation with NTUA.

4. Contractor shall reimburse NTUA for materials and labor from an allowance.

C. Provide flanged, electromagnetic flowmeter meeting the following requirements:

1. Size: 8-inch

2. Battery powered

a. Replaceable battery

b. 5 year minimum battery life

3. Flange: ANSI B16.1 Class 125, epoxy coated cast iron.

4. Liner: Polyethylene epoxy

5. Electrodes: AISI 316 Stainless Steel

6. Pressure Rating: 230 psi maximum operating pressure.

7. Sampling rate: 0.5 seconds
8. Accuracy: +/- 1.5% of true flow value through normal flow range.
9. NSF-61 Approved
10. Provided with LCD display mounted on top of meter, incorporating totalized volume, reference flow-rate, and alarm functions.
11. Manufacturers Reference: Elster evoQ_4

D. Provide pulse transmitter module meeting the following requirements:

To be included with meter installed in surge tank building only. This module is not required for the meter to be installed in the RF control valve vault.

1. Battery powered (10 year battery life)
2. Maximum load current: 20mA
3. Maximum load voltage: 30V DC
4. Pulse output: NPN signal
5. Pulse weight: Provide transmitter with Pulse Output Option G
    a. Channel 1: 1gallon
    b. Channel 2: 10 gallon
6. Channel 3: Alarm output channel will transmit signals indicating: meter low battery, pulser low battery, measurement stopped/no water, and tamper.
7. Enclosure: IP 68 / NEMA 6P
8. Operating temperature: 15°F to 120°F

E. Provide rate of flow transmitter meeting the following requirements:

To be included with meter installed in surge tank building only. This transmitter is not required for the meter to be installed in the RF control valve vault.

1. Manufacturer: Model RIDA4-20AK (provided by Elster AMCO)
2. Rate meter:
    a. 4-20mA analog output.
    b. 5 digit display.
    c. Count rate: 0.01Hz (min.), 20kHz (max.).
    d. Signal accuracy: 0.4% of full scale.
3. Totalizer
    a. 3 configurable totalizers.
    b. 6 digit display.
4. Red LCD display, independent rate and total factors and selectable decimal position.

F. Provide encoder module for AMR/AMI interface and radio meeting NTUA's requirements:

To be included with meter installed in the RF Valve vault at end of Reach 24.1 JAN only. Do not provide AMR/AMI module for meter installed in surge tank.

1. Provide battery powered radio for connection to encoder module.

    1) 10-year minimum battery life.

2.2 PRESSURE TRANSMITTER

A. Provide pressure transmitter meeting the following requirements:

1. Type 316 stainless steel wetted process parts.
2. Type 316 stainless steel diaphragm.
3. 316 Stainless steel head.
4. NEMA 4X watertight electronics housing.
5. Process connector: 1/2-inch NPT.
6. Stainless steel instrument tag, with process ID.
7. Input Power: 2-wire current loop driven by 24 VDC power supply.
8. Output Signal: 4 - 20 mA proportional to pressure over specified range.
9. Output Load: 1400 Ohms, maximum.
10. Instrument range: Factory calibrated 0-200 psi span.
11. Working pressure rating: 300 psi minimum.
12. Accuracy: ±0.25% of calibrated span.
13. Stability: ±0.5% of upper range limit per six months.
14. Conduit connector: 1/2-14 NPT.
15. Electrical Connections: Screw terminals for Instrument Cable.
16. Manufacturers Reference: Ametek 88C-005-A-2.

2.3 THERMOSTAT

A. Physical requirements:

1. Surface mount.
2. Remote capillary, 5 foot.
3. Setpoint dial:

    a. High limit: 55-175 °F.

B. Electrical requirements:

1. Contact Arrangement: SPDT.

2. Contact Rating: 8A, 120 VAC.
3. Electrical Connections: Screw terminals for Instrument Cable.
4. Grounding: Ground housing per manufacturer's instructions.
5. Manufacturer's Reference: Honeywell T675A.

C. Provide two (2) redundant thermostats: one for heater/ ventilation control, and one to provide low-temperature alarm signal to PLC to be posted to SCADA.

2.4 INTRUSION SWITCH:

A. Type: Magnetic Contact.

B. Construction: Aluminum housing, with anodized aluminum finish.

C. Mounting: Integral mounting holes.

D. Maximum Voltage: 30 VDC.

E. Contact Arrangement: SPDT, Form C.

F. Gap Distance: Up to 3".

G. Lead Type: 3' flexible metal clad jacketed, #22 AWG.

H. Manufacturer's Reference: Sentrol 2507-A.

2.5 MULTIPLE ADDRESS TELEMETRY RADIO ANTENNAS, MOUNTING AND SUPPORT

A. Provide masts, mounting hardware, antenna, ½" Heliax cable and other apparatus required to make a complete and operable radio system.

2.6 PLC CONTROL PANEL **(Feedback from Darrell or others at NTUA is very much welcome and appreciated.)**

A. General

1. The PLC control panel shall be stainless NEMA 4X rated.
2. The PLC control panel shall house the following equipment:
   a. Human Machine Interface (HMI)
   b. PLC with I/O as specified herein
   c. Power supply
   d. Surge suppressor
   e. Ethernet Switch: Modicon TCSESU83FN0

B. The PLC control panel shall be supplied, installed, wired and tested by manufacturer.

1. Products
   a. PLC

1) The PLC shall be a chassis mount PLC designed for up to 1024 points of I/O.

2) The PLC shall:

   a) Collect data, perform process control functions, communicate with other PLCs, and distribute process information along the local area network.

   b) Be able to have its program downloaded from a remote workstation over a network, or locally programmed from a portable laptop computer.

   c) Allow for the expansion of the system by addition and configuration of hardware.

   d) Executive firmware shall be stored in Flash memory and can be updated in the field using standard programming tools. Executive firmware files shall be readily available via a public web site.

   e) Each discrete point shall have a light emitting diode to indicate point status. Green shall indicate that the point is logic level "1", also referred to as "on" or "high".

   f) The PLC shall utilize Ethernet protocols that meet the following:

      (1) Protocols that are assigned to port 502 of the TCP/IP stack by the IANA (Internet Assigned Numbers Authority).

      (2) Protocols that are supported by the Open DeviceNet Vendors Association (ODVA)

   g) Programming software will have embedded network configuration tools that utilize FDT/DTM technologies. PLC systems that have the PLC programming and network configuration tools in separate software will not be acceptable.

   h) Each Processor shall have a USB terminal port for programming. The processor shall accept an 8Mb SD memory card. This card shall be capable of storing, at a minimum, application files, data files, PDF files, CAD files, Microsoft office files. Processor performance shall be rated at least 6,900 instructions per millisecond at a program make up of 65% Boolean and 35% numerical.

   i) The processor shall be equipped with 4,096 Kb of internal user RAM and have a multi-protocol serial port, and an Ethernet port.

j) Upon power loss, the PLC shall insure memory is transferred to flash memory before PLC RAM powers down. PLCs with a battery backup will not be accepted.

k) The PLC shall have on board status lights to indicate the following various functions:

(1) Green RUN lamp that will illuminate while the program is executing

(2) Red ERR lamp that will illuminate when a fault occurs in the processor

(3) Red I/O Lamp that will illuminate upon an I/O failure or configuration fault.

(4) Yellow SER COM lamp will illuminate when activity is present on the serial port

l) A four (4) channel +/- 10V, 0-20mA, analog input card shall be provided.

m) A sixteen (16) channel sink and source 24VDC discreet input card shall be provided.

n) A sixteen (16) channel 24VDC/240VAC relay output card shall be provided. With interpose Relays used Channels

o) Communication Capabilities: The PLC shall be equipped to support the following without the need for third party modules

(1) 10/100Mb Ethernet with fast device replacement (FDR) capability, standard web page and custom web page capability. A memory card will be available to store web pages and data.

(2) Serial protocols including Modbus, Unitelway, and ASCII.

(3) Power Supplies: The PLC shall have chassis mounted power supplies to provide power for the processor and applicable modules. The power supplies shall be available in both 24 VDC and 115 VAC models. The available power ratings will be from 16 to 36W.

p) The PLC shall be an 8 slot chassis. The I/O cards will be secured to the chassis via a screw connection.

q) Programming cable: The PLC shall utilize a USB to Mini B cable for programming. This cable shall be compatible with those designed for downloading digital cameras to USB compatible PC. Accordingly, this cable shall be available through most traditional retail stores serving the consumer electronics market.

r) Alarming: The PLC shall have a configurable alarming capability. Each alarm point can be configured to display an alphanumeric message in the alarm buffer. The buffer can be displayed via a web page, or on an operator interface screen.

s) Unterminated connector cables shall have one end terminated to HE10 terminal block modules. The other end shall be unterminated to allow custom interface to panel devices.

t) Terminated connector cables shall have one end terminated to interface to terminal block, or FCN socket, cards. The other end shall be terminated to interface with HE10 terminal block modules.

u) All specified PLC platforms will be programmed using the same programming software package. PLCs that use multiple software programming packages under similar trade names will not be accepted.

v) The system shall be designed to execute all languages without a significant decrease in processing speed.

w) Programming software shall have integrated tools for network configuration, and communication capabilities. PLC's that use separate programming, communication, and network configuration software shall not be accepted.

x) The PLC must meet or exceed the following environmental requirements:

(1) Minimum temperature range:

i) Operating: -25 to +70o C (-13 to +158oF)

ii) Relative humidity: 30% to 95% non-condensing.

(2) Altitude:

i) Operation 0-7,200 feet minimum

ii) Storage 0-9,800 feet minimum

(3) Degree of protection: NEMA 1 (IP20)

(4) Vibration resistance in accordance with at least one of the following:

i) Installed rating:

(1) DIN rail mounted PLC: 10-57 Hz, amplitude 0.075 mm, acceleration 25-100 Hz, and

(2) Panel or plate mounted PLC: 2-25 Hz, amplitude 1.6mm, acceleration 25-200 Hz.

ii) In compliance with IEC 60068 and IEC 61131.

(5) Shock resistance: 147m/s2 for 11ms.

y) The PLC's shall be designed for connection to the World Wide Web via standard and customizable web pages. Standard web pages shall display all internal status points, status registers, alarm words, and status of each I/O point. Customizable web pages shall be created by the programmer to display the actual process or machine being operated.

3) Manufacturer: The PLC, an appurtenant components shall be manufactured by Schneider Electric, with the following model numbers:

a) PLC: Modicon M340

b) Processor: BMXP342020

c) Back plane: BMXXBP0600

d) Power supply: BMXCPS2010

e) Input Module: BMXDDI1602

f) Relay Output Module: BMXDRA1605

g) Analog Input Module: BMXAMI0410 (minimum 1 unit, additional as required for all signals)

h) Screw terminal strips: BMXFTB2010

i) Note: Each I/O Module requires one terminal strip.

j) Note: These are the minimum requirements. Confirm input modules are compatible with flowmeter and rate of flow transmitter outputs.

k) **Contractor shall submit all PLC component data and part numbers to Owner's SCADA programmer for approval prior to purchase.**

b. Human Machine Interface (HMI)

1) The HMI shall be a 5.7" color touch screen.

2) The HMI shall be TFT type providing 65,536 colors.

3) The HMI shall be equipped with built-in Ethernet TCP/IP functionality and equipped with one compact flash card slot and two USB ports.

4) The HMI shall be equipped to communicate over Ethernet via an onboard RJ45 port.

5) In addition to Ethernet communication, the HMI shall be equipped with one Sub-D9 and 1 RJ45 port for serial communication.

6) The HMI shall be a Schneider Electric Magelis Model No. XBTGT 2330, or Engineer-approved equal.

2.7 MISCELLANEOUS ELECTRICAL ITEMS

A. Selector Switches: Use NEMA-style type 4X, 1-13/64" panel cutout, oiltight/watertight rotary selector switch, screw terminal modular contact blocks.

B. Pushbutton Switches: Use NEMA-style type 4X, 1-13/64" panel cutout, oiltight/watertight unguarded flush-head or mushroom-head pushbutton switch, screw terminal modular contact blocks.

C. Pilot Lights: Use NEMA-style type 13, XLV LED Lamps, 1-13/64" panel cutout, oiltight/watertight push-to-test with transformer pilot light, screw terminal modular contact blocks.

D. Control Stations: Use NEMA type 4X, unless otherwise noted.

E. Control Relays: Provide relays meeting the following specifications:

1. General Purpose ("Ice Cube") Control Relay:

a. Contact rated NEMA B300.

b. Provide pilot light for positive indication of power to the coil.

c. DIN-rail mounted blade-style relay socket with screw terminals.

d. Coil Voltage: As required.

e. Surge protection: provide diode (DC) or capacitor/resistor (AC) at coil.

f. Contact Arrangement: Minimum DPDT.

2. Industrial Control Relays.

a. Machine tool relay with convertible screw terminal contact rated NEMA A600.

b. Coil Voltage: As required.

c. Surge protection: provide diode (DC) or capacitor/resistor (AC) at coil.

d. Contact Arrangement: Quantity and arrangement as required plus two additional contacts.

F. Control Power Transformers: Provide transformers meeting the following specifications:

1. Dry type.

2. Include one fuse block with (2) class CC and (1) 1-½ x 13/32" fuses; screw terminals.

3. Isolated secondary winding.

4. Provide 50% additional capacity above required load.

G. Overcurrent Protection: Provide overcurrent protection meeting the following specifications:

1. Incoming power protected with DIN-rail mounted circuit breaker.

2. Provide fuse protection for branch circuits.

3. Provide fuse protection and loop testing capability on 4-20 mA instrument circuits.

4. Install tag near fuseblock indicating the fuse amperage.

H. Wire Duct: Rigid PVC, slotted wall, snap-on cover, UL flammability rating 94V-0.

2.8 CONTROL PANELS AND CABINETS

A. General:

1. Provide NEMA Type 4X single-door enclosures per Section –Raceway and Boxes. Enclosure located within the surge tank building shall be a Nema type 4X Stainless enclosure, Saginaw P/N's SCE 36H2410SSLP or equal.

2. Size enclosures to accommodate instruments, power supplies, terminal strips, devices, wireways, wire duct, and wiring.

3. Provide wiring, wire labels, and wire terminations.

PART 3 EXECUTION

3.1 GENERAL

A. Perform work in accordance with ANSI/NFPA 70 and 79 unless otherwise specified.

B. Install equipment and products in accordance with manufacturer's instructions.

3.2 FLOWMETER INSTALLATION

A. Contractor shall coordinate furnishing and installation of AMI/AMR meters and all required appurtenances and converters in RF valve vault and surge tank building with NTUA.

1. Meters shall be ordered and purchased by NTUA.

2. Meters shall be programmed by NTUA.
3. Contractor shall reimburse NTUA for cost of meters from an allowance.
4. NTUA shall provide fully programmed meters to Contractor.
5. Contractor shall install meters.

B. Wire magnetic flowmeter transmitter control and power wiring. Provide instantaneous flow and flow totalizer signals at surge tank building. Provide flow totalizer signal at RF valve vault.

C. Ground flowmeter and transmitter per manufacturer's recommendations. Connect transmitter ground wire to panelboard ground.

D. Ensure wiring to AMI/AMR module in RF valve vault does not interfere with workspace in the vault. Secure wire to underside of vault lid and vault wall to keep wire out of works space and to prevent damage to wire. Ensure adequate wire slack is provided near door hinge to allow the access doors to be fully opened without damaging the wire or AMI/AMR equipment.

E. Calibrate and test per manufacturer's recommendations. Record calibration and test data.

3.3 PRESSURE TRANSMITTER INSTALLATION

A. Connect pressure transmitter to associated piping.

B. Wire pressure transmitter to PLC.

C. Ground housing per manufacturer's instructions. Ground cable shield at PLC enclosure terminal block only.

D. Calibrate and test per manufacturer's recommendations. Record calibration and test data.

3.4 THERMOSTAT INSTALLATION

A. Mount thermostat 5’-0” above finish floor to centerline of switch.

B. Direct sensing tip toward center of room away from cold exterior walls. Insulate capillary tube if required to prevent cold spots.

C. Wire thermostat switch to exhaust fan control circuit.

D. Calibrate and test per manufacturer’s recommendations. Record calibration and test data.

3.5 INTRUSION SWITCH INSTALLATION

A. Locate switch in location where it is least likely to be damaged due to normal daily operations.

B. Install within specified adjusting points and per manufacturer’s recommendations.

3.6 CONTROL PANEL AND CABINET FABRICATION

A. Provide space for 30% minimum spare terminal blocks in enclosures.

B. Install 15% minimum spare terminal blocks in enclosures.

C. Fabricate all enclosure holes with hydraulic punch. Do not use hole saw. Protect wiring through hole by gasketing hole per NEMA cabinet rating.

D. Mount and wire control panel equipment to terminal blocks at shop.

E. Install sub-panel in enclosure using enclosure collar studs.

F. Install interior-of-enclosure equipment without enclosure penetrations.\

G. Enclosure Wiring.

1. Wire: Use enclosure wire and instrument cable.
2. Connect analog input devices as 4-20 mA current loop in the field and in the enclosure. Coordinate analog device loop power requirements with device manufacturer.
3. Route enclosure wiring as follows:
    a. Separate AC and DC wires.
    b. Exposed Wire:
        i. Run wire horizontally and vertically.
        ii. Bundle wire with nylon tie wraps every 2 inches, minimum.
        iii. Tie down wire every 4 inches, minimum.
        iv. Tie down wire within 1” of each bend.

H. Wire Duct:

1. Run wire duct horizontally and vertically.
2. Provide sufficient wire duct so no more than 8” of wire is exposed.
3. Provide wire duct with slotted side walls.
4. Attach wire duct to sub-panel with mechanical fasteners.
5. Size wire duct for 50% fill.
6. Do not use nylon tie wraps inside wire duct.
7. Mount no devices in or on wire duct cover.
8. Ensure wire duct is 2” from enclosure side walls and 2” from enclosure front, minimum.

I. Hinge Wiring:

1. Secure wiring at each end so that any bending or twisting will be around the longitudinal axis of the wire.
2. Protect wire with a sleeve.

J. Interior-of-enclosure grounding: Connect ground wire from enclosure ground terminal to enclosure door stud. Remove paint from enclosure door stud where ground connections are made.

3.7 CONTROL PANEL AND CABINET INSTALLATION

A. Install control panels and cabinets per Section Raceway and Boxes.

B. Mount wall-mounted control panels and cabinets 5'-0" above finish floor to centerline of panels and cabinets. Control panels with a HMI the panel shall be mounted at 62" above finish floor to centerline of screen

C. Mount enclosures to panel equipment stanchions with nuts, bolts, lock washers, and neoprene seal washers.

D. Use a punch for any conduit penetrations. Do not use hole saw.

3.8 INSTALLATION AND START UP

A. Provide on-site supervision for installation, calibration, equipment testing, start up, and functional testing efforts.

B. Contractor shall provide all set-up, programming, and calibration of the PLC, using a programmer selected by the Owner, at Contractor's expense. A bid allowance is provided on the Bid Form for this sole purpose.

C. Prepare process and instrument lines as follows:

1. Verify all lines which are opened during the installation are cleaned per the recommendation of the Owner.

2. Leak test all lines which are opened during the installation.

D. Verify installation of each instrument as follows:

1. Ensure the model number of instrument installed matches the submittal data.

2. Review the completed installation of instrument, referencing the manufacturer's recommendations.

E. Test field wiring for continuity before applying power to equipment.

F. Verify voltage upstream of each overcurrent device before applying power to equipment.

G. Ensure all manual valves are OPEN and switches/breakers are ON as required for normal site operation.

H. Calibrate instruments.

3.9 SITE ACCEPTANCE TESTING

A. Prepare commissioning binder and include the following items:

1. Red-lined wiring diagrams.

2. Completed instrument data sheets.

3. Instrument Operations and Maintenance manuals.

4. Checksheets and test records.

B. Ensure sufficient spare parts and consumables are available to complete the site acceptance test.

C. Verify installation of each instrument as follows:

1. Ensure the model number of instrument installed matches the submittal data.
2. Review the completed installation of instrument, referencing the manufacturer's recommendations.

3.10 TEST RECORDS

A. Record test results on appropriate checklists or other records that can be traced to the item and individual responsible for performing the test.

B. Identify the following on the test records:

1. Specific item tested.
2. Procedure number and revision to which the test was performed.
3. Model and serial number of any test equipment used.
4. Calibration expiration date for any test equipment used.
5. Range of Calibration.
6. Data recorder by signature or stamp.
7. Type of observation.
8. Results and acceptability.
9. Action taken in connection with any deficiencies noted.

When modifications, repairs or replacements are made after completion of tests, retest to the extent necessary to verify acceptability in accordance with the original plans and specifications, and to ensure compatibility with system interfaces.

3.11 TRAINING

A. Provide the following training for the Maintenance Technicians.

1. Number of Attendees: 10.
2. Duration:
   a. 1/2 day formal training onsite.
3. Location: Owner's facility.
4. Topics:
   a. Hands-on troubleshooting of instruments and hardware.
   b. Use of test equipment.
   c. Use of technical manuals for preventive and corrective maintenance.
5. Video recording of training and three (3) DVD copies produced.
6. Operate the complete system in Auto with operator(s) for at least 15 minutes.
7. Check complete system for alarm conditions.

B. Provide follow-up training 30 days after system acceptance.

1. Number of Attendees: 6.
2. Duration: 1 day.
3. Location: Owner's facility.
4. Topics: Additional Maintenance topics as required.
5. Video recording of training and three (3) DVD copies produced.

C. Text material: Use O&M Manuals and supplemental materials as required.

END OF SECTION

SECTION 31 35 27

CABLE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cable concrete mats.

B. Related Sections:

1. Section 31 22 13 - Rough Grading.
2. Section 03 30 00 Cast-In-Place Concrete.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Cable concrete mats:

1. Basis of Measurement: By square yard of cable concrete mat for horizontal surface only. Wastage will not be paid for. Area of turn-downs are not included in quantities on Drawings and Bid Form and shall be considered incidental to the Contractor's price.
2. Basis of Payment: Includes cable concrete mat, geotextile, preparation of surface, compaction, placing of cable concrete mats, cable clamps, clips, anchors, lifting bar rental, mobilization and delivery.

B. Bid items for cable concrete mats or other specific erosion control features that appear on the Bid Form apply only to features designed and directed by the Engineer. They do not include preparation of the Storm Water Pollution Prevention Plan (SWPPP) or implementation of any Best Management Practices (BMPs) stipulated therein. Separate bid items are provided for preparation and implementation of the SWPPP. Contractor is wholly responsible to prepare and implement the SWPPP to the satisfaction of relevant governmental authorities for the prices given under the SWPPP bid items.

1.3 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Cable concrete materials.

1.4 QUALITY ASSURANCE

A. General:

1. Tests on concrete will be performed in accordance with all requirements of applicable ASTM standards for such tests, including but not limited to obtaining samples, temperature, slump, air entrainment, making and curing specimens, breaking concrete cylinders, and other as may be applicable.

2. The cost of all laboratory tests on cement, aggregates, and concrete, for the development of the mix design, will be borne by the Contractor. The laboratory must meet or exceed the requirements of ASTM C1077.

3. Test cylinders will be prepared one (1) test each day of placement for each mixture for the first 50 or less cubic yards and one (1) test for each additional 100 cubic yards of concrete.

B. Compression Tests:

1. Compression test specimens will be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as indicated above to ensure continued compliance with these specifications. Each set of test specimens will be a minimum of 5 cylinders.

2. Compression test specimens for concrete shall be made in accordance with ASTM C31. Specimens shall be 6-inch diameter by 12-inch high cylinders.

3. Compression tests shall be performed in accordance with ASTM C39. One test cylinder will be tested at 7 days, and 2 at 28 days. The remaining cylinders will be held to verify test results, if needed.

4. Compression testing will be paid for by the Owner.

C. Evaluation and Acceptance of Concrete:

1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 318, and as specified herein.

2. All concrete that fails to meet the ACI requirements and these specifications, is subject to removal and replacement at the cost of the Contractor.

3. Concrete delivered to the site that does not meet the requirements as herein specified may be rejected.

D. Visual Inspection:

1. A visual inspection of the mats shall be completed.

2. All mats shall be sound and free of defects that would interfere with the proper placing of the mats or impair the strength or performance of the construction.

3. Pin holes on the surface of the mats resulting from entrapped air in the wet cast procedure, surface cracks and any other incidental imperfections from the usual methods of manufacturing including surface chipping from handling the mats on the job site and in shipment and delivery, shall not be deemed grounds for rejection.

4. Cable concrete that does not meet the requirements as herein specified may be rejected.

PART 2 PRODUCTS

2.1 MATERIALS

A. Concrete:

1. Minimum 28- day compressive strength: 4,000 psi.
2. Minimum density: 140 lbs/cf
3. Air entrainment- all concrete shall contain 5.5% +/- 1.5% entrained air of evenly dispersed air bubbles at the time of placement.
4. Concrete Materials: Refer to Technical Specification 03 30 00 – Cast-In-Place Concrete.
5. Blocks shall be 15.5” square at the base and 11.5” square at the top face (truncated pyramid shape), and have a height of 5.5”.
6. The blocks shall be spaced 0.5” at the base.
7. Weight: 52 lbs per square foot

B. Geotextile Fabric:

1. 8 oz. per square yard.
2. Needle punched non-woven geotextile fabric.
3. Shall be attached to the bottom of the articulated concrete mat during production.
4. An overlap of 2’ to 3’ shall be incorporated on three sides of the mat. The overlap shall provide an area for the adjoining mats to be placed upon and prevent undermining of the erosion control system.

C. Cables:

1. Cables shall be made of stainless steel aircraft cables of type 304, shall be 1 x 19 construction, with 3/16” diameter, and 4,700 lbs breaking strength.
2. Cables shall be integral (poured into) to the concrete block, and shall traverse through each block in both longitudinal and lateral directions of the mat system.

D. Clamps:

1. Stainless steel clamps shall be used to secure loops of adjoining cable concrete mats.
    a. The standard placement of clamps shall be placed on 4’ centers interlocking adjoining mats together.
    b. The clamps are required only in applications exceeding 10’ per section. In slope applications greater than 2 to 1 where the mats are placed end to end, clips shall be placed on 4’ centers interlocking adjoining mats together.
2. Position cable clamps as close to the base of the concrete block by sliding cable clamp down to the adjacent loops before tightening securely.
3. Stainless steel Type 304 shall be used.

PART 3 EXECUTION

3.1 INSTALLATION

A. Placement shall be in accordance with Manufacturer's recommendations.

B. Do not place cable concrete mats over spongy subgrade surfaces.

C. Surface erosion control locations, dimensions, and quantities shown on Drawings are approximations only, and are subject to change based on finished grade. Final quantities, dimensions, and locations of cable concrete mats to be determined in field by Engineer after installation of pipeline and related facilities.

D. Prepared areas shall be graded to a smooth plane finish. Any roots, debris and stones must be removed and regarded. The mats shall be laid in such a manner to produce a smooth plane surface.

E. The gaps between each cable concrete mat shall not be greater than 1".

F. For at-grade installations, where approved by Engineer, the upstream and downstream edges of the mat system shall be keyed into the ground at a 45°angle for a length of 3 block rows on each of the upstream and downstream edges, or as shown on Drawings.

G. For buried installations at wash crossings, the upstream and downstream edges shall be turned down vertically for 2 block rows, or as shown on Drawings.

3.2 FIELD QUALITY CONTROL

A. Cracks exceeding 0.25 inches (0.635 cm) in width and/or 1.0 inch (2.54 cm) in depth, shall be deemed grounds for rejection.

B. Chipping resulting in a weight loss exceeding 10% of the average weight of the blocks shall be deemed grounds for rejection.

END OF SECTION

SECTION 33 11 13

PUBLIC WATER TRANSMISSION SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings for public line including potable water line.
2. Tapping Sleeves and Valves.
3. Corrosion Protection and Monitoring Systems.
4. Underground and Aboveground Pipe Markers.
5. Bedding and Cover Materials.
6. Source Quality Control and Assurance.

B. Related Sections:

1. Section 02 21 13 - Surveying.
2. Section 03 30 00 - Cast-in-Place Concrete: Thrust restraints.
3. Section 31 23 17 - Trenching: Execution requirements for trenching.
4. Section 31 23 23 - Backfill: Requirements for backfill to be placed.
5. Section 32 92 19 - Seeding.
6. Section 33 12 15 - Water Surge Control Tanks.
7. Section 33 12 16 - Water Utility Valves.
8. Section 33 13 00 - Disinfection of Water Utility Transmission Systems.

1.2 DEFINITIONS

A. Throughout the Drawings and Specifications, the terms “jointed PVC pipe” and “bell-and-spigot PVC pipe” shall be used interchangeably.

1.3 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Pipe and Fittings:

1. Basis of Measurement: By the linear foot.
2. Basis of Payment: Includes hand trimming, excavation, trenching, piping and fittings, all valves and appurtenances not listed separately on the Bid Form, bedding, backfill, compaction, tracer wire, detectable warning tape, above ground pipe marker posts, concrete thrust restraints (where applicable), mechanical joint restraints, connection to public utility water source (if not separately listed on Bid Form). Special excavation methods for trenching in rock or hard soils, rock removal and disposal, and/or imported bedding material, if required to meet the project specifications, shall be considered incidental to the cost of the pipe

installation. Soil cement, if used, shall be considered incidental to the cost of the pipe installation.

a. Fusible PVC pipe, where required, shall be included in the same bid item and paid on the same basis as bell-and-spigot PVC pipe. All materials, labor, and equipment required to fuse, install, and test fusible PVC pipe shall be included in this same pay item.

3. The actual laboratory cost of compaction, concrete, and destructive fusible PVC joint testing shall be reimbursed to the Contractor, upon submittal of invoices. Work performed by Contractor or Sub-Contractor related to such testing, or any other work performed by laboratory personnel outside of actual compaction, concrete, and PVC joint testing, shall be considered incidental and shall not be reimbursable from testing allowance. Work shall be coordinated and directed by Engineer. Contractor shall pay for all failed tests.

4. The cost of work associated with hydrostatic pressure testing for main pipeline and wash crossings shall be paid via a separate bid item. The cost of work associated with hydrostatic pressure testing for all other facilities (including site piping, pump stations, chlorination buildings, tanks, etc.) for which a separate bid item is not provided shall be considered incidental to their respective bid items.

5. The cost of work associated with disinfection and bacteriological testing for main pipeline and wash crossings shall be paid via a separate bid item. The cost of Contractor's work associated with disinfection and bacteriological testing for all other facilities (including site piping, pump stations, chlorination buildings, etc.) for which a separate bid item is not provided shall be considered incidental to their respective bid items.

a. Laboratory costs associated with bacteriological testing shall be considered incidental, and are not eligible for reimbursement under the testing allowance.

B. Cathodic Protection:

1. Basis of Measurement: Per each for valves and steel casings. Cathodic protection for metallic fittings or any other unlisted non-stainless metallic components within corrosive soil zones shall be considered incidental.

2. Basis of Payment: Includes cathodic protection design, installation, energizing, adjustment, testing and all materials not listed separately on the bid form.

1.4 REFERENCES

A. Contractor shall refer to the latest revision of all standards listed herein.

B. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

C. American Society of Mechanical Engineers (ASME):

1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard

D. American Society for Testing and Materials International (ASTM):

1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
4. ASTM A139 – Standard Specification for Electric Fusion (Arc) Welded Steel Pipe
5. ASTM A283 – Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
6. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
7. ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
8. ASTM F594 – Standard Specification for Stainless Steel Nuts.
9. ASTM A1011 – Standard Specification for Steel, sheet and strip, Hot Rolled, Carbon, Structural, High Strength Low Allow, High Strength Low Alloy with Improved Formability, and Ultra High Strength
10. ASTM A1018 – Standard Specification for Steel, Sheet and Strip, Heavy Thickness Coils, Hot Rolled, Carbon, Commercial, Drawing, Structural, High Strength Low Alloy, High Strength Low Allow with Improved Formability, and Ultra High Strength
11. ASTM B843 – Standard Specification for Magnesium Alloy Anodes for Cathodic Protection
12. ASTM D653 - Terminology Relating to Soil, Rock, and Contained Fluids.
13. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))
14. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
15. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
16. ASTM D2152 - Test Method for Degree of Fusion of Extruded Poly(Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion
17. ASTM D2467 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
18. ASTM D2487 - Classifications of Soils for Engineering Purposes (Unified Soil Classification System).
19. ASTM D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping

20. ASTM D3363 – Standard Test Method for Film Hardness by Pencil Test
21. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
22. ASTM D4752 – Standard Practice for Measuring MEK Resistance of Ethyl Silicate Zinc Rich Primers by Solvent Rub ASTM D638 – Standard Test Method for Tensile Properties of Plastics
23. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
24. ASTM E165 – Standard Practice for Liquid Penetrant Examination for General Industry
25. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
26. ASTM F1057 - Standard Practice for Estimating the Quality of Extruded Poly (Vinyl Chloride) (PVC) Pipe by the Heat Reversion Technique

E. American Water Works Association (AWWA):

1. AWWA C104 - ANSI Standard for Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105 - ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110/ ANSI A21.10 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In. (76 mm through 1,219 mm), for Water.
4. AWWA C111/ ANSI A21.11 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
5. AWWA C115 - ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
6. AWWA C116 – Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service
7. AWWA C151 - ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
8. AWWA C153 - ANSI Standard for Ductile-Iron Compact Fittings for Water Service.
9. AWWA C200 - Steel Water Pipe 6 In. (150 mm) and Larger.
10. AWWA C206 - Field Welding of Steel Water Pipe.
11. AWWA C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 In. through 144 In. (100 mm through 3,600 mm).
12. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
13. AWWA C209 - Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.

14. AWWA C210 – Standard for Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
15. AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
16. AWWA C219 – Standard for Bolted, Sleeve-Type Couplings for Plain-End Pipe
17. AWWA C600 - Installation of Ductile-Iron Water Mains and their Appurtenances.
18. AWWA C605 - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water.
19. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. through 12 In. (100 mm through 300 mm), for Water Distribution.
20. AWWA C901 - Polyethylene Pressure Pipe and Tubing, 1/2 In. through 3 In. (13 mm through 76 mm), for Water Service.
21. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. through 48 In. (350 mm through 1,200 mm), for Water Transmission and Distribution.
22. AWWA M11 – Steel Pipe: A Guide for Design and Installation
23. AWWA M23 – PVC Pipe – Design and Installation

F. NACE International (NACE)

1. SP0169 – Control of External Corrosion on Underground or Submerged Metallic Piping Systems
2. TM0497 – Measurement Techniques Related to Criteria for Cathodic Protection on Underground or Submerged Metallic Piping Systems
3. SP0274 – High-Voltage Electrical Inspection of Pipeline Coatings Prior to Installation.

G. Manufacturer's Standardization Society of the Valve and Fittings Industry:

1. MSS SP-60 - Connecting Flange Joint between Tapping Sleeves and Tapping Valves.

H. Society for Protective Coatings:

1. SSPC-SP5 White Metal Blast Cleaning

I. National Fire Protection Agency

1. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

J. NSF International Standard / American National Standard (ANSI)

1. NSF/ANSI 61 – Drinking Water System Components – Health Effects.

K. National Association of Pipe Fabricators

1. NAPF 500 – Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings.

L. American Welding Society

1. AWS D1.1 – Structural Welding Code

M. Underground Solutions

1. OB-8-273 – Recommended Cutting Procedure for Fusible PVC Pipe
2. OB-8-274 – Recommended Cold Weather Fusion Procedures for Fusible PVC Pipe
3. OB-8-275 – Recommended Intermediate Fusion Procedures for Fusible PVC Pipe
4. Operational Quick Cards
5. Operational Procedural Documents

1.5 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, and accessories.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

D. In addition to the submittal requirements listed above, Contractor shall also submit:

1. Pipe restraint plan indicating all locations where restrained pipe joints, including all fusible PVC joints, will be used to comply with the Drawings and Specifications. The plan shall be in tabular form indicating beginning and ending station of every restrained section, as well as in graphic form with restrained sections indicated graphically with written station numbers. Locations of any bell ends fabricated as part of the fusible PVC pipe shall be noted. Locations of all appurtenances, including air valves and flush valves, shall be noted on the graphic and tabular plans with corresponding station numbers. The pipe restraint plan must be submitted and approved by the Engineer before any submittals for pipe, fittings, restraints, or casing will be approved.
2. Shop drawings for any custom-fabricated steel fittings which clearly show compliance with AWWA M11, AWWA C207 and AWWA C208. Include design calculations, as applicable.
3. Submittal for all coatings which demonstrate compliance with relevant AWWA and NACE standards.
4. Design calculations, drawings and material data sheets for cathodic protection and monitoring systems. Include assumptions and basis for design. Include approximate locations of anodes, test stations and isolation kits. Include copy of cathodic protection specialist’s NACE certification.
5. As-built drawings and any Contractor-provided survey data. Refer to Sections 01 00 00 – Basic Requirements and 02 21 13 - Surveying.
6. Shop drawings, with dimensions, of fusible PVC sweeps.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 00 00 - Execution Requirements: Requirements for submittals.

B. Project Record Documents: Refer to Sections 01 00 00 – Basic Requirements and 02 21 13 – Surveying.

1. All fusible PVC joint fusion documentation and fusion machine data logs shall be submitted to Engineer with project record documents, in addition to ongoing data log and analysis submittals during construction process.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with the most recent edition of New Mexico Standard Specifications for Public Works Construction, with latest revisions.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 00 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Block individual and stockpiled pipe lengths to prevent moving.

C. Do not place pipe or pipe materials on private property without prior authorization, or in areas obstructing pedestrian or vehicular traffic.

D. Store PVC materials out of sunlight. Contractor shall, at Contractor's expense, provide and maintain tarps, temporary shelters, or other such measures as necessary to protect PVC materials from sunlight. Such tarps or shelters must be adequately vented to prevent excess heat accumulation

1. Any PVC materials judged by the Engineer to be sun-damaged, including tan to brown discoloration, blistering, roughening or cracking of surface, or embrittlement, prior to installation shall be rejected.

E. Coated pipe shall be shipped on bunks and secured with nylon belt tie down straps or padded banding over braces, and shall be stored on padded skids or other suitable means to prevent damage to coating.

F. Coated pipe and other components shall be handled with wide belt slings, padded forks or other means to prevent damage to coating. Chains, cables or other equipment likely to damage coating or pipe shall not be used.

G. PVC pipe shall be bundled or stacked throughout the shipping, storage and handling process in accordance with AWWA M23 and pipe supplier's recommendations, whichever is most stringent. Excessive bundling or stacking that results in bends, kinks, gashes or uncorrectable ovality shall be rejected. Transport and handle pipe in accordance with AWWAM23 and pipe supplier's recommendations, whichever is most stringent. Off-loading devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut, or gouge the pipe are strictly prohibited.

1. Any pipe showing a crack or which has received a blow that may have caused an incident fracture, even though no fracture can be seen, shall be rejected.

2. Any pipe with a scratch or gouge greater than 10% of the wall thickness will be rejected.

H. Prior to shipment and again prior to installation, all materials shall be visually inspected for damage, including coatings and surfaces. Any damaged materials shall be repaired to original standards or replaced.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 WATER PIPING AND FITTINGS

A. Polyvinyl Chloride (PVC):

1. All PVC pipe, whether jointed or fusible, shall conform to AWWA C900 and AWWA C905, on all PVC pipe 4" diameter and greater, and ASTM D1785, Schedule 80, on all PVC pipe less than 4" diameter. Testing shall be in accordance with the referenced AWWA standard for all pipe types.
2. All piping shall be made from PVC compound conforming to cell classification 12454 per ASTM D1784.
3. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.
4. Pipe shall be blue in color for potable water use.
5. Nominal laying length:
    a. Jointed PVC pipe: 20 feet.
    b. Fusible PVC pipe: 40 feet, or custom lengths as required on Drawings
6. Gasketed Joints:
    a. Joints per ASTM D3139.
    b. Use rubber gaskets manufactured and tested in accordance with ASTM F477.
    c. For all PVC casings at petroleum line crossings or where otherwise indicated on Drawings, use petroleum-resistant gaskets in accordance with ASTM F477 or fusible PVC pipe joints.
7. Fusible PVC Pipe:
    a. Manufacturers:
        1) Underground Solutions, Inc.
        2) Substitutions: Not allowed
    b. Fusible polyvinylchloride pipe shall be extruded with plain ends. The fused ends shall be square to the pipe and free of any bevel or chamfer. Bell ends with gaskets, if required, shall be extruded with the pipe.
        1) Any bell ends shall be noted on the Contractor's pipe restraint submittal for Engineer's approval prior to extrusion.

8. Fittings:
    a. Ductile iron on all PVC pipe 4" diameter and greater.
        1) Refer to specifications for ductile iron fittings in this section, below.
    b. All PVC pipe and fittings less than 4" diameter shall be solvent welded Schedule 80.
    c. Solvent-weld joints are not permitted on pipe 4" diameter and greater.
9. Mechanical Joint Restraints:
    a. Refer to specifications for ductile iron joint restraints in this section, below.
10. Fusible PVC Sweeps:
    a. Fusible polyvinyl chloride sweeps shall conform to the same sizing convention, diameter, dimensional tolerances and pressure class of the pipe being joined using the sweep or bend.
    b. Fusible polyvinyl chloride sweeps shall be manufactured from the same fusible polyvinyl chloride pipe being used for the installation, and shall have at least 2 feet of straight section on either end of the sweep or bend to allow for fusion of the sweep to the pipe installation. There shall be no gasketed connections utilized with a fusible polyvinyl chloride sweep.
    c. Standard fusible polyvinyl chloride sweep angles shall not be greater than 22.5 degrees.
11. Mechanical bell harnesses shall not be allowed. All PVC pipe joint restraints shall be provided using fusible PVC pipe.
12. Substitutions: Contractor has option of using Fusible PVC where Bell and Spigot PVC is specified at the Contractor's expense. Fusible PVC is considered a restrained pipe system.

B. Ductile Iron Pipe, Joints, and Fittings:
1. Manufacturers:
    a. US Pipe
    b. American Pipe
    c. Substitutions: Approved Equal
2. Ductile iron pipe:
    a. Pipe Class: AWWA C151, for nominal thickness, rated water working pressure and maximum depth of cover.
    b. 350 psi working pressure.
    c. Coatings:
        1) For use with cathodically-protected components (meter/ flow control vault site only):

a) All exposed interior and exterior surfaces shall be coated with fusion-bonded epoxy in accordance with AWWA C116.

b) All coatings shall be applied in strict accordance with coating manufacturer's recommendations.

c) All fusion-bonded epoxy coatings shall be holiday-free

2) For use without cathodic protection:

a) Bituminous Coating: AWWA C151.

b) Cement Mortar Lining: AWWA C104, standard thickness.

3. Fittings: Ductile iron.

a. Compact MJ fittings conforming to AWWA C153 or AWWA C110, unless otherwise noted on Drawings.

b. Flanged fittings shall conform to AWWA C110. Do not use flanged fittings for buried installations unless otherwise noted on Drawings.

1) Contractor responsible to ensure that all mating flanges have compatible diameters, bolt sizes and drill patterns. Overdrill bolt holes as necessary, provided such overdrlling is within manufacturer's recommended tolerances.

c. Pressure rating of joints, fittings and gaskets shall be at least 350 psi, unless otherwise noted on the Drawings.

d. Pressure rating of flanged fittings and gaskets shall at least match that of the attached pipe, unless otherwise noted on the Drawings.

e. Marked with pressure rating, nominal diameter of opening, manufacturers' identification, country where cast, and degree of bend.

f. Coatings:

1) For use with cathodically-protected components (meter/ flow control vault site only):

a) All exposed interior and exterior surfaces shall be coated with fusion-bonded epoxy in accordance with AWWA C116.

b) All coatings shall be applied in strict accordance with coating manufacturer's recommendations.

c) All fusion-bonded epoxy coatings shall be holiday-free

2) For use without cathodic protection:

a) Bituminous Coating: AWWA C110.

b) Cement Mortar Lining: AWWA C104, standard thickness.

g. Provide sacrificial anode cathodic protection where indicated in this Section.

4. Joints:

a. Mechanical and Push-On Joints: AWWA C111.

1) All push-on joints shall use be fully restrained

2) TR Flex restrained pipe joints

3) TR Flex lockers shall be ductile iron. Redwood or other materials shall not be allowed.

b. Flanged Joints: AWWA C115; ASME B16.1.

5. Mechanical Joint Restraints:

a. Mechanical joint restraints for all fittings and appurtenances, unless otherwise noted on Drawings.

b. Mechanical joint restraints shall be "EBAA Iron, Megalug®" Series 2000PV and 2200, Smith-Blair Cam-Lock, or approved equal, for all pipe 4" diameter and greater.

c. Wedge assemblies and glands shall be fusion bonded epoxy coating in accordance with AWWA C116 or Mega-Bond coated, interior and exterior

d. Provide sacrificial anode cathodic protection where indicated in this Section.

e. Stainless steel 304 bolts, nuts and washers for all buried applications, provided by manufacturer especially for use with their respective components. If fitting manufacturer cannot supply stainless steel bolts contractor may provide bolts from another source; however, contractor is solely responsible to ensure fit and compatibility of said bolts.

6. Jackets:

a. AWWA C105 polyethylene jacket, Installation Method "A".

b. Double-wrap all ductile iron components, unless they are cathodically protected.

c. Inner PE jacket shall be V-Bio enhanced, minimum thickness: 8 mil

d. Outer PE jacket shall be standard polyethylene, minimum thickness: 8 mil

e. Secure PE jackets with ultra-high molecular weight (UHMW) polyethylene film tape, 10 mil thickness.

1) Do not use duct tape to tape the PE jackets.

f. Do not use polyethylene encasement on ductile iron fittings with cathodic protection.

C. Steel Pipe and Fittings:

1. Pipe fabrication:

a. For pipe 26" diameter and greater, fabricate arc-welded spiral seam steel pipe: ASTM A139, Grade B, C, D or E. For pipe 26" diameter or less, fabricate pipe per ASTM A-53 B.

b. Fabricated in accordance with AWWA C200, except:

1) Steel plate: ASTM A283, Grade C or D, or ASTM A36.

2) Steel sheet: ASTM A1011, Designation SS, Grade 40, 45 or 50; or ASTM A1018, Designation SS, Grade 40.

3) Standard wall thickness, unless otherwise indicated on Drawings.

2. Fittings and Special Sections:

a. Steel for fittings: ASTM A283, Grade C or D, or ASTM A36 for carbon steel.

b. Welding: Per AWS D1.1. All welding must be completed prior to application of lining and coatings, unless otherwise permitted by the Engineer. In no case shall any welding damage lining or coatings.

c. Dimensions in accordance with AWWA C208.

d. Custom fabricated fittings shall be designed and fabricated in accordance with AWWA M11, with outlet reinforcements per AWWA M11. All other standards and specifications for steel, welds, coatings, flanges and dimensions of component fittings provided herein shall apply equally to custom fabricated fittings.

e. No custom-made fittings shall be used without prior written approval by the Engineer.

3. Coatings: Interior and exterior surfaces of all non-stainless steel pipe and fittings shall be coated as follows:

a. Interior and exterior fusion bonded epoxy coated in accordance with AWWA C213.

1) For small diameter pipes, where it is not practical to apply fusion bonded epoxy coatings, the use of liquid epoxy coatings in accordance with AWWA C210 may be considered in lieu of fusion-bonded epoxy for interior surfaces, with prior approval by the Engineer. The burden shall be upon to Contractor to submit sufficient data and obtain Engineer's approval for such substitutions.

2) Pipes underneath welded steel tanks: Refer to Section 33 16 19 – Welded Steel Water Storage Tank and Section 09 97 14 – Water Storage Tank Painting.

b. All coatings shall be NSF 61-approved.

c. All surfaces shall be ground smooth. All weld splatter and other defects shall be removed prior to blasting.

d. Surface preparation shall conform to SSPC-SP5 White Blast Clean with surface profile of 2.0 to 3.0 mils.

e. Coating thickness for both interior and exterior shall be not less than 12.0 mils DFT and shall not exceed coating manufacturer's recommended maximum thickness.

f. All wetted surfaces of pipe interior shall be coated. All exposed surfaces of pipe exterior shall be coated.

g. Do not apply coating to mating surfaces of flanges.

h. Typical water temperature: Less than 140 degrees Fahrenheit.

i. Minimum field adhesion: 700 psi.

4. Additional Coatings:

a. Exterior surfaces of all buried non-stainless steel pipe and welded fittings shall include cold-applied tape coating, manufactured and installed in accordance with AWWA C209, applied with a minimum overlap width of 1-inch and a total coating thickness shall be a minimum of 80 mils. Such tape coating shall be applied in addition to fusion-bonded epoxy coatings specified above.

5. Flanges:

a. Steel: ANSI Class 150 / AWWA C207 Class E / ASME B16.5 Class 150, unless otherwise noted on Drawings.

b. Ductile or Cast Iron: ANSI Class 125 / AWWA C207 Class E / ASME B16.1 Class 125, unless otherwise noted on Drawings.

c. Pressure rating of flanges and gaskets shall meet or exceed surge pressure rating of attached pipe.

d. Coatings and linings shall be continuous to the ends of pipe and backs of flanges.

e. Do not apply coatings to mating surfaces of flanges.

f. Gaskets shall be ring-type, per AWWA C207, unless the flanged connection is between PVC and steel, in which case full face type gaskets with outer diameter equal to that of the flange shall be used.

g. Retainers shall be fabricated of phenolic or other suitable material as recommended by manufacturer and conforming to NSF 61, with minimum thickness of 1/8 inch and minimum dielectric strength of 500 volts/mil.

h. Nitrile sealing rings.

i. Steel washers shall be 1/8-inch thick.

j. All bolts, nuts and washers shall be stainless steel 304, unless otherwise noted. All bolts shall be provided by manufacturer especially for use with their respective fittings. If manufacturer cannot supply stainless steel bolts, Contractor may provide bolts from another source; however,

Contractor is solely responsible to ensure fit and compatibility of said bolts.

k. Bolt shall be long enough to protrude through the assembled nut at least two threads but not more than ½-inch.

l. Contractor is responsible to ensure that all pipe flanges that connect to valve body flanges have the same dimensions, drill pattern, bolt hole diameter and equal or higher pressure rating as the valves to which they are connected.

1) Overdrill bolt holes as necessary, provided such overdrlling is within manufacturer's recommended tolerances.

m. Contractor shall be responsible to verify compatibility of all flange bolt patterns prior to purchasing materials and shall notify the Engineer in the event that alternate bolt patterns are required to mate flanges.

6. Field Welding Materials:

a. Pipe: AWWA C206.

2.2 TAPPING SLEEVES, SADDLES, TEES AND VALVES

A. Tapping Sleeves and Saddles:

1. Manufacturers:

a. Mueller Co.

b. Kennedy Valve Co.

c. Romac Industries, Inc

d. JCM Industries

e. Ford Meter Box Company, Inc

f. Smith-Blair, Inc

g. Substitutions: Approved equal.

2. For taps 2-inches or smaller, use nylon coated ductile iron tapping saddles with dual compression type tapping sleeves .

3. For taps larger than 2-inches, use fusion-bonded epoxy-coated steel, dual compression type tapping sleeves.

4. All saddles shall be specifically designed for use on C900 PVC pipe.

5. All bands, straps, bolts, nuts and washers shall be SS 304. All bolts shall be provided by manufacturer especially for use with their respective components.

6. Working pressure rating: 350 psi.

7. Tapping sleeves and saddles shall be used on non-fusible PVC, unrestrained bell-and-spigot PVC, and DI pipe only. All taps on fusible PVC pipe or restrained PVC pipe shall be performed using MJ reducing tees.

8. Tapped Outlet: FNPT or MJ, as indicated on Drawings

9. Non-stainless tapping sleeves within "Corrosive Soil Areas" as designated on the Drawings and this Section shall require cathodic protection.
10. All pipe taps shall be made with an engineer approved "tapping machine".
11. Threadolets, where called for on Drawings, shall be welded to the pipe, ground, and blasted (if possible) prior to applying fusion-bonded epoxy coating to the pipe.

2.3 CORROSION PROTECTION AND MONITORING SYSTEMS

A. Design:

1. Systems shall be consistent with corrosion engineering principles set forth in NACE SP0169 (latest revision) and NACE TM0497 (latest revision).
2. Design and installation of corrosion protection and monitoring systems shall be performed under the direction of a NACE-accredited Cathodic Protection Specialist.
3. Materials shall be as manufactured by Corrpro, Inc., or approved equal.
4. Minimum design life: 20 years.
5. Polarization potential: Between -0.85 and -1.10 volts
6. Contractor may use the soil resistivity data provided in this section as a basis for design of corrosion protection systems.

B. Flange isolation kits:

1. Isolate new cathodically protected structures from adjacent metallic structures not to be protected, as needed, with flange isolation kits consisting of dielectric material with a minimum dielectric strength of 500 volts/mil.
2. Isolate steel pipes with corrosion monitoring from adjacent metallic structures not to be monitored, with flange isolation kits consisting of dielectric material with a minimum dielectric strength of 500 volts/mil.
3. Flange isolation kits shall include bolt isolating sleeves: Sleeves shall be full length, extending halfway into both steel washers when installed, with tube thickness of 1/32-inch. Sleeves shall be composed of mylar or other suitable material recommended by flange manufacturer.
4. Steel washers shall have sufficient diameter to fit over the bolt isolating sleeve.
5. Isolating washers shall be 1/8-inch thick, with inner diameter sufficient to fit over bolt isolating sleeve, composed of phenolic or other suitable material with minimum dielectric strength of 500 volts/mil as recommended by flange manufacturer.

C. Magnesium alloy anodes in accordance with ASTM B843.

1. Actual weight shall be based on NACE engineer's design, with minimum weight of 17 lb.
2. Shall contain mild steel core centered within anode with silver-solder connect between steel core and anode cable.

3. Anode cable shall be No. 12 AWG or larger if required by NACE-certified designer.
4. Anode to cable connection, exposed mild steel and exposed cable shall be potted in epoxy.
5. Anodes pre-packages within chemical backfill specifically designed for the type of anode being used.

D. Cable:

1. Cable material:
   a. Anode leads: Solid, plain annealed cable, #12 AWG or larger
   b. Test leads: Stranded, plain annealed cable, #12 AWG or larger
   c. Bonding cables: Stranded, plain annealed cable, #6 AWG or larger
2. Cable insulation: Rated for 600 volts and direct burial. Min. thickness of 100 mils. All cables shall have HMWPE insulation
3. Unspliced for entire length of connection, sufficient length to avoid mechanical stress on cable.
4. Anode-to-cable connection shall be factory-made.
5. Cable colors:
   a. Anode: Black
   b. Pipe / structure: White
   c. Casing: Yellow
   d. Foreign Line (if any): Red

E. Test stations:

1. Test stations for cathodic protection systems use three-cable type to carry current from the anode, carry current to the protected structure and to monitor soil-to-structure potential.
2. For corrosion monitoring of buried ferrous pipe and appurtenances without cathodic protection, use two-cable type such that one cable can be used for bonding and one cable can be used for determining soil-to-structure potentials.
3. Enclosures shall be either NM-5 water-tight, flush-to-grade test stations (Cott, OAE) or wall mounted anode terminal boxes within vaults. Wall-mounted anode terminal boxes shall be NEMA 250 Type 3-R cabinets with NEMA Grade C phenolic panels and solderless, pressure-type identified terminals.
4. Provide 0.01 ohm calibrated shunts and variable resistors to allow current output of each anode to be measured and adjusted. Variable resistors (for use in terminal boxes only) shall be sized to allow current of each anode to be adjusted to within 150% of one another without overheating.

F. Welds: Thermite “cad” welds.

G. All FBE-coated buried metallic components installed within corrosive soil zones, as designated in this Section and on the Drawings, shall have an anode connector welded to

the fitting prior to application of the FBE coating. The anode connector must be a permanently welded-on, copper-clad connector capable of receiving two #12 copper wires. Anode connector must be sufficient in length to install and crimp one #12 wire and still be capable of installing and crimping a second wire in place.

H. Warning tape: Shall be minimum 3-inch wide, suitable for direct burial, yellow with black lettering, full-length printed with “Caution – Cathodic Protection Cable Buried Below”.

2.4 UNDERGROUND PIPE MARKERS

A. Furnish materials in accordance with the most recent edition of New Mexico Standard Specifications for Public Works Construction, with latest revisions.

B. Tracer Wire: 12 AWG, Solid Copper, Single Conductor, 600V, UF-XHHW wire or equal, for underground installation.

C. Metal-backed detectable water marker tape: Bright colored, metallized for detection by above-ground metal detector, continuously printed, minimum 6 inches wide by 4-mil thick, manufactured for direct burial service, imprinted with "BURIED WATER SERVICE" in large letters.

2.5 ABOVE-GROUND PIPE MARKERS

A. Carsonite marker posts, blue, with Navajo Tribal Utility Authority (NTUA) decals. Decals to be specified by NTUA and provided by the Contractor. Place markers as specified on the Drawings.

2.6 PIPE SUPPORTS AND ANCHORING

A. Metal for pipe support brackets: ASTM A123/A123M, galvanized structural steel thoroughly coated with bituminous paint.

B. Metal tie rods and clamps or lugs: Galvanized steel sized in accordance with NFPA 24 thoroughly coated with bituminous paint.

2.7 CASING SPACERS

A. Polyethylene Casing Spacer

B. Two part or multi segmented

C. Stainless steel 304 bolts, nuts and washers. All bolts shall be provided by the fitting manufacturer especially for use with their respective components.

2.8 BEDDING AND BACKFILL MATERIALS

A. As specified in Section 31 23 23.

2.9 ACCESSORIES

A. Concrete for Thrust Restraints (where applicable): Conform to Section 03 30 00, with minimum compressive strength of 3,000 psi.

B. Steel rods, bolt, lugs and brackets

1. For applications not in contact with soil: ASTM A36/A36M or ASTM A307 carbon steel.
2. For buried applications: Stainless steel 304.

2.10 SOURCE QUALITY CONTROL

A. Pipe:

1. Polyvinyl chloride (PVC): Factory test all PVC pipe, both jointed and fusible types, in accordance with AWWA C900 or AWWA C905, as applicable.
    a. Fusible PVC: In addition to standard AWWA C900/905 testing, the pipe supplier shall perform third party quality assurance for the pipe lot to be provided for the project. Testing shall be per the pipe supplier protocol and include the following tests as a minimum:
        1) Heat reversion testing per ASTM F1057
        2) Acetone immersion testing per ASTM D2152
        3) Flattening testing per AWWA C905
2. Ductile iron: Factory test in accordance with AWWA C151 and AWWA C104.
3. Steel: Factory test in accordance with AWWA C200, ASTM A53, or ASTM A139.
    a. Hydrostatic test: Factory test per AWWA C200 to stress steel to 23,000 psi for at least 15 minutes, or longer as needed to allow for thorough inspection. Conduct test after all formed and welded ends have been completed and attached.
    b. Repair defects and re-test prior to applying lining and coating.

B. Fittings:

1. Ductile iron (DI): Factory test in accordance with AWWA C153 and AWWA C110, as applicable.
2. Steel:
    a. Steel plate fittings: Factory test fittings fabricated from steel plate to stress steel under hydrostatic pressure to 23,000 psi for at least 15 minutes, or longer as needed to allow for thorough inspection.
    b. Steel pipe fittings: Fittings fabricated from tested steel pipe do not require hydrostatic testing if girth butt welds are complete penetration welds. Perform dye penetrant test on welds in accordance with ASTM E165.
    c. Pipe should conform to ASTM A53, ASTM A139 or AWWA C200.
    d. Remove all defects disclosed during testing, re-weld and re-test the fitting.
3. Fusible PVC Sweeps:

a. In addition to the factory testing of the fusible PVC pipe stipulated above prior to bending, every individual fusible PVC sweep shall be inspected for quality at the factory after bending, as follows:

1) Visual inspection for heat damage, kinks, ovality, and other irregularities

2) OD measurements parallel and perpendicular to the plane of the bend, at not less than five (5) locations evenly spaced along the length of the sweep

C. Coatings:

1. Cure testing for fusion bonded or liquid epoxy coatings: ASTM D4752 and ASTM D3363, Every 1000 sq. ft. of epoxy coating.

2. Holiday testing for epoxy and cold-applied tape coatings:

a. All fusion-bonded epoxy coatings and cold-applied tape coatings on all pipes and fittings shall be holiday tested prior to installation, at no additional cost to the Owner.

b. Perform testing in accordance with NACE Standard SP0274, using electrical holiday tester. Use test voltage below:

Total Coating Thickness (Mils)	Test Voltage (Volts)
20 or less	6000
30	7500
50	9000
70	11500
80 or more	12000

c. All holidays shall be repaired and re-tested, at no additional cost to the Owner.

3. Touch up and repair of Fusion Bonded Epoxy Coatings

a. Applies to all FBE coated valves for field repair of minor holidays, scratches, breaks or other damage to FBE coating.

b. Does not include repair or touch up of systemic or large area holidays in FBE coating. Repair of systematic holidays or damaged areas larger than three (3) sq. in. will require the damaged coating be ground off and the valve be newly shop-coated.

c. Materials and application:

1) NSF/ ANSI 61 certified, two-part, 100% solids, liquid epoxy coating meeting the requirements of AWWA C210.

a) Manufacturer: 3M Scotchkote Epoxy Coating 323, OAE.

b) If temperature is below 55 degrees Fahrenheit, the metal substrate shall be pre-heated in accordance with coating

manufacturer's recommendations prior to applying the coating.

d. Prepare surface and apply per coating manufacturer's instructions for use as a field repair material.

D. All shop welding shall be performed by certified welders.

E. All shop welds shall be tested by ultrasonic or radiographic methods in accordance with AWS D1.1.

F. Engineer reserves right to require additional holiday testing of any and all coated components that are suspected of having holidays in the field prior to installation. Costs of failed tests shall be borne by the Contractor; costs of passed additional tests shall be reimbursable from the Testing Allowance.

2.11 SOURCE QUALITY ASSURANCE

A. Acceptance of materials will be based on compliance with relevant AWWA, ASTM and other relevant standards. Materials must pass all relevant tests prior to acceptance.

B. Compliance with standards will be determined based on:

1. Documentation of factory testing. Such tests must be completed in accordance with relevant AWWA, ASTM, AWS or other applicable standards. All testing must be completed and documented by qualified personnel. The Engineer reserves the right to observe the testing while in process and to demand all testing documentation at any time.

2. Inspection by the Engineer. The Engineer reserves the right to inspect all materials both during and after manufacture.

C. The Engineer reserves the right to demand evidence of certification of all personnel performing shop or field welding on steel pipe and fittings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 00 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify existing utility water main size, location, and invert, are as indicated on Drawings.

3.2 PREPARATION

A. Pre-Construction Site Photos:

1. Prior to beginning construction, take photographs or videotape along centerline of proposed pipe trench. The photos or video must include coverage of all areas and adjacent features that may potentially be impacted by the impending construction work.

2. Photographs shall be taken at a minimum of one for each 200 feet of pipe trench. Videos shall cover a maximum of 2,000 feet per video file.

3. Video or photographs shall be taken after Station markers or stakes are in place for the section of pipeline or site(s) to be recorded. Video or photos must include sufficient close-ups of stakes to clearly indicate the location.

4. Prior to groundbreaking on any section of pipeline or site work, video or photographs must be submitted to the Engineer for review and approved. Video or photo documentation must be approved as sufficient by Engineer before groundbreaking may proceed.

5. Show station markers, mailboxes, fences, structures, driveways, signs, culverts, and other existing site features.

6. Include project description, applicable stations or sites, and date taken in the file name of every photograph or video, using the following filename convention: "<project name>_<begin station>_to_<end station>_<date>".

7. Video or photo submittals may be rejected because of failure to include or document any of the items above, a lack of visual or audio clarity, or for any other deficiency that prevents the Owner / Engineer from easily viewing and documenting the pre-construction conditions of the pipeline and sites.

8. If using video, Contractor must submit two (2) copies of the video documentation on DVD format as part of the submittal process. If using photographs, Contractor must submit 2 copies of digital photograph files in DVD format as part of the submittal process.

B. Construction staking:

1. Refer to Section 02 21 13 – Surveying.

C. Restricted Areas and Culturally Sensitive Areas:

1. Contractor shall notify Engineer prior to work within 100 feet of any restricted area as designated on the Drawings; refer to Section 01 00 00.

2. The Owner's Surveyor will erect barricades at the limits of any truncated temporary construction easements. The Owner's Archaeologist will flag culturally sensitive sites as designated on the Drawings.

3. Contractor shall maintain all flags, stakes and barricades in place until the end of construction. Contractor shall notify Engineer in the event of damage or removal of said markers. Re-marking due to negligence by Contractor shall be subject to charge-backs to the Contractor.

4. No work shall be performed within 100 feet of any restricted area or truncated TCE unless barricades and/or flags are up.

5. No work shall be performed within 100 feet of any restricted area designated on the Drawings as requiring archaeological monitoring unless the Owner's archaeologist is physically present at the site.

3.3 TRENCHING

A. In accordance with Section 31 23 17.

3.4 BEDDING

A. In accordance with Section 31 23 23.

3.5 INSTALLATION – PIPE

A. Install bell-and-spigot PVC pipe in accordance with AWWA C605, AWWA M23 and pipe manufacturer's instructions, whichever is most stringent.

1. Use only lubricants supplied by the pipe manufacturer and apply to both bell and spigot ends of the joint, in accordance with manufacturer's recommendations.

2. Clean the gasket, bell, groove and spigot immediately prior to connecting pipe joints.

3. Do not over-insert pipe joints. Any over-inserted pipe joints shall be removed and the pipe bell and gasket inspected for damage. Any damaged bells or gaskets shall be discarded and replaced.

4. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Use only equipment specifically designed for pipe cutting. The use of chisels or hand saws will not be permitted. Grind edges smooth with beveled end for push-on connections.

B. Install fusible PVC pipe in accordance with AWWA C605, AWWA M23 and pipe supplier's instructions, whichever is most stringent.

1. If ambient temperature drops below 40 degrees Fahrenheit refer to Underground Solutions Operational Bulletin for Cold Weather Installation (OB-8-274 012411).

2. When pulling fusible PVC pipe, do not exceed the supplier's maximum recommended safe pulling force.

3. Fused lengths of pipe shall be installed by lowering into the trench or excavation, using approved strapping per the pipe supplier's guidelines. The lowering operation, once initiated shall proceed until the entire length of the fused section of pipe is installed.

a. Coordination of lifting equipment shall ensure that the fused pipe does not exceed the bending and buckling limitations of the pipe, per the pipe supplier's guidelines.

b. Equipment shall be utilized and staged per the pipe supplier's guidelines.

c. Under no circumstances will the pipe be "dropped" or "rolled" into the trench or excavation.

4. If the length of the fused pipe is longer than what the available equipment can lower into the trench or excavation at one time, equipment shall be staged so that lowering shall begin at one end of the installation, and proceed along the trench or excavation, so that the entire fused length is installed without exceeding the minimum bend radius of the fused pipe.

5. Pipe may also be installed by pulling it into the end of the trench via a sloped section that is constructed so as not to exceed the minimum bending radius of the pipe. Pipe may be pulled by the use of a pull head and winch or piece of equipment as recommended by the pipe supplier.

6. Initial lengths of installed fused polyvinylchloride pipe shall be bedded and backfilled before any connections are made between adjacent lengths.
7. Initial lengths of installed fused PVC pipe shall be allowed to come to thermal equilibrium with the ground temperature at burial depth, by waiting at least 24 hours after installation prior to making connections such as air valves, butterfly valves, or flush valves.
8. Where fusible PVC is to be installed inside a casing, remove the exterior weld bead prior to installation in the casing.
9. Connection between fusible PVC and jointed PVC pipe:
    a. Connections between fusible PVC and jointed PVC pipe shall be bell-and-spigot joints in accordance with this Section.
    b. Bevel the spigot end prior to insertion into the bell.
    c. Contractor shall coordinate to ensure bell/ spigot pipe ends match up where fusible PVC pipe connects to jointed PVC pipe.
10. Fusible PVC pipe shall be used:
    a. For all restrained pipe
    b. At all cased road and pipeline crossings
    c. At any location where required bending radius is shorter than the minimum bending radius allowable using bell-and-spigot joint deflection
    d. At all locations where PVC pipe slope exceeds 20%
    e. At all other locations indicated on the Drawings
    f. At any other locations at Contractor's option and expense

C. Install ductile iron piping and fittings according to AWWA C600.

1. Encase all ductile iron pipe and fittings that are not cathodically protected in polyethylene, per AWWA C105, Method "A".
    a. Use two (2) separate polyethylene jackets.
        1) Inner jacket: V-bio enhanced polyethylene
        2) Outer jacket: standard polyethylene
    b. No tears, cuts, rips or other breaks in the polyethylene encasement shall be acceptable. No dirt, water or debris inside the encasement shall be acceptable.
    c. When installing ductile iron pipe floor penetrations under buildings and concrete slabs, bring both layers of polyethylene into the slab inside the roof felt isolation joint. Trim and tape the PE at the mid-point of the slab thickness (e.g. 6" below the floor for a 12" slab). Wrap the felt outside both layers of polyethylene. Trim the felt to 2" above the floor and seal with silicone.

d. When installing ductile iron floor drain lines, bring both layers of polyethylene into the slab, trim, and tape to pipe just below the inset floor drain.

e. Do not polyethylene encase any ductile iron fitting that has cathodic protection.

f. Use only 10-mil UHMW polyethylene film to tape the PE jackets. Do not use duct tape.

2. All push-on joints shall be installed using TR Flex restrained joints. Install restrained joints in accordance with manufacturer's recommendations.

D. Install steel pipe in accordance with AWWA M11. Field weld and test steel pipe, as needed, in accordance with AWWA C206, except as follows:

1. Test field welds by ultrasonic or radiographic method, in accordance with AWS D1.1.

2. Do not field weld pipe without permission from the Engineer.

Any damaged shop-applied coatings shall be repaired in accordance with this Section. In the event that field repair is required due to damage of shop-applied coating, Contractor shall notify Engineer prior to making the repair.

E. Install cathodic protection for buried ferrous pipe, fittings and valves as indicated in the Corrosion Protection and Monitoring Systems provisions of this Section.

1. All buried steel and ductile iron pipe, whether cathodically protected or not, shall be joint bonded and connected to corrosion monitoring stations in accordance with the Corrosion Protection and Monitoring Systems provisions of this Section.

F. Handle and assemble pipe in accordance with manufacturer's instructions and as indicated on Drawings. Inspect each pipe and fitting prior to lowering into trench to ensure there is no damage to the pipe, fitting or coatings. Repair any damage prior to installation. Clean ends of pipe and remove foreign material from inside of pipe and fittings.

G. Maintain 10 ft horizontal separation of water main from sewer piping in accordance with local code.

H. Lay pipe in straight line and center pipe within trench. Re-lay pipe that is out of alignment.

I. Horizontal and vertical pipe bending, angles and joint deflections

1. All ells shall be one of the following standard angles: 11.25, 22.5, 45, 60 or 90 degrees. No other ell angles shall be allowed.

2. Actual horizontal and vertical angles required in the field shall be accomplished by a combination of allowable DI ells, fusible PVC sweeps, and/or pipe deflection (i.e. pipe bending for fused pipe or joint deflection for jointed pipe).

a. At most locations, the plan and profile sheets show horizontal bends without specifying whether the horizontal bend is to be accomplished by DI ells, fusible PVC sweeps, bending of fusible PVC pipe, or joint deflection of jointed PVC pipe. At such locations, the method of bending

is at Contractor's option, provided all design requirements set forth in the Drawings and Specifications are met.

b. At locations where fusible PVC sweeps are shown in plan and profile sheets, they must be used.

c. If the Contractor chooses to use DI ells or fusible PVC sweeps at any given location, the required length of restrained (fusible PVC) pipe must be used on both sides of the bend, whether the restraint length is shown on the plan and profile sheet, or not.

1) The plan and profile sheets assume that bends greater than 18° will be made using ells, that bends less than 9° will be made by pipe deflection ("roping"), and that angles in between could be made using either method. The fusible PVC call-outs at these locations on the plan and profile sheets are based on these assumptions. However, in some cases the Contractor may differ from these assumed methods. In such cases, it is the responsibility of the Contractor to provide adequate restraint length for all fittings, regardless of whether the plan and profile sheets indicate restrained pipe, or not. Refer to restraint detail sheet, DT-3.

3. Lateral pipe bending forces shall be isolated from all fittings.

4. PVC pipe deflections may be made either at joints or by pipe bending, as allowed by AWWA C605.

a. For jointed PVC pipes 12-inch diameter or smaller, pipe bending shall be allowed, provided that such bending complies with AWWA C605 and/or pipe manufacturer's minimum allowable bending radius, whichever is more stringent.

b. For jointed PVC pipes 14-inch diameter or larger, deflections shall be made at the pipe joints only.

c. For all pipe diameters, jointed PVC pipe joint deflection shall not exceed 1 degree per joint.

d. For fusible PVC pipe, deflection shall be accomplished by pipe bending. The pipe bending radius shall not be less than the minimum bending radius recommended by the pipe supplier.

1) If the ambient temperature is less than 40 degrees Fahrenheit, consult the pipe supplier for bending radius adjustments.

5. Steel and ductile iron pipe deflections shall be made at joints, provided pipe manufacturer's allowable deflection limits are not exceeded.

6. Mechanical Joints: contractor to abide by manufacturer's recommended maximum allowable deflection

J. Horizontal and vertical pipe line and grade

1. The horizontal and vertical lines and grades shown on the Drawings indicate the intent of the design. Actual horizontal and vertical lines and grades in the field

may deviate from those shown on the Drawings, provided all of the following conditions are met:

a. Actual minimum slope of pipe shall not be less than 0.00100 ft/ft.

b. Actual maximum slope of pipe shall not be greater than 0.40000 ft/ft, except where otherwise noted on the Drawings.

c. Direction of pipe slope shall not differ from that shown on Drawings.

d. Minimum pipe cover of 4 feet shall be maintained throughout the project.

e. Additional minimum cover or specific minimum vertical clearances called out on the Drawings at specific locations, such as wash crossings, road crossings or pipeline crossings, shall be maintained.

f. In the case of horizontal bends, the outer wall of the pipe must remain at least 12 horizontal feet within the permanent right-of-way boundaries.

g. At bends near casings, pipe bending and/or off-set from centerline shall be done on the far side of the PI from the casing, to maximize the length of straight pipe in the sleeve on each side of the casing.

h. In certain locations, the pipe elevation and/or slope must remain as shown on drawings to facilitate pipe draining, maintain pressures, or other performance criteria. In such cases, deviation from the Drawings may not be allowed.

i. All deviations from the Drawings shall be documented by the Contractor and must be approved in advance by the Engineer.

j. All other specifications shall be met.

k. Any exceptions to the foregoing conditions must receive prior written approval by the Engineer.

2. No high points of any magnitude shall be allowed without an approved air valve. If the As-Built survey of the pipeline reveals high points not shown on the Drawings, Contractor shall correct the pipe grade or install additional air valves, as directed by Engineer.

a. Additional air valves required due to unforeseen field conditions not the fault of the Contractor shall be paid for at the prices established in the Bid.

b. Additional air valves or pipe re-installation required due to high points caused through fault of the Contractor shall be provided at no additional cost to the Owner. This includes failure of Contractor to meet lines and grades set forth in the Drawings or failure to meet minimum pipe slope.

1) If the required air valve is located on a fusible or restrained section of main line, a reducing tee is required in lieu of tapping sleeve. If a reducing tee is required within a corrosive soil zone, Contractor shall provide cathodic protection for the tee at no additional cost to the Owner.

K. Install pipe to bear on the trench bottom along entire length of pipe. For jointed pipe, excavate bell holes in the bottom of the trench to prevent the bell from coming into contact with the sub-grade.

L. Do not lay pipe in wet or frozen trench.

M. Direction of pipe bells may be reversed for ease of installation, provided that all pipe material and installation meets applicable AWWA, ASTM, NTUA and material manufacturer's standards. On grades greater than 10%, install jointed pipe uphill.

N. Pipe expansion and contraction

1. Install pipe to allow for expansion and contraction without stressing pipe or joints.

O. Do not allow trench water, dirt, debris or other foreign material to enter the pipe during or after installation.

1. Keep pipe ends sealed after joining pipes, both while pipe string is laying on top of ground and after pipe is lowered into trench.

2. Close pipe openings with watertight plugs during work stoppages.

P. Clean inside of pipe by "pigging" immediately prior to connecting pipe ends to butterfly valves, elbows or other fittings that do not allow the pig to pass through. Seal all exposed pipe ends to prevent contamination after pigging.

1. Flanged ends shall be temporarily sealed using approved blind flanges. Straight pipe ends shall be temporarily sealed using approved pipe covers.

2. Pigging system shall be submitted to Engineer for approval prior to use.

Q. Install tracer wire continuous, taped to top of pipeline; coordinate with Sections 31 23 17 and 31 23 23.

R. Install metal-backed detectable water marker tape continuous over top of pipe, buried 18 inches above pipe; coordinate with Section 31 23 17 and 31 23 23.

S. Install thrust blocks at locations indicated on Drawings. Installation of thrust blocks shall not relieve the Contractor of responsibility to provide pipe restraints as indicated on Drawings and Specifications.

T. Flanged Joints: Not to be used in underground installations except within accessible structures or as shown on Drawings.

U. All pipes, fittings and appurtenances must remain within designated permanent rights-of-way. All construction activities must remain within the right-of-way or temporary construction easement. Do not encroach on adjacent properties or culturally sensitive areas.

V. Embed pipe within 100 feet behind pipe-laying operations, unless otherwise permitted by the Engineer.

W. Do not backfill pipe prior to as-built surveying; refer to Section 02 21 13 - Surveying.

3.6 JOINING FUSIBLE PVC

A. Fusible polyvinylchloride pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and pipe supplier's guidelines.

B. If ambient temperature drops below 40 degrees Fahrenheit refer to Underground Solutions Operational Bulletin for Cold Weather Fusion (OB-8-274 012411).

C. Do not perform fusions during adverse weather conditions, including high wind, any amount of blowing dust or precipitation events. Protect exposed pipe faces after facing and surface preparation from blowing dust. Engineer shall have the right to shut down fusing operations if weather conditions are not suitable or if weld quality is suspect. Contractor shall not be entitled to additional compensation for any such additional testing or shut-downs; however, shut-downs required by the Engineer through no fault of the Contractor (i.e. due to weather) shall be considered excused weather delays.

1. In the event of inclement weather, a tent, shelter, or weld screen may be used to protect the fusion environment from dust, precipitation and heater plate variance. Any such enclosures must be approved by the Engineer. Engineer reserves the right to reject such enclosures and shut down operations if the enclosures do not adequately protect the pipe faces or fusion environment.

D. Protect fusible PVC at all times during handling, storage, transport, cutting and fusion from oil contamination.

1. Clean or wipe blades of facing equipment in accordance with equipment manufacturer's recommendations. Unless otherwise indicated by the manufacturer, do not use solvents for cleaning, as these can leave residues that can weaken the fusion joints and cause failures.

E. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following elements:

1. Heat Plate – Heat plates shall be in good condition with no deep gouges or scratches. Plates shall be clean and free of any debris or contamination. Heater controls shall function properly; cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's guidelines.

2. Carriage – Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.

3. General Machine – Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.

4. Data Logging Device – An approved datalogging device with the current version of the pipe supplier's recommended and compatible software shall be used. Datalogging device operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.

F. Other equipment specifically required for the fusion process shall include the following:

1. Pipe rollers shall be used for support of pipe to either side of the machine.

2. A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement, extreme temperatures, and /or windy weather, per the pipe supplier's recommendations.
3. An infrared (IR) pyrometer for checking pipe and heat plate temperatures.
4. Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.
5. Facing blades specifically designed for cutting fusible polyvinylchloride pipe shall be used.

3.7 INSTALLATION - TAPPING SLEEVES AND SADDLES

A. Install tapping sleeves and valves in accordance with Drawings and in accordance with manufacturer's instructions.

B. For dry taps, after drilling into the pipeline, remove all pipe shavings and debris from inside the pipe using a vacuum or other method approved by the Engineer.

C. Do not install tapping sleeves or saddles on fusible or restrained PVC pipe. All taps on fusible or restrained PVC main lines must use MJ reducing tees.

3.8 INSTALLATION – BOLTS

A. Apply heavy duty anti-seize to lubricate all stainless steel bolts.

B. Anti-seize compound shall be recommended by manufacturer for use with stainless steel.

3.9 INSTALLATION – STAINLESS STEEL THREADED PIPES AND APPURTENANCES

A. All threaded stainless steel pipes, valves, and fittings shall be wrapped with Teflon graphite tape and/or coated with anti-seize compound approved by manufacturer specifically for use with stainless steel threads.

3.10 THRUST RESTRAINT

A. All restrained PVC pipe joints shall consist of fusible PVC. Bell restraint harnesses are not allowed.

B. Install restrained fittings in accordance with Drawings and in accordance with manufacturer's instruction.

C. Joint restraint lengths:

1. Minimum joint restraint lengths shall be as provided in the Drawings for each appurtenance.
2. For adjacent appurtenances where the required joint restraint lengths overlap each other, refer to the Plans for total required restraint length. In the event of adjacent fitting restraints that are not noted in Plans, consult the Engineer for required restraint length.
3. Lengths of pipe not in contact with soil (i.e. inside casings) shall not be counted toward the restraint length requirement.

D. All thrust blocks shall bear against undisturbed earth.

3.11 BACKFILLING

A. In accordance with Section 31 23 23.

3.12 INSTALLATION – CORROSION PROTECTION AND MONITORING SYSTEMS

A. Design, install, energize, adjust and test sacrificial anode cathodic protection systems and corrosion monitoring stations for all buried ferrous pipe, valves and fittings within the corrosive soil zones designated on the Drawings.

B.

B. All buried ferrous pipe, whether cathodically protected or not, shall be provided with corrosion monitoring systems, consisting at a minimum of joint bonding of all non-welded joints between sections of ferrous pipe and adjacent valves and fittings, and two-cable corrosion monitoring stations. Corrosion monitoring systems shall be designed by a NACE-certified Cathodic Protection Specialist.

1. Buried ferrous valves that are not connected to ferrous pipe and that are not located within corrosive soil zones, do not require corrosion monitoring, provided such valves and fittings are coated with fusion bonded-epoxy.

2. Ferrous pipe sections at drain outfalls which are connected to PVC pipe do not require corrosion monitoring.

C. Bury cable to a minimum depth of 36 inches. Install without kinks, stresses, defects, nicks or splices. Install any above grade cables in rigid galvanized steel conduit.

D. Bury warning tape approximately 12 inches above cable for the entire length of cable.

E. Connect cables to test station with crimped, ring-tongue connectors. Identify the origin of all cables terminating in test stations or anode boxes with labels encased in shrink wrap tubing.

F. Install anodes at depth and distance from protected structure in accordance with design provided by NACE-certified designer. Bed anodes in compacted native soil and soak with water. Do not soak with water until after bedding of the anode and compaction of the soil.

G. Joint bonds:

1. Provide metallurgical bonds at non-welded joints between pipe sections, valves or other ferrous components.

2. Minimum of two bonds per joint.

3. Allow for total joint displacement of ½ inch.

H. Welds:

1. Prepare surfaces and perform thermite “cad” welds in accordance with NACE-certified designer’s and manufacturer’s instructions.

2. Connections shall be placed a minimum of 3 inches apart. Unsuccessful welds shall be abandoned, with original coating repaired, and moved to another prepared surface not less than 3 inches away.

3. Test by striking side of weld nugget with 16-ounce hammer.

4. Coat any bare copper, weld nugget or ferrous material with at least 8 mils of bituminous industrial grade primer. Allow coating to cure before repairing any damaged coatings.
5. Apply thermite weld caps to finished welds.
6. Repair any damaged coatings to original condition.

I. Test Stations:

1. Install at all cathodically protected steel piping, valves and fittings.
2. Terminate all cables for a given location within the same test station enclosure.
3. Identify all cables as to the originating pipe or structure.
4. Contain minimum of three cables for carrying current from the anode, carrying current to protected structure and monitoring soil-to-structure potential.
5. For single anode installations, connect individual anodes to structure through calibrated shunts.
6. For multiple anode installations, a cable between the test station and an anode junction box may be used to connect the anode to the structure.
    a. Connect individual anodes to structures through individual calibrated shunts within junction boxes for current measurement.
    b. Install individual variable resistors in series with these calibrated shunts.
    c. Install junction boxes adjacent to and below test stations where required
7. Install flush-to-grade test stations flush to finished grade with 24”x24”x6” reinforced concrete collars, etched with “CP test station”.
8. Mount anode terminal boxes to inside wall of structures.

J. Electrically isolate all cathodically protected structures from rebar or other non-protected and extraneous metal.

3.13 PIPELINE RIGHT-OF-WAY GRADING

A. Establish finished grade to provide a minimum of four (4) foot of cover over the pipe. Measure depth of cover from final surface grade to top of pipe barrel.

1. At certain locations such as wash crossings, road crossings, utility line crossings or to prevent high points, the Drawings indicate greater than 4 ft minimum cover. At such locations, Contractor shall maintain the site-specific minimum cover.

B. Do not place fill material or raise the finished grade above existing grade in the flow lines of washes or surface water drainages, regardless of size.

C. Finished grade along pipeline right-of-way and temporary construction easement shall have a maximum longitudinal slope of 4:1 and maximum side slope of 4:1, unless otherwise noted on Drawings.

D. The pipeline right-of-way shall be leveled from side-to-side to slow down surface run-off from causing erosion rills perpendicular to the pipeline, as well as to make the ROW accessible to the Owner for future maintenance.

1. The entire right-of-way shall be re-seeded and reclaimed after construction. Do not build any new roads. Refer to Section 32 92 19 – Seeding for re-seeding requirements.
2. The right-of-way shall not be open to the general public and shall have minimal impact on the environment. Upon completion of construction, the right-of-way shall be reclaimed to visually blend in with the surrounding environment and minimize its visual impact.

E. All construction activities, including clearing and grading, must remain within the designated right-of-way and temporary construction easement. Do not encroach on adjacent properties or culturally sensitive areas.

F. Final acceptance of ROW grading and restoration on Bureau of Land Management (BLM) lands shall be subject to approval by BLM.

3.14 TAPPING EXISTING WATER DISTRIBUTION FACILITIES

A. Obtain permission to tap from the Navajo Tribal Utility Authority (NTUA). A blank Permission to Tap application form is provided in Appendix F. Contractor shall not connect to existing system without written permission from NTUA and the Engineer to proceed with connection to the existing system.

B. Coordinate with NTUA's designated representative regarding schedule, means and methods, maximum allowable shut-off time, water usage rates (both gpm and gpd) and other parameters stipulated by NTUA.

C. Contractor is advised that a Water Use Permit from Navajo Nation Water Code Administration is required for use of the NTUA water. Contact Wayne Williams at (928) 729 – 4132 or wwilliamsjr@navajo-nsn.gov for more information.

D. Perform all work in conformance with the tapping permit and all written and verbal instructions from NTUA personnel, including notification and coordination with NTUA, maximum water usage rates, time and duration of shut-offs, and disinfection requirements.

E. Minimize shut-off time during connections to existing facilities. Contractor shall have all tools and materials for actual field conditions as well as foreseeable problems on hand in order to minimize shut-off time.

F. Floor penetrations on existing tanks:

1. Shall be performed dry. Contractor shall drain tank prior to tapping.
2. Grind and dress the welds.
3. Remove all existing paint damaged during the cutting and welding process by blasting to bare metal (same surface preparation standard as specified for new tank coatings).
4. Recoat the damaged areas to match original coating. No bare metal shall be left in contact with water.
5. Contractor shall compact disturbed sub-foundation and fill underneath and within 5 feet of the tank to 95% standard proctor and shall perform necessary testing to ensure adequate compaction.

6. Tanks shall be disinfected and bacti tested after tapping prior to putting tanks back in service.

7. Contractor shall take necessary measures to prevent interruption of service to existing NTUA customers during tapping, including provision of temporary tanks as needed.

G. Taps on existing NTUA pipelines shall be by cut-in tees, with NTUA's approval. Wet taps shall not be permitted.

H. Prevent contamination of existing facilities with trench water, mud, debris, chemicals or other substances.

I. All new materials shall be thoroughly cleaned and disinfected with a strong (200 ppm) chlorine solution prior to connecting to existing NTUA facilities.

3.15 INITIAL FILLING OF PIPELINE

A. "Initial filling" refers to first introduction of water and evacuation of air in the pipeline.

B. Initial filling of pipeline shall not exceed maximum instantaneous flow rate (in gpm) or maximum daily fill rate (in gpd) set forth by NTUA and the Engineer in the field.

C. Unless otherwise directed by the Engineer, the maximum allowable instantaneous flow rate shall be 450 gpm. Note that actual allowable maximum fill rate based on availability of water from NTUA's existing facilities may be significantly less than this amount. Contractor shall schedule sufficient time for filling and flushing to account for actual water availability from NTUA.

3.16 DISINFECTION OF POTABLE WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.17 FIELD QUALITY CONTROL

A. Section 01 00 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.

B. The Contractor shall be required to hydrostatic pressure test all water mains, appurtenances and plumbing trains.

1. Perform testing in accordance with applicable standards:

a. PVC pipe: Simultaneous hydrostatic pressure and leakage test. The system shall be pressure tested in accordance with AWWA C605 and M23, with the exceptions noted below:

1) Test pressure: In accordance with test pressure summary table provided as Appendix to Contract Documents.

2) In no case shall the test pressure exceed the manufacturers' recommended maximum safe test pressure for the pipe, fittings or appurtenances.

3) Test duration: 2 hours minimum.

a) Engineer may require longer duration test (up to 24 hours) if there is any doubt as to integrity of a particular section of pipe or appurtenances.

b. Ductile iron pipe: AWWA C600

c. Steel pipe: AWWA C200

2. Hydrostatic pressure testing of main line shall be performed in sections between each pair of adjacent butterfly valves. Do not skip any butterfly valves in delineating test sections, without express written permission by Engineer.

3. No observable leakage is allowed. Measurable leakage must be within the maximum allowable limits set forth by applicable AWWA and ASTM standards.

4. Any leaks detected during testing shall be repaired. After repairs are completed, another full duration test shall be performed on the section of the pipeline to which the repairs were made.

5. All air must be vented from the pipeline prior to pressurization.

6. The pipeline must be fully restrained prior to pressurization, including permanently installed items and any temporary appurtenances used for testing.

7. All hydrostatic pressure tests must be witnessed by NTUA personnel. Contractor is responsible for coordination of testing schedule with NTUA to allow NTUA's representative to be present.

C. Qualifications of fusible PVC fusion personnel:

1. All fusion technicians shall be fully qualified by the pipe supplier to install fusible polyvinylchloride pipe of the type(s) and size(s) being used. Qualification shall be current as of the actual date of fusion performance on the project.

2. The entity certifying an operator's qualifications shall retain the ability to revoke an operator's qualification if it is determined that there is a specific reason to question the operator's ability to make joints that meet project specifications.

D. Fusible PVC pipe fusion monitoring and recording:

1. All fusible PVC pipe fusion machines shall be equipped with data loggers connected to the fusion machine to record, at a minimum, joint temperature, pressure, time, and any other parameters required by the pipe supplier.

2. Data loggers shall be used during all joint fusions.

3. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of fusible polyvinyl chloride pipe. The software shall register and/or record the parameters required by the pipe supplier and these specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.

4. Provide fusion documentation to the Engineer. Documentation shall contain, at a minimum, the following information for every individual fusion:

a. Data logger device reports

b. Pipe Size and Thickness

c. Machine Size

d. Fusion Technician Identification

e. Job Identification

f. Fusion Joint Number

g. Fusion, Heating, and Drag Pressure Settings

h. Heat Plate Temperature

i. Time Stamp

j. Heating and Cool Down Time of Fusion

k. Ambient Temperature

5. Contractor shall submit fusion documentation to the Engineer at least weekly while pipe fusing is taking place. Contractor shall not bury any fused pipe until the documentation on the fusion has been reviewed and approved by the Engineer.

   a. Any fusion that is buried prior to Engineer's review and is subsequently rejected shall be removed at Contractor's sole expense.

   b. All fusion documentation shall be reviewed and approved by the pipe supplier's quality assurance manager prior to, or concurrent with, submittal to the Engineer.

E. Fusion Quality Testing on fusible PVC pipe: The Contractor shall verify field fusion quality by making and testing a trial fusion as follows:

1. Frequency: Minimum of one trial fusion with destructive test per crew or per fusion machine, whichever is greater, prior to starting production. Changes in weather, including increase in wind velocity or blowing dust, precipitation events or severe changes in temperature, changes to fusion machine, or changes in fusion personnel may require additional tests, up to a maximum of 5% of welds, at the discretion of the Engineer.

2. Procedure: The trial fusion shall be allowed to cool completely; then test coupons shall be cut out and tested in using the Standard Test Method for Tensile Properties of Plastics in accordance with ASTM D638, with the following modification: The sample coupon shall be the full wall and fusion bead thickness, rather than be machined down to the maximum thickness specified by ASTM D638..

   a. For convenience, Contractor may use other, non-ASTM field tests to gather immediate general information regarding weld quality; however, such tests shall not replace the ASTM D638 test. Only the ASTM D638 test shall be used by the Engineer as a basis of whether to accept or reject any destructively tested fusion joints.

F. Rejection of fusible PVC fusion joints:

1. Engineer reserves the right to reject, or require destructive testing on, any joint that does not meet pipe supplier's recommended fusion parameters, as evidenced by the fusion machine data log.

2. Engineer reserves the right to reject, or require destructive testing on, any joint for which adequate fusion data is not available to verify that the fusion was performed properly.

3. If any tested joint fails the laboratory test, all field fusions represented by that joint shall be rejected.

    a. Any joint that exhibits a yield point lower than that of the unfused pipe or that fails in a brittle mode shall be considered to have failed the tensile impact test.

4. The Contractor shall make all necessary corrections to equipment, set-up, operation, and fusion procedure, and shall re-make the rejected fusions, at no additional cost to the Owner.

5. In the event that a rejected joint is already installed, the Contractor shall remove, re-fuse, and re-install all pipe represented by that joint at no additional cost to the Owner.

G. Testing of field welds on steel pipe and fittings shall be by ultrasonic or radiographic method in accordance with AWS D1.1.

1. The Engineer reserves the right to demand evidence of welder's certification for all personnel performing field welding of steel pipe and fittings.

H. Thermal contraction and expansion of fusible PVC pipe:

1. Engineer reserves the right to unbolt any flange or mechanical joint attached to fusible PVC pipe (including all butterfly valve assemblies) to check for tensile or compressive loading due to thermal contraction or expansion of the fusible PVC pipe. Excessive tension, indicated by pull-back of the fusible PVC end, or excessive compression of the flange shall be cause for the Contractor to excavate the fusible pipe, lengthen or shorten the pipe as necessary, and re-bury. Refer to Section 33 12 16 – Water Utility Valves.

I. Compaction Testing: Refer to Section 31 23 23 – Backfill.

J. Testing of cathodic protection systems in accordance with NACE SP-0169. Provide report on test methods utilized and results of tests conducted, as well as as-built drawings with list of anode locations.

K. Test electrical isolation kits for cathodic protection isolation using radio frequency isolation test device both prior to burial and after burial. Test in the presence of the Engineer.

L. When tests indicate Work does not meet specified requirements, remove Work, replace and retest at no additional cost to the Owner.

3.18 TOLERANCES

A. Line and grade surveying tolerances:

1. See Section 02 21 13 – Surveying.

2. Flange alignment tolerances as specified in AWWA C207 and AWWA M11.

END OF SECTION

SECTION 33 12 15

WATER SURGE CONTROL TANKS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnishing of all equipment, materials, and labor to provide, install and test horizontal bladder-type surge tanks for potable water surge control as shown on the Drawings and specified in these Contract Documents.

B. Related Sections:

1. Section 26 27 34 – Surge Tank Building Instrumentation and Control Requirements
2. Section 33 11 13 - Public Water Transmission Systems.
3. Section 33 12 16 - Water Utility Valves.
4. Section 33 13 00 - Disinfection of Water Utility Transmission Systems.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Surge Tanks:

1. Basis of Measurement: By the unit.
2. Basis of Payment: Includes connection to main line, surge tank, supports, anchor bolts, structure, electrical connections and appurtenances, rubber expansion joints, fittings and accessories.

1.3 REFERENCES

A. American Society of Mechanical Engineers (ASME):

1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

B. American Society for Testing and Materials International (ASTM):

1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
4. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft3 (2,700 kN-m/m3)).

C. American Water Works Association (AWWA):

1. AWWA C104 - ANSI Standard for Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

2. AWWA C110 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In. (76 mm through 1,219 mm), for Water.
3. AWWA C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C115 - ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
5. AWWA C151 - ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
6. AWWA C153 - ANSI Standard for Ductile-Iron Compact Fittings for Water Service.
7. AWWA C200 - Steel Water Pipe 6 In. (150 mm) and Larger.
8. AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. and Larger - Shop Applied.
9. AWWA C206 - Field Welding of Steel Water Pipe.
10. AWWA C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 In. through 144 In. (100 mm through 3,600 mm).
11. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
12. AWWA C209 – Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections and Fittings for Steel Water Pipelines
13. AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
14. AWWA C600 - Installation of Ductile-Iron Water Mains and their Appurtenances.
15. AWWA C605 - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water.
16. AWWA C606 - Grooved and Shouldered Joints.

D. Manufacturer’s Standardization Society of the Valve and Fittings Industry:

1. MSS SP-60 - Connecting Flange Joint between Tapping Sleeves and Tapping Valves.

E. National Fire Protection Agency

1. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

1.4 SUBMITTALS

A. Section 01 00 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, and accessories.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

D. Layout drawings shall be submitted and include the dimensions of all equipment, accessories, supports, connections, outlets, and all related piping.

E. Equipment weights and anchor bolt designs.

F. Manufacturer shall perform transient surge analysis and provide a complete report in the submittal package. Report details shall include maximum upsurge and downsurge transient pressures as well as required vessel precharge pressures. In no case shall the maximum upsurge pressure exceed 235 psi at the surge tank inlet, nor more than 265 psi at the highest pressure point along the pipeline. In no case shall the minimum downsurge pressure be less than 5 psi anywhere along the pipeline.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with the most recent edition of New Mexico Standard Specifications for Public Works Construction, with latest revisions.

B. Surge Tanks:

1. The manufacturer of the surge tanks shall be ISO-9001 certified. Vessel manufacturer shall manufacture their own vessels and bladders within the same plant as per quality control through ISO.

2. Manufacturer shall provide in-house x-rays of welds if required by ASME Code. The Engineer reserves the right to inspect the vessel manufacturing facility to confirm requirement above.

PART 2 PRODUCTS

2.1 SURGE TANKS

A. Manufacturers:

1. Charlatte America, Model HCA 5283G 250PD/375PT-H

2. Substitutions: Not permitted.

B. The tank shall be a horizontal, bladder-type vessel suitable for use with potable water.

C. The sizing and location of the surge bladder tanks shall be as indicated on the Drawings.

D. Structural Design and Supports shall include the tank, supports, and anchor bolts shall be designed based upon local building codes in addition to the following criteria:

1. Design for a hydrostatic operating pressure of 250 psi and a test pressure of 375 psi with no reactive load permitted through the inlet/outlet piping.

2. Support tank by support legs (four minimum) for attaching to a concrete floor or slab. Material of construction shall comply with ASTM A36 or ASTM A285, Grade C. Weld the support legs to the tank.

3. Seismic Design Parameters to conform to the current IBC for the site location.

E. Surge Tank Design and Materials:

1. Materials for the tank, design, and shop fabrication and inspection shall comply with Section VIII, Division 1, of the ASME Boiler and Pressure Vessel Code

with only the plate steels in Table UCS-23 of said code being used. Provide ASME code stamp, National Board Registration number and pressure rating on tank.

2. Minimum design pressure shall be as stated in this section of the Specifications. Perform hydrostatic testing in shop. Test pressure shall be 150% of the design pressure of the tank.

3. The surge tank, bladder and manufacturing facility shall be NFS-61 approved for potable water and listed with NFS.

4. Complete anchor bolt assembly (studs, nuts, washers, etc.) to be provided by Contractor.

5. Bladders and replacement bladders shall be manufactured in the tank manufacturers' plant. Tanks/Vessels shall be fabricated by listed manufacturer, not contracted out.

6. Provide a 1/2 inch threaded connection at the top of the tank to contain a gas charging valve and pressure gauge. Tank shell will be constructed of deep drawn carbon steel double sub-arc welded domes and side shells with double welded seams. Tank shall be equipped with a food grade, heavy duty butyl rubber bladder. The precharge pressure will be located between the shell of the tank and the bladder. The side manhole shall be removable to allow inspection and maintenance of the bladder. The bladder shall be sized to conform to the inner shape of the vessel. Bladder tank shall be of the horizontal configuration.

7. Bladder tank shall be National Board approved with ASME Liquid Relief Valve set at 10% above the operating pressure. Relief valve to be installed on a ½" NPT side outlet at the bottom of the vessel.

8. Stainless steel magnetic level gauge. No glass level indicators shall be allowed. Level gauge shall be supplied with manual isolation ball valves on the air side & water side connections as well as the drain. In addition, 120 vac solenoid valves shall be provided at all three locations on each tank. A solenoid timer control panel shall be provided and field wired by the Contractor to each of the three solenoid valves. All wiring shall be overhead; do not create any tripping hazards. Timer shall have a single green button which when depressed will start an automatic timing sequence to open the air & water connection solenoid valves for an adjustable period of time to allow the magnetic float to reach a steady state level. Then the air & water connection solenoid valves will be closed and a green light indicating the reading is ready shall be illuminated. Finally, the drain solenoid valve shall open to empty the level gauge.

9. One differential pressure transducer shall be provided for each tank and shall be Rosemount Model 3051L/1199 2" ANSI Class 150, 316 SST flange mounted with silicone filled capillary tube and ½" NPT connection for vessel air side mounting on top. Also included shall be a 2" stainless steel ball valve for isolation and stainless steel flange bolt kits with 1/8" red rubber gasket.

    a. 4-20mA transmitter output.

    b. -250 to 250 inH_20 transmitter pressure range, field calibrated to tank low and high levels.

c. Provided with LCD display.

10. Proco model EJ231HP/BB high pressure expansion joint, 14" diameter, 8" neutral compression length, shall be supplied with the vessel. Expansion joint assembly shall be manufactured of butyl rubber and include retaining rings and control rods all rated to 200 psi working pressure. Expansion joints will be mounted directly to vessel outlet flange and shall be sized accordingly. Mounting bolt heads shall be towards the center of the expansion joint with threaded end facing the ends to prevent contact between bolt and joint during pressurization.

11. An additional 2" ANSI Class 150 flanged connection shall be provided as a side outlet for tank drain. Also provided shall be another 2" stainless steel ball valve for isolation with blind flange and stainless steel flange bolt kits with 1/8" red rubber gasket.

F. Service Conditions:

1. Tank hydraulic performance conditions and design data shall be as shown below. In the event that the manufacturer's hydraulic analysis of the system yields varying design requirements, the Engineer must be contacted prior to tank fabrication.

a. Surge Tank:

1)	Tank Configuration:	Horizontal
2)	Minimum Capacity:	5283 Gallons
3)	Diameter	83 inch (approx.)
4)	Overall Length	250 inch (approx.)
5)	Minimum Operating Pressure:	250 psi
6)	Minimum Test Pressure:	375 psi
7)	Bladder Material:	Food Quality Butyl Rubber
8)	Precharge Pressure Setting:	Based on Analysis, to be provided by manufacturer as part of material submittal
9)	Outlet Flange Size:	14 inch
10)	Outlet Pressure Rating:	Class 150 per ANSI B16.5
11)	Minimum Manhole Size:	24 inch

G. Painting and Coating:

1. All painting and coating shall be completed at the factory. Field painting and coating will not be accepted. The tank interior shall be painted with an NSF 61 epoxy paint with a uniform layer thickness of no less than 6 mils. The tank exterior shall be painted with anti-corrosion polyurethane and shall have a uniform layer with a minimum thickness of 10 mils.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 00 00 - Administrative Requirements: Verification of existing conditions before starting work.

3.2 INSTALLATION - SURGE TANKS

A. Contractor shall coordinate with surge tank supplier and make measurements of actual surge tank dimensions and pipe connection locations prior to constructing foundation or installing yard pipe risers. Contractor is wholly responsible to align foundations, piping and any other connections with surge tanks in the field.

B. The tank shall be installed in accordance with the manufacturer's recommended procedures.

C. Proco joint compression shall be within manufacturer's recommended tolerances.

1. Do not allow bolts to make contact with rubber joint.

2. Mounting bolt heads shall be towards the center of the expansion joint with threaded end facing the ends to prevent contact between bolt and joint during pressurization.

3. Field verify laying length and control bolt lengths before foundation construction.

D. Pre-charge of tanks shall be performed by an authorized factory representative or employee of the manufacturer.

3.3 DISINFECTION OF POTABLE WATER PIPING SYSTEM (BY CONTRACTOR)

A. Flush and disinfect system in accordance with Section 33 13 00.

3.4 START-UP SERVICES

A. Provide at least one full 8-hour day of service from manufacturer's representative to approve the tank installation and advise the Contractor during startup, testing, and final adjustment of each tank. In addition to this day, one additional full 8-hour day shall be provided in a separate trip to instruct the Owner's personnel in the operation and maintenance of the tank system.

B. Contractor shall coordinate with both surge tank manufacturer's representative and pump station manufacturer's representative to schedule start-up, and allow for simultaneous start-up and testing of both pieces of equipment.

C. Perform quality control testing, as described below, during start-up.

3.5 FIELD QUALITY CONTROL

A. Verify pre-charge, static, and dynamic working pressures are all within manufacturer's recommended ranges

1. Dynamic working pressures must be tested during pump station startup, with pumps running.

B. Verify tank water levels under static, dynamic, and transient conditions are all within manufacturer's recommended ranges

1. Transient water levels shall be tested during pump station start-up by running pumps to full operating speed and performing an emergency sudden shut-down to simulate pump power failure. Surge tank water levels shall not exceed manufacturer's recommended ranges under these conditions.

C. Test all water level indicators, gauges, and pressure transducers.

D. Test all air lines and fittings for leaks.

END OF SECTION

SECTION 33 12 16

WATER UTILITY VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gate Valves.
2. Ball Valves.
3. Butterfly Valves.
4. Orifice Plates.
5. Rate of Flow Control Valves
6. Air Valves.
7. Dismantling Joints
8. Flush Valve Assemblies.
9. Valve boxes.
10. Meter cans.
11. Pipe Supports
12. Valve vaults.
13. Accessories.
14. Corrosion Protection.

B. Related Sections:

1. Section 03 30 00 - Cast-in-Place Concrete.
2. Section 26 27 34 – Surge Tank Building Instrumentation and Control Requirements
3. Section 31 22 13 - Rough Grading.
4. Section 31 23 23 - Backfill.
5. Section 33 11 13 - Public Water Transmission Systems.
6. Section 33 13 00 - Disinfection of Water Utility Transmission Systems.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Vacuum Breaker and Air Valve Assemblies:

1. Basis of Measurement: Each.
2. Basis of Payment: Includes excavation, vacuum breaker / air valve assembly, concrete vault with ladder, cover and hatch, fittings, accessories and backfill.

B. Gate Valve Assemblies:

1. Basis of Measurement: Each.

2. Basis of Payment: Includes excavation, valve, valve box, valve riser and collar, meter can (where applicable), accessories, tests, and backfill.

C. Flush Valve Assemblies:

1. Basis of Measurement: Each.

2. Basis of Payment: Includes excavation, 4-inch piping, 4-inch gate valve or ball valve assembly as shown on plans, drain line or outlet pipe, orifice plate, rubber check valve (where applicable), outfall structure (where applicable), fittings, meter can and riser (where applicable), accessories and backfill.

D. Cathodic Protection:

1. Refer to Section 33 11 13

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO M 306-10 - Standard Specification for Drainage, Sewer, Utility and Related Castings

B. ASTM International (ASTM)

1. ASTM A48 – Standard Specification for Gray Iron Castings

2. ASTM A126 – Standard Specification for Gray iron Castings for Valves, Flanges, and Pipe Fittings

3. ASTM A536 – Standard Specification for Ductile Iron Castings

4. ASTM A564 – Standard Specification for Hot Rolled and Cold Finished Age Hardening Stainless Steel Bars and Shapes

5. ASTM B62 – Standard Specification for Composition Bronze or Ounce Metal Castings

6. ASTM B148 – Standard Specification for Aluminum Bronze Sand Castings

7. ASTM C478 – Precast Reinforced Concrete Manhole Sections

8. ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

9. ASTM F594 – Standard Specification for Stainless Steel Nuts.

10. ASTM A312 – Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipe

11. ASTM D3363 – Standard Test Method for Film Hardness by Pencil Test

12. ASTM D4752 – Standard Practice for Measuring MEK Resistance of Ethyl Silicate Zinc Rich Primers by Solvent Rub

13. ASTM D638 – Standard Test Method for Tensile Properties of Plastics

C. American Water Works Association (AWWA):

1. AWWA C207 – Standard for Steel Pipe Flanges for Waterworks Service
2. AWWA C504 – Rubber-Seated Butterfly Valves
3. AWWA C508 – Swing-Check Valves for Waterworks Service, 2- through 24-in.
4. AWWA C509 - Resilient-Seated Gate Valves for Water-Supply Service.
5. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
6. AWWA C605 - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water.
7. AWWA M11 – Steel Pipe: A Guide for Design and Installation
8. AWWA M23 – PVC Pipe – Design and Installation

D. American National Standards Institute

1. ANSI B16.1 Gray iron Pipe Flanges and Flanged Fittings

E. NACE International (NACE)

1. SP0274 – High-Voltage Electrical Inspection of Pipeline Coatings Prior to Installation.

F. NSF International/ American National Standard (ANSI):

1. NSF/ANSI Standard 61 - Drinking Water Components - Health Effects.

G. Manufacturers Standardization Society

1. MSS SP-67 Butterfly Valves

H. Society for Protective Coatings:

1. SSPC-SP1 – Solvent Cleaning
2. SSPC-SP2 – Hand Tool Cleaning

1.4 SUBMITTALS

A. Design Data: Submit manufacturer's latest published literature. Include illustrations, installation instructions, maintenance instructions and parts lists.

B. Manufacturer’s Certificates: Submit Statement of Compliance, supporting data, from material suppliers attesting that valves and accessories provided meet or exceed AWWA Standards and specification requirements.

C. Submit proofs on all signs, placards, and tags prior to fabrication.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves.

B. Provide Operation and Maintenance Data for each type of valve installed.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with applicable New Mexico Standards and the National Fire Protection Act (NFPA).

B. Valves: Mark valve body with manufacturer's name and pressure rating.

1.7 DELIVERY, STORAGE AND HANDLING

A. Prepare valves and accessories for shipment according to AWWA Standards and seal valve ends to prevent entry of foreign matter into product body.

B. Deliver and store valves in shipping containers with labeling in place.

C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior and exterior surfaces.

D. Coated valves and appurtenances shall be shipped on bunks and secured with nylon belt tie down straps or padded banding over braces, and shall be stored on padded skids or other suitable means to prevent damage to coatings.

E. Coated valves shall be handled with wide belt slings, padded forks or other means to prevent damage to coatings. Chains, cables or other equipment likely to damage coatings or valves shall not be used.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

1.9 MAINTENANCE MATERIALS

A. Furnish two (2) tee wrenches to Owner (required length) for each valve type.

PART 2 PRODUCTS

2.1 GENERAL

A. All valves shall be American made, unless otherwise specified.

B. All non-stainless steel and iron valves and appurtenances shall be fusion bonded epoxy coated, interior and exterior, conforming to AWWA C550 and NSF 61.

C. All valves and coatings shall be NSF 61-certified.

D. All bolts, nuts, and washers (where required) shall be stainless steel 304, unless otherwise specified, and shall be provided by the valve or fitting manufacturer especially for use with their respective valves or fittings. If manufacturer cannot supply stainless steel bolts for the MJ or flange connection, Contractor may provide bolts from another source; however, Contractor is solely responsible to ensure fit and compatibility of said bolts.

2.2 RESILIENT WEDGE GATE VALVES

A. Manufacturers:

1. Mueller Company

a. A-2361

2. Substitutions: Approved Equal

B. Resilient Wedge Gate Valves: AWWA C515, NSF 61, American-made; iron body, bronze or ductile iron.

1. Resilient seats.

2. Stem: Non-rising bronze stem.

3. Operating Nut: Square; open counterclockwise unless otherwise indicated.

4. Gearing

a. Bevel geared for horizontal installation.

b. Spur geared for vertical installation.

5. Valve Ends:

a. Mechanical joint or flanged, as indicated on Drawings.

b. Flanged ends shall be drilled in accordance with ANSI Class 125/150 bolt pattern.

c. Pressure rating not less than that of valve body.

6. Working pressure rating: 350 psi.

7. Pressure testing: Seat test – 525psi for 15 seconds, test seat from each side of valve separately per UL262. Shell test pressure: 700 psi.

8. Inside and outside of valve fully coated with Fusion Bonded Epoxy, 10 mils nominal, conforming to AWWA C550 and NSF 61 requirements.

C. Where waterline is buried at a depth greater than 4 feet, provide valve stem extensions, complete with extension stem stabilizers, until depth of extension nut matches depth of operating nuts on valves installed at four-foot depth.

2.3 BALL VALVES

A. Stainless steel ball valves for air and vacuum breaker valve assemblies

1. May be imported or domestic

2. Manufacturers:

a. Milwaukee Valve.

b. Apollo

c. Red White Valve Corp.

d. Stockham

3. Working Pressure: Not less than 350 psi

4. Inlet/Outlet: As shown on Drawings
5. All stainless steel construction, including body, tailpiece, ball, ball retainer, stem, handle, handle nut, packing nut, and lock washer
6. Valve shall be actuated manually using lever-type handle, one-quarter turn to open and close. Handle length and range of motion shall allow handle to be located in most accessible location without interference with any other object.

2.4 BUTTERFLY VALVES

A. Manufacturers:
   1. Henry Pratt Co.
      a. HP250II
   2. Val-Matic Valve and Manufacturing Corporation
      a. Series 2400
   3. Substitutions: Not permitted.

B. 250 psi Butterfly Valves:
   1. Conforming to AWWA C504, Pressure class AWWA 250B, MSS SP 67 and NSF 61.
   2. Rated to 250 psi full differential working pressure.
   3. Shell test pressure 500 psi.
   4. Leak test at 250 psi.
   5. Body: Ductile iron ASTM A536 Grade 65-45-12, drilled in accordance with ANSI B16.1 Class 125, stainless steel stem, extended neck. Body wall thickness shall be in accordance with AWWA C504.

C. Valve Ends:
   1. Mechanical joint or flanged, as indicated on Drawings.
   2. Flanged ends shall be drilled in accordance with ANSI Class 125/150 bolt pattern.
   3. Pressure rating not less than that of valve body.

D. Disc: Epoxy-coated cast iron, with stainless steel 316 edge.

E. Seat: Resilient Buna N.

F. Shafts: Shall be sized, designed and constructed in conformance with AWWA C504 for pressure class AWWA 250B. Shafts shall be SS ASTM A-564 Type 630 Condition H-1150 (17-4).

G. Handle and Operator:
   1. Plant service actuator with handwheel.
      a. Manufacturer & model: AUMA GS100.3, OAE
      b. Size: 126:1 reduction ratio. Fully closes valve in 31 turns of handwheel.

2. Handwheel maximum rim pull shall not exceed 80 lbs.

3. Manual actuators shall conform to AWWA C504 for pressure class AWWA 250B.

4. Actuators shall be self-locking type able to hold valve in any intermediate position without fluttering or creeping. Actuators shall have external travel stops for open and closed position adjustment. Internal stops which require actuator cover and grease removal shall not be used.

5. Actuators shall have mechanical position stops able withstand 450 ft-lbs of input torque.

6. Open left, close right.

7. Limit switch

   a. Westlock Limit Switch Model 2007.

   b. Switch shall change state when valve is 100% open.

2.5 ORIFICE PLATES

A. Stainless steel 304

B. Thickness 3/8” or as shown on plans

C. Orifice shall be beveled 1/8” deep on upstream side.

D. Fabrication:

1. Flush Valve Orifice Plates: Orifice plates shall be fabricated and drilled with a single concentric hole of the proper diameter for each installation as indicated on the Drawings. Both faces of the plate shall be machined smooth to remove all burrs, ridges and other imperfection in the flow area. Mating edges shall be machined to the same tolerances as flange mating faces (see Section 33 11 13). The orifice holes shall be machined to a tolerance of +/- 15 mils.

2.6 RATE OF FLOW CONTROL VALVES

A. Manufacturers:

1. Singer Valve, Rate of Flow Control Valve, Model 106-RF-X142-G

2. Substitutions: Approved Equal.

B. Working Pressure: at least 150 psi

C. Valve ends: Flanged, drilled in accordance with ANSI Class 125/150 bolt pattern, rated to at least 150 psi working pressure.

D. Globe Style valve with single rolling diaphragm configuration.

E. Body and bonnet shall be constructed of ductile iron conforming to ASTM A536 Grade 65-45-12.

F. The main valve internal and external fasteners: bolts, nuts, studs, cap screws and washers shall be supplied as 304 Stainless Steel.

G. The main valve elastomers: diaphragm, resilient disc and seals, shall be of Buna-N.

H. Design flow range: 840 to 966 gpm.

I. Internal and external coatings shall be fusion bonded epoxy conforming to AWWA C550 and NSF-61 requirements.

1. Minimum 8 mils DFT

2. Color: Blue

J. Main Valve Accessories

1. Visual Position Indicator- The control valve shall be supplied with a Singer Model X142-SS Dry Position Indicator, OAE, that does not leak water if the glass breaks. The valve position indicator shall provide a visual reference to the main valve open position. The limit switch actuator stem shall be threaded or pinned to the main valve stem.

2. Pressure Gauges- Main valve shall be supplied with 0 - 200 psi pressure gauges on inlet and outlet sides.

K. Rate of Flow Control Pilot

1. The pilot shall be a normally open Singer Model 160-RF (OAE) Pilot that remains open when the differential pressure is below the pilot setting allowing water to leave the bonnet and the main valve to open.

a. The pilot shall have a spring to adjust the pressure setting.

b. The adjustable pilot spring range shall be supplied as 3 to 12psi.

c. Pilot set-point shall be factory preset to 5 psi, corresponding to rate of flow of 966 gpm.

d. The pilot shall be self-cleaning and self-flushing with the outlet of the pilot located at the bottom of the pilot flow with the pilot stem and guide free from any debris build-up.

e. The pilot trim, consisting of a seat ring, stem and inner valve shall be constructed of AISI 316 stainless steel.

f. The pilot elastomers: diaphragm, inner valve and seals, shall be of EPDM.

g. The pilot body and spring casing shall be constructed of AISI 316 stainless steel or ASTM A351 CF8M stainless steel.

2. A model 26 Flow Stabilizer/Opening Speed Control shall be supplied.

3. Orifice housing assembly

a. Stainless steel orifice plate shall have a Cv factor 432, corresponding to a pressure loss of 3.0 psi at 744 gpm and 5.0 psi at 966 gpm.

b. Sensing line connection integral to orifice housing assembly.

c. 150# flange pattern.

4. Equipped with Arion Strainer with Blowdown, Singer Model J1521 (OAE)

2.7 AIR VALVES

A. 2-inch vacuum breaker/ air release valve:

1. Manufacturer:
    a. Val-Matic Valve and Manufacturing Corporation.
    b. Model 1852AVB.3XF / 38HPSV.
    c. Dual-body Type.
    d. Substitutions: Not permitted
2. Working pressure: At least 400 psi for vacuum breaker valve and 500 psi for air release valve
3. Outlet: 2” ANSI Class 250 flanged
4. Cast iron or ductile iron body, cover and baffle; stainless steel trim, float, and fasteners.
5. Seat: Resilient Buna N.
6. Valve to perform functions of both air release and vacuum relief.
    a. Vacuum breaker orifice: 2”
    b. Air release orifice: 1/8”
        1) Air release valve to be mounted adjacent to vacuum breaker valve.
7. Stainless steel 304 piping, ball valve, and fittings between vacuum relief valve and air valve bodies.
8. Internal and external coatings shall be fusion bonded epoxy conforming to NSF-61 requirements.
9. Meshed hood required for vacuum breaker valve

B. 4-inch vacuum breaker/ air release valve:

1. Manufacturer:
    a. Val-Matic Valve and Manufacturing Corporation.
    b. Model 1804AVB.3XF / 38HPSV.
    c. Dual-body Type.
    d. Substitutions: Not permitted
2. Working pressure: At least 200 psi for vacuum breaker valve and 500 psi for air release valve
3. Outlet: 4” ANSI Class 125 flanged
4. Cast iron or ductile iron body, cover and baffle; stainless steel trim, float, and fasteners.
5. Seat: Resilient Buna N.

6. Valve to perform functions of both air release and vacuum relief.
    a. Vacuum breaker orifice: 4”
    b. Air release orifice: 1/8”
        1) Air release valve to be mounted adjacent to vacuum breaker valve.
7. Stainless steel 304 piping, ball valve, and fittings between vacuum relief valve and air valve bodies.
8. Internal and external coatings shall be fusion bonded epoxy conforming to NSF-61 requirements.
9. Meshed hood required for vacuum breaker valve

2.8 DISMANTLING JOINTS

1. Manufacturer:
    a. ROMAC, Model DJ400
    b. Substitutions: Approved Equal
2. Flanges: ANSI Class 125
3. NSF 61 Certified fusion bonded epoxy coating
4. Color: Blue
5. NBR gasket
6. Integral Tie Rods
7. 316 stainless steel fasteners
8. Working pressure: 150 psi

2.9 FLUSH VALVE ASSEMBLIES

A. Components of flush valve assembly shall be as provided elsewhere in project specifications.

B. Rubber check valves:
1. Manufacturers:
    a. Tideflex Series 35
    b. Proco Series 710
    c. Approved Equal
2. End: Flanged

2.10 VALVE BOXES

A. 12-inch diameter Valves and Smaller: Domestic cast iron, two-piece, slip type.

B. Valves larger than 12-inch diameter: Domestic cast iron, three-piece, slip type; round base.

C. Where waterline is buried at a depth greater than 4 feet, provide valve box extensions as required.

D. Cast iron lid marked “Water”.

E. Heavy duty, traffic rated.

F. Valve boxes with warning placards shall have locking lids with standard pentagon nut, which shall be installed below grade in heavy-duty traffic-rated meter cans.

G. Valve boxes without warning placards shall have non-locking lids.

2.11 METER CANS

A. Frame and cover:

1. Traffic-rated to H20 proof load of 20,000 lbs applied on a 9” x 9” steel plate in center of cover for one minute.

2. Reversible ring, ASTM A48 CL35B gray iron, undipped

a. Shall fit the 18-inch CMP meter can as specified below.

b. 15-inch minimum opening size.

3. Lid shall have non-skid machined surface with "WATER" inscribed on the top

4. Type 2 Non-penetrating pick hole

5. Lockable lid

B. Meter Can:

1. 18” inner diameter, 20 gauge corrugated metal pipe, length per detail drawing.

2. Maximum wall deflection shall not exceed $^{1}/_{8}$” at any one point when subtracted from earth pressures or forces created during backfilling.

C. Contractor responsible to ensure compatibility between corrugated metal pipe, flange, ring, and cover.

2.12 PIPE SUPPORTS

A. Manufacturer:

1. Standon, S8900 Series

2. Substitutions: Approved Equal

B. 304 stainless steel

C. Size per drawings

D. 8”x8”x3/8” thick base plate bolted to chamber floor

2.13 VALVE VAULTS

A. Concrete manhole sections conforming to ASTM C478.

1. Bell and spigot joints.

2. Symmetrical reinforcement only.

3. Soil-tight gasket conforming to ASTM C-990.
4. Embedded ladder rungs.

B. Concrete shall conform to Section 03 30 00 – Cast-in-Place Concrete.

C. Manufactured or cut to lengths shown on Drawings.

D. "Mouse hole" or circular cut-outs to accommodate main line pipe inside vaults, if needed, shall be pre-cast.

E. Pre-fabricated reinforced flat, slab-type lids with hinged, lockable hatches as shown on Drawings.

1. Shallow well manhole covers, where indicated on Drawings, shall be 24" diameter, as provided by Four Corners Precast, OAE. Steel pipe used for shallow well covers may be domestic or import.

F. Square access covers

1. Manufacturers:
   a. Halliday Products, Series W2S
   b. MSU Mississauga Ltd series MD-CL625
   c. Substitutions: None
2. Dimensions as shown on Drawings.
3. Load Rating: 300 lbs
4. Gasketed lid with channel system to divert water
5. Assisted opening with slam prevention system
6. Bituminous coating
7. Stainless Steel Hardware
8. Recessed padlock bar and lifting handle
9. Provided with factory installed insulation

G. Foam insulation.

1. 2" minimum thickness
2. Spray Foam Insulation.
   a. 2-lb closed cell, two-component, rigid polyurethane.
   b. R Value per inch of 6.6 or greater (K factor 0.15 or less).
   c. Suitable for application to low temperature substrates (15°F).
      1) 35°F rating may be used if installing during reliably warm weather.
   d. Waterproof mixture in sealant

3. Sheet insulation may be considered by the Engineer as a substitute if demonstrated to meet or exceed the properties of spray foam insulation, including resistance to moisture build up or condensation behind the insulation. The burden to demonstrate the properties of any substitute shall be borne by the Contractor.

H. Two-way draft damper

1. Manufacturers:

a. Val-Matic, Frost Safe, VM-1504

b. Substitutions: Approved Equal

2. Field replaceable disc that opens fully to provide full flow area in both directions without requiring annular clearance with the body.

3. Contains no hinges or seats subject to freezing

2.14 WARNING PLACARDS FOR GATE VALVE BOX LIDS

A. Rectangular aluminum plate with 1 7/8" pre-drilled center hole.

1. Contractor responsible to verify diameter of center hole to correspond to outer diameter of key to locking nut of lockable valve box lid.

B. Dimensions: 4½"w x 4½"h x 0.04"t

C. Print aluminum placard with high performance vinyl background and lettering.

D. White background with red and black lettering as shown on Drawings.

E. Arial font with 0.25" minimum height lettering, or as permitted by placard dimensions and pre-drilled holes.

F. Warning placards shall be affixed to lockable valve box lids with Engineer-approved two-part epoxy.

G. Submit a proof to Engineer for approval before producing placards. Proof shall include placement of placard on the valve box cover to ensure proper fit and clearances.

2.15 VALVE IDENTIFICATION TAGS (FOR VACUUM BREAKER VALVES)

A. Identification tag:

1. Photosensitive anodized aluminum tag

a. Manufacturer: Metalphoto, OAE

b. Natural aluminum color lettering with black background

c. 0.09" thick aluminum sheet

d. Includes pre-cut hole for fastener. Contractor responsible for assuring pre-cut hole is properly sized for fastener.

e. Minimum letter/font height: 0.1", or larger depending on available printing space for each tag

f. Wording as indicated on drawings.

B. Fastener:

1. Stainless Steel #6 Beaded Chain

C. Submit a proof to Engineer for approval before producing tags.

2.16 ACCESSORIES

A. Concrete for thrust restraints, blocks and collars: Concrete type specified in Section 03 30 00.

2.17 CORROSION PROTECTION

A. Refer to Section 33 11 13.

2.18 SOURCE QUALITY CONTROL

A. Coatings:

1. Cure testing for fusion bonded or liquid epoxy coatings: ASTM D4752 and ASTM D3363, Every 1000 sq. ft. of epoxy coating.

2. Holiday testing for epoxy coatings:

a. All fusion-bonded epoxy coatings on all valves shall be holiday tested prior to installation, at Contractor's expense.

b. Perform testing in accordance with NACE Standard SP0274, using electrical holiday tester. Use test voltage below:

Total Coating Thickness (Mils)	Test Voltage (Volts)
20 or less	6000
30	7500
50	9000
70	11500
80 or more	12000

c. All holidays shall be repaired and re-tested, at no additional cost to the Owner.

3. Touch up and repair of Fusion Bonded Epoxy Coatings

a. Applies to all FBE coated valves for field repair of minor holidays, scratches, breaks or other damage to FBE coating.

b. Does not include repair or touch up of systemic or large area holidays in FBE coating. Repair of systematic holidays or damaged areas larger than three (3) sq. in. will require the damaged coating be ground off and the valve be newly shop-coated.

c. Materials and application:

1) NSF/ ANSI 61 certified, two-part, 100% solids, liquid epoxy coating meeting the requirements of AWWA C210.

a) Manufacturer: 3M Scotchkote Epoxy Coating 323, OAE.

b) If temperature is below 55 degrees Fahrenheit, the metal substrate shall be pre-heated in accordance with coating manufacturer's recommendations prior to applying the coating.

d. Prepare surface and apply per coating manufacturer's instructions for use as a field repair material.

e. Prepare surface and apply per coating manufacturer's instructions for use as a field repair material.

B. Control Valves

1. Control valve manufacturer shall be ISO 9001:2008 certified in the design and manufacture of automatic control valves and related equipment.

2. The control valve shall be tested prior to shipment. The standard test shall include a functional stroke test and pressure and leak test of valve body, seat and fitted pilots and accessories.

3. The control valve shall be covered by a minimum three (3) year warranty against defects in materials and workmanship. The 316 stainless steel seat ring shall be covered by lifetime warranty.

4. All control valve maintenance and repairs shall be possible without removing the main valve body from the line, when installed in accordance with manufacturer's recommendations.

PART 3 EXECUTION

3.1 EXAMINATION

A. Determine exact location and size of valves from Drawings; obtain clarification and directions from Engineer prior to execution of work.

B. Verify invert elevations prior to excavation and installation of valves.

3.2 PREPARATION

A. Identify required lines, levels, contours and datum locations.

B. Locate, identify, and protect utilities to remain from damage.

C. Do not interrupt existing utilities without permission or without making arrangements to provide temporary utility services.

1. Notify Engineer not less than 48 hours in advance of proposed utility interruption.

2. Do not proceed without written permission from the Engineer.

D. Perform trench excavation, backfilling and compaction in accordance with Sections 31 23 17 and 31 23 23.

3.3 INSTALLATION

A. Valve scribing: All valve collars and vaults shall be scribed with the valve data.

1. Gate valve and butterfly valve collars shall be scribed neatly before the concrete has cured. If scribing of wet concrete is not possible, valve collars may be etched using a 4-inch grinder, with Engineer's approval in field.
2. Air valve vault lids shall be etched using a 4-inch grinder.
3. All valve collars and vault lids outside fenced sites ("pipeline valves") shall be etched with the following valve data:
    a. Flow direction
    b. Station number in standard "STA XXX+XX" format, including the abbreviation "STA" in front of the number
    c. Pipe size (if different from valve size) and material
    d. Valve size and type (i.e. ARV, VB, GV, BFV)
    e. Valve description for non-air valves (i.e. Transmission, By-pass, Flush)
4. All valve collars and vault lids inside fenced areas ("site valves") shall be etched with:
    a. Flow direction arrows
    b. Valve type
    c. Valve size
5. All valve collars and vault lids inside fenced areas ("site valves") shall be further labeled with a stamped 8" x 6" aluminum placard, as specified above.
    a. Follow anchor manufacturer guidelines for proper installation.
    b. Contractor responsible for verifying anchor and anchor head diameters are compatible with holes in aluminum plate.
    c. Valve identification placards shall contain the following valve data:
        1) Valve number, as provided on site valve numbering plans
        2) Valve size
        3) Valve type (i.e. BFV, GV, etc.)
        4) Description of valve function, as provided on site valve numbering plans
6. Contractor shall verify all data on the site valve numbering plans with Engineer prior to scribing of valve collars or fabrication of placards. Contractor shall be responsible for replacement of any incorrect placards or valve collars if this data is not verified by Engineer.

B. Valve box security and warning placards:

1. Affix warning placard, as specified above, to the top of valve box lid at locations indicated on Drawings.

a. Ensure placards centered within valve box lids and center hole aligned with locking nut. Do not allow corners of placard to overhang the lid.

b. Thoroughly clean and roughen surfaces to be glued (top of valve box lid and back of aluminum placard) prior to applying epoxy adhesive.

c. Apply epoxy in accordance with manufacturer's recommendations.

2. All valves indicated as requiring warning placards shall be installed below grade inside meter cans, as shown on Drawings.

C. Valve Vaults

1. Thoroughly clean vault section ends with wire brush prior to joining sections.

2. Place vault sections with bell down.

3. Seal all vault sections with sealant approved by Engineer.

4. Grout lids as directed by Engineer.

5. Field apply foam insulation in accordance with manufacturer's instructions and recommendations. Personnel applying spray foam insulation shall be sufficiently trained by the manufacturer, the Center for the Polyurethane Industry, the Spray Polyurethane Foam Alliance, or similarly competent certifying body.

D. Apply heavy duty anti-seize to lubricate all stainless steel bolts. Anti-seize compound shall be recommended by manufacturer for use with stainless steel bolts.

E. Air Valve Assemblies

1. Install in accordance with AWWA standards and manufacturer's recommendations

2. After drilling into the main line, remove all pipe cuttings and other debris with a vacuum or other method approved by the engineer prior to installing the valve assembly.

3. Install air valve assemblies in vertical position.

4. Where indicated at high points in pipe on Drawings, install at actual high points, as determined by as-built pipeline survey data.

5. Secure assemblies to Unistruts as shown on Drawings to prevent lateral movement or stresses.

6. Air valve assemblies installed on restrained or fusible PVC main line shall have FBE-coated DI reducing tees in lieu of tapping sleeves. Reducing tees located in corrosive soil zones shall be cathodically protected.

7. Galvanized steel air vents shall be painted blue as follows:

a. Minimum surface preparation: SSPC-SP1

b. Primer: 1 coat Sherwin Williams Galvite HS, OAE

1) 3.0-4.5 mils dry film thickness

c. Finish: Two coats Sherwin Williams Industrial Enamel (B54 Series), OAE

1) 2.0-4.0 mils dry film thickness

d. Follow all other paint manufacturer recommendations for preparation and application.

F. Gate Valves and Butterfly Valves:

1. Install in accordance with AWWA standards and manufacturer's recommendations

2. Install valves in conjunction with pipe laying; set valves plumb.

3. Assemble complete valve assembly and place in open excavation at proper line and grade.

4. Provide buried valves with valve boxes or meter boxes installed flush with finished grade.

a. Any valve box lids, meter can lids, or collars that do not meet grade requirements shown on Drawings shall be removed and replaced.

5. Install valve stem risers and collars, and valve box extensions as required to match finished grade.

6. Gate valves and butterfly valves shall require the same joint restraint lengths as dead-ends of similar size and pipe material.

G. Flush Valves

1. Install drain lines at constant downward slope to daylight at banks of adjacent washes, as shown on Drawings. Orient outlets of drain lines pointing upstream in the wash from the pipeline. Angle outlet to minimize scour and erosion of wash from water discharged from blow-off, as directed in field by Engineer.

2. Stations of tees and lengths of 45-degree risers shown on Plans are approximate. Contractor shall ensure outfalls of flush drain lines have minimum required clearance to riprap at wash bottoms. Contractor may adjust tee location and/or riser height, as needed, to provide minimum clearance at the outfall clearance and adequate slope and cover for drain pipe.

3. Length of 4-inch 45-degree riser pipe shall be determined in the field by Engineer, in order to allow end of drain pipe to outfall at the wash at correct elevation while maintaining required slope on the drain pipe.

4. Length of 4-inch vertical riser pipe shall be determined in the field by Engineer, in order to bring blind flange into meter can with meter can lid flush with surrounding finished grade.

5. Install splash pad/ outfall structures as directed in field by Engineer. Adjust flush pipe outlet to direct water flow into the riprap. Do not allow water stream to hit unarmored soil.

H. Assemble steel flanged joints in accordance with AWWA M11 and AWWA C207.

I. No high points in the pipe of any magnitude shall be allowed without an appropriate air valve. If the As-Built survey of the pipeline reveals high points not shown on the Drawings, Contractor shall correct the pipe grade or install additional air valves, as directed by Engineer.

1. Additional air valves required due to unforeseen field conditions not the fault of the Contractor shall be paid for at the prices established in the Bid. Contractor shall promptly report such conditions to the Engineer.

2. Additional air valves required due to high points caused through fault of the Contractor shall be provided at no additional cost to the Owner. This includes failure of Contractor to meet lines and grades set forth in the Drawings or failure to meet minimum pipe slope.

a. If the required air valve is located on a fusible or restrained section of main line, a reducing tee is required in lieu of tapping sleeve.

b. If a reducing tee is required within a corrosive soil zone, Contractor shall provide cathodic protection for the tee at no additional cost to the Owner.

3. Engineer shall determine which type of air valve is required at a given location.

J. Tracer wire:

1. For direct buried valves with surface valve box lids, tape tracer wire to outside of valve box up to last section of box. Bring tracer wire into the valve box above the operating nut. Coil 18" tracer wire inside valve box under the lid.

2. For direct buried valves with valve box lids inside meter cans, bring tracer wire into the meter can outside of the valve box. Coil 18" tracer wire inside meter can.

3. For all valve vaults, coil min. 24" tracer wire against wall on each side of vault.

K. All shallow well manhole covers, valve box lids, meter can lids, and other cast iron appurtenances visible from surface shall be painted blue as follows.

1. Minimum surface preparation: SSPC-SP2

2. Primer: Sherwin Williams Kem Kromik Universal Metal Primer, OAE

a. One coat, 3.0-4.0 mils dry film thickness

3. Finish: Sherwin Williams Industrial Enamel (B54 Series), OAE

a. Two coats, 2.0-4.0 mils dry film thickness

4. Follow all other paint manufacturer recommendations for preparation and application.

3.4 CORROSION PROTECTION

A. Refer to Section 33 11 13 and Drawings for designation of corrosive soil zones in which buried valve assemblies require cathodic protection and/or corrosion monitoring and for specification for design, materials, installation, energizing and testing of cathodic protection systems.

B. Ferrous components not in contact with soil do not require cathodic protection.

C. Stainless steel components do not require cathodic protection.

3.5 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.6 FIELD QUALITY CONTROL

A. Section 01 00 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform pressure test on domestic site water transmission system in accordance with AWWA C605.

C. All valves, including butterfly valves, gate valves, check valves and air valves shall be manually actuated through their full cycle to ensure proper operation prior to installation.

1. The Contractor shall provide the Engineer the opportunity to witness all valve actuations prior to valve installation.

D. Inspect coatings of all valves immediately prior to installation and repair all damaged coatings.

E. Properly align all pipes, valves and fittings prior to making connections. Do not install any pipes or fittings with internal longitudinal or shear stresses. Engineer reserves the right to disassemble any flange, joint, or union to check for internal stresses. Contractor shall correct any connection with internal stress at no additional cost to the Owner.

3.7 START-UP SERVICES

A. Control Valves: Provide start-up services of control valve manufacturer's authorized representative for at least one 8-hour work day for valve start-up, adjustment, calibration, and operator training.

3.8 SPARE PARTS

A. Contractor shall supply the following spare parts to NTUA, at a location to be specified by NTUA within 75 miles of the project site:

1. Five (5) 2-inch stainless steel ball valves
2. Two (2) 2-inch vacuum relief valves with 1-inch air valves
3. Five (5) 10-inch gate valves
4. Three (3) 4-inch rubber check valves for flush valve outlets
5. Five (5) locking cast iron valve box covers
6. Five (5) locking cast iron meter can covers

END OF SECTION