SECTION C - DESCRIPTION/SPECIFICATIONS
TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

01 11 00	Summary of Work
01 12 10	Other Contracts
01 14 10	Use of Site
01 14 12	Work Restrictions and Limitations
01 31 04	Partnering
01 31 19	Project Management and Coordination
01 31 30	Contract Document Management System (CDMS)
01 32 10	Construction Program
01 33 00	Submittals
01 33 26	Electrical Drawings and Data
01 35 10	Safety Data Sheets
01 35 20	Safety and Health
01 35 30	Contractor's Onsite Safety Personnel
01 42 10	Reference Standards
01 46 00	Quality Procedures
01 46 20	Testing Agency Services
01 51 00	Temporary Utilities
01 55 00	Vehicular Access and Parking
01 55 20	Traffic Control
01 56 10	Protection of Existing Installations
01 56 15	Protection of Existing Utilities
01 56 20	Existing Fences
01 56 32	Temporary Safety Fence
01 57 20	Environmental Controls
01 57 30	Water Pollution Control
01 57 40	Pesticides
01 57 50	Tree and Plant Protection
01 57 60	Protected Species
01 57 90	Preservation of Historical and Archeological Data
01 60 00	Product Requirements
01 61 10	Buy American
01 71 20	Surveying
01 74 00	Cleaning and Waste Management
01 78 30	Project Record Documents

DIVISION 03 – CONCRETE

03 11 10	Concrete Forming
03 15 12	PVC Waterstop
03 15 18	Hydrophilic Waterstops
03 20 00	Concrete Reinforcement

03 30 00 Cast-in-Place Concrete
03 48 00 Precast Concrete Structures
03 62 20 Nonshrink Grout for Equipment and Metalwork
03 63 00 Epoxy Grout

DIVISION 5 – METALS

05 50 00 Metal Fabrications

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 21 50 Spray-Applied Polyurethane Foam Insulation
07 21 60 Insulation Jacket

DIVISION 08 – OPENINGS

08 31 25 Access Hatches

DIVISION 09 – FINISHES

09 96 20 Coatings

DIVISION 10 – SPECIALTIES

10 14 26 Utility Markers

DIVISION 25 – INTEGRATED AUTOMATION

25 00 01 System Control and Monitoring
25 08 10 Automation System Testing and Acceptance

DIVISION 26 – ELECTRICAL

26 05 02 Basic Electrical Materials and Methods
26 05 10 Conductors and Cables
26 05 20 Grounding and Bonding
26 05 33 Raceways and Boxes
26 05 90 Wiring Checkout and Tests
26 24 41 Distribution Panelboards
26 27 10 Meter Socket
26 42 00 Cathodic Protection Systems
26 42 11 Buried Galvanic Anode Cathodic Protection
26 42 12 Buried Impressed Current Cathodic Protection
26 42 15 Galvanic Anode Cathodic Protection for Welded Steel Tanks

DIVISION 31 – EARTHWORK

31 02 10 Water for Dust Abatement
31 02 30 Dust Palliative
31 03 33 Removal and Control of Water
31 11 00 Clearing and Grubbing
31 14 10 Topsoil Stripping, Stockpiling, and Placement
31 23 02 Compacting Earth Materials
31 23 11 Earthwork for Structures
31 23 22 Pipe Trench Earthwork
31 23 39 Disposal of Excavated Waste Materials
31 23 70 Controlled Low Strength Material (CLSM)
31 24 18 Gravel Drain for Water Storage Tanks
31 31 30 Soil Applied Herbicide
31 32 36 HDPE Geomembrane for Water Storage Tanks
31 37 00 Riprap

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 12 22 Asphalt Concrete Pavement
32 15 10 Gravel Surfacing
32 31 10 Chain Link Fence
32 91 60 Erosion Control Blanket
32 92 20 Seeding

DIVISION 33 – UTILITIES

33 05 21 Bored Crossings
33 05 23 Maintained and Un-Maintained Road Crossings
33 11 10 Pipeline General Requirements
33 11 12 Steel Line Pipe
33 11 13 Ductile Iron Pipe
33 11 16 PVC Pressure Pipe
33 11 17 PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks
33 11 18 HDPE Pressure Pipe
33 11 50 Pipe Crossing at Existing Utility Pipelines
33 12 15 Valves and Equipment for Line Pipe Installations
33 16 00 Water Storage Tanks
33 16 50 Steel Tanks
33 16 51 Concrete Wire Wrapped Tank
33 16 52 Concrete Prestressed Tank
33 21 95 Metal Piping for Line Pipe Installations
33 42 30 Corrugated Metal Pipe Culverts

DIVISION 35 -WATERWAY AND MARINE CONSTRUCTION

35 21 95 Steel Manifold Piping
35 22 14 Valves and Equipment
35 42 35 Wash Crossing Bank Protection

DIVISION 51 – INFORMATION AVAILABLE TO OFFERORS

51 00 00 Information Available to Offerors
51 00 35 Site Specific Revegetation Plan
51 00 40 NTUA – Markers
51 00 42 NTUA Waterline Relocation Requirements
51 00 45 Weathers Property Water Sample Results
51 00 50 Electronic Media Release
51 00 70 BLM Herbicides
51 02 83 Hazardous Materials Survey and Analytical Results

DIVISION 52 – DRAWINGS

52 00 00 Drawings

DIVISION 53 - GEOLOGIC INVESTIGATIONS AND RECORDS

53 10 00 Geologic Investigations
53 15 00 Geotechnical Recommendations
53 20 00 Records of Geologic and Subsurface Investigations

END OF CONTENTS

SECTION 33 11 10
PIPELINE GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Line Pipe (Reach 2), 48-Inch Line Pipe (Reach 3), and 42-Inch Line Pipe (Reach 3):

1. Measurement: Horizontally along pipe centerline, without allowance for slope, between ends of pipe in place. Continuous through fittings, outlets, wash crossings, casing pipes, end collars, thrust restraints, and road crossings with no allowance for lap at joints:

   a. Measurement for pipe from pipe outlets will begin at downstream face of valve or flange.

2. Payment: Linear foot prices offered in Price Schedules:

   a. Includes cost of the following:

      1) Pipe trench excavation in accordance with Section 31 23 22 – Pipe Trench Earthwork.

      2) Furnishing and placing materials, including but not limited to the following:

         a) Fittings, bedding, embedment, utility markers, concrete, reinforcing steel, blocking and collars, not included elsewhere.

         b) Asphalt concrete pavement.

         c) Laying pipe.

      3) Connections of Line Pipe to existing Horizontal Directionally Drilled (HDD) Pipe, and existing Steel Manifold Piping at Pumping Plant No. 1 and San Juan Lateral Water Treatment Plant Regulating Tanks.

         a) Construct pipe connections as restrained pipe lengths between Line Pipe and existing HDD Pipe and Steel Manifold Piping.

         b) Different pipe materials may exist between Line Pipe and existing HDD Pipe and Steel Manifold Piping. Connections must accommodate different pipe materials.

         c) A miter bend, at each end of existing HDD Pipe, to transition from HDD Pipe slope to Line Pipe slope as constructed.

      4) Carrier Pipe for Bored Crossings.

b. Does not include:

1) Steep pipe.

2) Installation of Bored Crossings.

3. Linear foot price shall be an average price of pipe pressure class shown on drawings.

B. Steep Line Pipe (Reach 2):

1. Measurement: Horizontally along pipe centerline, without allowance for slope, between ends of pipe in place. Continuous through fittings, outlets, wash crossings, casing pipes, end collars, thrust restraints, anchor blocks and road crossings with no allowance for lap at joints:

2. Payment: Linear foot prices offered in Price Schedule 1:

a. Includes cost of the following:

1) Pipe trench excavation in accordance with Section 31 23 22 – Pipe Trench Earthwork.

2) Furnishing and placing materials, including but not limited to the following:

a) Fittings, bedding, embedment, utility markers, concrete, reinforcing steel, blocking and collars, not included elsewhere.

b) Laying pipe.

3) Does not include rock excavation.

3. Linear foot price shall be an average price of pipe size and pressure class shown on drawings.

C. Filling and Testing Pipe:

1. Payment: Lump sum prices offered in Price Schedules.

a. Includes: One pipe volume of water used for filling and testing or as approved by COR.

b. Additional water required for flushing and testing is at Contractor's expense.

D. Repair Kits:

1. Payment: Lump sum prices offered in Price Schedules.

E. NTUA 4-inch Waterline Relocation:

1. Measurement: Horizontally along pipe centerline,

2. Payment: Linear foot prices offered in Price Schedule 2:

a. Includes the cost of the following:

1) Pipe trench excavation in accordance with Section 31 23 22 – Pipe Trench Earthwork.

2) Removal and disposal of existing waterline.

3) Furnishing and re-placing materials, including but not limited to the following:

a) Isolation valves, fittings, bedding, embedment.

b) Laying pipe.

4) Disinfection of installed pipeline, in accordance with 51 00 42 -. NTUA Waterline Relocation Requirements.

1.02 DEFINITIONS

	Piping Types			
Material	Size (Inch)	Location	Specification	Drawings
PVC, HDPE, Ductile Iron, or Steel	Greater than 36-inches	Line Pipe	As per material type.	
Steel only	36-inches and less	Assembly Piping and Vaults	33 21 95 – Metal Piping for Line Pipe Installations	60798, 60799, 60800, 60801, 60802, 60804, and 60812

A. Line Pipe:

1. Water transmission pipe.
2. Unless otherwise specified, does not include piping for appurtenances such as blowoffs, air valves, or manholes.
3. Includes pipe from:

a. Reach 2:

1) Start of Reach 2 (2002+00) to start of Shumway Arroyo HDD,

2) End Shumway Arroyo HDD to Start of San Juan River HDD,

3) End of San Juan River HDD to start of Pumping Plant No. 1,

4) End of Nenahnezad Bluff HDD to end of Reach 2 (2287+67.49).

b. Reach 3:

1) Start of Reach 3 (3302+00) to Chaco River HDD,

2) End of Chaco River HDD to end of Reach 3 (3744+56.27).

B. Horizontal Directionally Drilled (HDD) Pipe:

1. Previously installed water transmission pipe, by others.

C. Pipe sizes and classes: Line Pipe is designated on plan and profile drawings by an alphanumeric symbol:

1. Symbol identifies pipe diameter, cover class and hydraulic transient head as follows:

a. First number in symbol indicates nominal diameter in inches.

b. Alphabetic character represents cover class of pipe where; B < 10 feet, C < 15 feet, and D < 20 feet:

1) K Class pipe: Metallic pipe with a special design at locations shown on the drawings:

a) Joints shall be butt welded if steel pipe is used.

b) Joints shall be restrained if ductile iron is used.

c. Second number in symbol is maximum hydraulic transient head measured to centerline of pipe.

d. A symbol of 42C600 means pipe is 42-inches in diameter with a cover between 10- and 15-feet and a hydraulic transient head of 600-feet at centerline of pipe.

2. Unless specific reference is made to outside or inside diameter of pipe, pipe diameters shown on drawings and used in this section are nominal pipe diameters.

D. Metal Piping for Line Pipe Installations:

1. In accordance with Section 33 21 95 – Metal Piping for Line Pipe Installations:

a. Piping in vaults, turnouts, or piping for appurtenances such as blowoffs, bypasses, air valves or manholes including air vent piping in manholes.

b. Includes, buried manholes, outlets, and associated flanges from the line pipe to which metal piping for line pipe is attached.

E. Steel Manifold Piping:

1. In accordance with Section 35 21 95 – Steel Manifold Piping:

a. Piping in San Juan Lateral Water Treatment Plant Regulating Tanks site.

1.03 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM C150/C150M-17	Portland Cement
2.	ASTM F2164-13	Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems using Hydrostatic Pressure.

B. American Water Works Association (AWWA)

1.	AWWA C205-12	Cement-Mortar Protective Lining and Coating for Steel Water Pipe – 4 In. (100mm) and Larger - Shop Applied
2.	AWWA C600-10	Installation of Ductile Iron Water Mains and Their Appurtenances
3.	AWWA C604-11	Installation of Steel Water Pipe 4 In. (100mm) and Larger
4.	AWWA C605-13	Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings

C. International Organization for Standardization (ISO)

1.	ISO 9001-15	Quality Management

D. National Sanitation Foundation (NSF)

1.	NSF Standard 61-16	Drinking Water System Components - Health Effects

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals:

B. RSN 33 11 10-1, Qualifications:

1. Certification of line pipe layers (Foreman).
2. Certification of line pipe and fitting manufacturers.
3. Certification of NSF 61 compliance of line pipe materials.

C. RSN 33 11 10-2, -3, -4, -5, Pipelaying Diagrams:

1. RSN 33 11 10-2, Reach 2, Start of Reach 2 to Start of San Juan River HDD.
2. RSN 33 11 10-3, Reach 2, End of San Juan River HDD to end of Reach 2.
3. RSN 33 11 10-4, Reach 3, Start of Reach 3 to Start of Chaco River HDD.
4. RSN 33 11 10-5, Reach 3, End of Chaco River HDD to end of Reach 3.
   a. Submit each reach in sections, not to exceed 5-miles, after utility crossing investigation and wash crossing field information has been submitted and approved for that section:
      1) If additional sections and/or reaches are submitted within 21-days, Government will require an additional 21-days for review of each additional section.
   b. Submit concurrently with applicable corresponding RSN in the following Sections:

1) 33 11 12 – Steel Line Pipe, RSN 33 11 12-2 through RSN 33 11 12-5.

2) 33 11 13 – Ductile Iron Pipe, RSN 33 11 13-1 through RSN 33 11 13-4.

3) 33 11 16 – PVC Pressure Pipe, RSN 33 11 16-1 through RSN 33 11 16-4.

4) 33 11 18 – HDPE Pressure Pipe, RSN 33 11 18-2 through RSN 33 11 18-5.

5) 33 21 95 – Metal Piping for Line Pipe Installations, RSN 33 21 95-1 through RSN 33 21 95-4.

c. For each type of pipe furnished.

d. Show position and marking of pipe sections.

e. Include centerline and invert stationing and elevations at horizontal and vertical changes in alignment, and subgrade elevation for each pipe segment and fitting.

f. Include pipe thickness, Dimension Ratio (DR) or pressure class of pipe segment or fitting.

g. For alignment changes not using a miter bend (pulling joints) provide station at point of curvature and point of tangent, and deflection angle at each pulled joint.

h. Fittings or insulating flange gasket kit used to isolate dissimilar metals.

D. RSN 33 11 10-6, Filling and Testing Plan:

1. Proposed rate, time, and procedure for:

a. Cleaning.

b. Filling.

c. Field and pressure testing.

d. Draining pipeline.

2. Method for disposing of water drained from pipeline to enable repair of leaks.

3. Leak testing equipment and data sampling plan.

E. RSN 33 11 10-7, Flotation Prevention Plan:

1. Show location and describe method of preventing pipe from floating.

2. Provide supporting calculations.

F. RSN 33 11 10-8, Pipe Deflection Measurements.

G. RSN 33 11 10-9, NTUA Waterline Relocation Work Plan:

1. Show position and marking of pipe sections.
2. Include centerline and invert stationing and elevations at horizontal and vertical changes in alignment, and subgrade elevation for each pipe segment and fitting.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Ship pipe after receiving COR approval as per Section 2.03 – Source Quality Assurance.

B. Prevent damage to pipe and fittings during loading, transporting, unloading, storing, and laying.

C. Transport metallic pipe and fittings on padded bolsters curved to fit outside of pipes. Use heavy padding under ties.

D. Tightly close open ends of shop-applied, cement-mortar-lined pipe with plastic wrap for protection of cement-mortar lining during shipment:

1. Plastic Wrap:
   a. At least 2 thicknesses of 6-mil sheet polyethylene plastic.
   b. Remain on pipe until installation.

E. Support and store pipe above ground surface. Do not allow bells and spigots to contact each other or the ground.

F. Government will inspect pipe once it is delivered.

G. Replace or repair, as approved by COR, any pipe that is damaged during shipment, storage, or installation at Contractor's expense. Include linings and coatings.

1.06 QUALIFICATIONS

A. Pipe manufacturers shall be certified in accordance with ISO:9001 or similar nationally certified program approved by COR.

B. Line pipe and specials manufacturers:

1. 10-years successful experience producing products as specified.
2. Provide references for at least 3 completed projects with similar pipe diameters (within 12-inches) and pressures.

C. Pipe Layers: Skilled and experienced in laying pipe with joints as needed for each material type of pipe used. Minimum 2-years installing pipe with similar pipe diameters (within 12-inches), pipe material, and pressures:

1. In the absence of specific pipe material experience, substitution of onsite pipe manufacturer training and quality control is allowed:

a. Provide manufacturer's representative certified in pipeline installation, including all applicable joints, for training pipe layers and pipe foreman prior to installation.

b. In lieu of specific pipe material installation experience, pipe layers and pipe foreman shall still have experience with installing similar pipe diameters and pressures.

D. Qualify welding procedures and welders in accordance with code under which welding is specified.

1.07 REPAIR KITS

A. Furnish 1 repair kit for each material type and size of pipe used.

B. Repair kit:

1. One standard length of pipe and 2 restrained couplings.
2. At highest loading and pressure rating for each material type and nominal size of pipe provided.

C. Place repair kits in storage within 150-miles from site, as designated by COR.

PART 2 PRODUCTS

2.01 PIPE OPTIONS

A. In accordance with the following Sections:

1. 33 11 12 – Steel Line Pipe,
2. 33 11 13 – Ductile Iron Pipe,
3. 33 11 16 – PVC Pressure Pipe,
4. 33 11 18 – HDPE Pressure Pipe.

B. Locations:

1. Reach 2:
   a. HDPE Pressure Pipe allowed with pipe head class 275 or less.
   b. PVC Pressure Pipe allowed with pipe head class 350 or less.
   c. Metallic Pipe required for pipe head class above 350.
2. Reach 3:
   a. HDPE Pressure Pipe allowed with pipe head class 275 or less.
   b. PVC Pressure Pipe allowed with pipe head class 350 or less.
   c. Metallic Pipe required for pipe head class above 350.

C. No more than one metallic line pipe type and one non-metallic line pipe type may be used, except as shown on drawings.

D. Materials and chemicals that may come into contact with drinking water shall be certified by NSF 61.

E. Rubber Gaskets:

1. Manufactured and tested in accordance with applicable AWWA standard for pipe type.
2. Petroleum-Resistant Gaskets: Use in pipe joints in accordance with Section 33 11 50 – Pipe Crossings at Existing Utility Pipelines.
3. Lubricant: Approved for potable water use.

F. Transitions between differing pipe materials:

1. Transitions between HDPE and PVC are not allowed.
2. All transitions between line pipe materials shall be fully restrained.
3. Steel:
   a. In accordance with 33 11 12 – Steel Line Pipe.
   b. Allowable connection types:
      1) Mechanical Joint: Series 1100 manufactured by Ebaa Iron Inc., www.ebaa.com or equal.
      2) Flanged.
4. Ductile Iron:
   a. In accordance with 33 11 13 – Ductile Iron Pipe.
   b. Allowable connection types:
      1) Mechanical Joint: Series 1100 manufactured by Ebaa Iron Inc., www.ebaa.com or equal.
      2) Restrained Flange Adapter: Series 2100 manufactured by Ebaa Iron Inc., www.ebaa.com or equal.
5. PVC:
   a. In accordance with 33 11 16 – PVC Pressure Pipe.
   b. Allowable connection types:
      1) Mechanical Joint: Series 2200 manufactured by Ebaa Iron Inc., www.ebaa.com or equal.
6. HDPE:
   a. In accordance with 33 11 18 – HDPE Pressure Pipe.
   b. Allowable connection types:

1) Flanged with backing ring.

2.02 FITTINGS

A. Fittings should resist same loading conditions as adjacent pipe.

B. Refer to applicable line pipe section for allowed fittings.

C. Each transition between the Line Pipe and HDD Pipe shall have a miter bend installed to align the pipeline to create a continuous segment.

1. The miter bends and connections shall be in accordance with the appropriate Section below, based upon the HDD and Line Pipe material at each location:
   a. 33 11 12 – Steel Line Pipe,
   b. 33 11 13 – Ductile Iron Pipe,
   c. 33 11 16 – PVC Pressure Pipe,
   d. 33 11 18 – HDPE Pressure Pipe.
2. At the extreme ends of the miter bends, either:
   a. A thrust block, with two restrained flexible couplings and a 10-foot articulating pipe segment between the couplings shall be installed on each end of the Line Pipe to allow for a flexible connection to the HDD Pipe, or
   b. Restrain pipe joints, if allowed, as shown on drawings.

D. Fittings and connections used to connect HDD Pipe to Line Pipe shall conform to Section 33 11 10 – Pipeline General Requirements. Transitions are required to connect pipes with material, diameter, and wall thickness differences.

E. Fittings and connections used to connect to Pumping Plant 1 shall conform to Section 33 11 10 – Pipeline General Requirements. Transitions are required to connect pipes with material, diameter, and wall thickness differences.

F. Fittings and connections used to connect to manifold piping at the San Juan Lateral Water Treatment Plant Regulating Tanks shall conform to Section 33 11 10 – Pipeline General Requirements. Transitions are required to connect pipes with material, diameter, and wall thickness differences.

2.03 NTUA WATERLINE

A. Replace per NTUA Requirements***, in accordance with Section 51 00 42 – NTUA Waterline Relocation Requirements, Section 3***. Re-route around San Juan Lateral Regulating Tank Site as shown on Drawing 1695-D-60809.

2.04 SOURCE QUALITY ASSURANCE

A. Approval for Shipment:

1. Pipe and fitting approval will be determined by inspection, during and after manufacture.
2. Notify Technical Service Center, Attn: 86-68140, and COR at least 14-days before manufacturing pipe and fittings and 3-days before shipping pipe and fittings.
3. Government will inspect pipe units and fittings and will approve for shipment those which have been manufactured and tested in accordance with these specifications, unless Contractor is notified in writing.
4. Further inspection of pipe units and fittings will be in accordance with clause at FAR 52.246-12 Inspection of Construction.

2.05 PIPE ACCESSORIES

A. Sectionalizing Valve, Air Valve, and Blowoff Assemblies: In accordance with Section 33 12 15 – Valves and Equipment for Line Pipe Installations.

B. Buried Manhole Assemblies:

1. In accordance with Section 03 48 00 – Precast Concrete Structures.
2. Cement-mortar lining: AWWA C205, in accordance with shop applied mortar for lining of specials, except:
   a. Reinforcement required for pipe larger than 24-inch diameter.
   b. Cement: ASTM C150, Type V.
3. Required at locations shown on drawings.

C. Warning Tape:

1. Polyethylene tape.
2. Thickness: 4 mils.
3. Magnetically detectable.
4. Width, minimum: 6-inches.
5. Color: Blue with silver lettering.
6. Legend repeated at least every 3-feet: "CAUTION: WATERLINE BURIED BELOW - FOR MORE INFORMATION CONTACT THE NAVAJO TRIBAL UTILITY AUTHORITY".

D. Tracer Wire for Non-Metallic Pipe:

1. Type: High strength copper clad steel.
2. Size: 10 AWG, minimum.
3. Insulation:
   a. High density, high molecular weight, polyethylene (HDPE).

b. Jacket Color: Blue.

c. Rated for direct burial.

E. Tracer Wire Terminal Post:

1. Designed and manufactured for specific application.
2. Temperature and ultraviolet light stable.
3. Color: Blue.
4. Terminals: Two, minimum, per post.
5. Provide terminal jumpers to interconnect lengths of trace wire as needed.
6. Space as recommended by manufacturer.

PART 3 EXECUTION

3.01 GENERAL

A. Perform cleaning, filling, and testing after backfill has been placed to finished grade or as approved by OGR.

B. Responsible Surveyor licensed in State of New Mexico or a certified Construction Surveyor, as defined in and in accordance with Section 01 71 20 – Surveying, shall be onsite during excavation and pipelaying.

C. Protect pipe from contamination, damage, and elements during storage on-site by covering with tarp as directed by OGR.

D. Install pipe based on these specifications or pipe manufacturer's recommendation, whichever is more stringent.

E. Isolate dissimilar metals.

3.02 INSTALLATION

A. Install pipe in accordance with appropriate Section for pipe option installed.

B. Keep openings to installed pipe closed with watertight inflatable plugs during work stoppage, including end of work day, breaks, and work delays.

C. If pipe is flooded during construction, clear floodwater by draining and flushing with water, or other approved method, until pipe is clean.

D. Lubricant:

1. Keep clean.
2. Apply with dedicated, clean applicator brushes.

3. Apply lubricant as specified by pipe manufacturer:
   a. Use only lubricant supplied by pipe manufacturer.
   b. Lubricate spigot end of pipe as recommended by manufacturer.
   c. Do not lubricate either gasket or gasket groove in bells where gaskets are field installed.
   d. Lubricate factory-installed, non-removable-type gaskets as recommended by pipe manufacturer.

E. Coat buried manholes with cement mortar as shown on drawings.

F. Install tracer wire for non-metallic pipe.

G. Install warning tape over center of pipe at least 18-inches below ground and at least 18-inches above pipe.

3.03 LAYING PIPE

A. Excavate pipe trench in accordance with Section 31 23 22 – Pipe Trench Earthwork.
   1. Grade pipe trenches to provide uniform slope along bottom of pipe.
   2. At joints involving bells or collars, provide holes at joint of ample size to prevent bells or collars from coming in contact with subgrade and to allow for bedding placement.

B. Keep pipe trenches free of water during pipelaying operations.

C. Lower pipe into trench and place pipe in position such that no soil gets inside pipe and pipe is not damaged.

D. Install pipe to line and grade as shown on drawings and approved lay diagrams.

E. On grades exceeding 10 percent, lay pipe uphill.

F. When pipelaying is not in progress, keep ends of pipelines closed with watertight inflatable plugs.

G. Joining Pipe:
   1. Assemble push-on or mechanical joints in accordance with applicable AWWA standard for pipe type and manufacturer's recommendations.
   2. If adjustment of the position of length of pipe is required after installation, remove and relay length of pipe as new pipe.
   3. Maintain pipe firmly in final position.
   4. Placing Elastomeric Gasket:
      a. Clean gasket, bell, especially the groove, and spigot with rag, brush, or paper towel to remove any dirt or foreign material.
      b. Use only gaskets which are designed for and supplied with pipe.

c. Lubricate pipe as recommended by manufacturer.

d. Spigot Groove Method:

1) Follow manufacturer's recommended practices for gasket installation.

2) After placing elastomeric gasket in spigot groove, equalize elastomeric gasket cross section by inserting tool such as a large screwdriver under elastomeric gasket and moving it around periphery of pipe spigot.

e. Coupling Groove Method: Follow manufacturer's recommended practices for gasket installation. Typically, factory installed.

5. Fit pipe unit's together, spigot to bell or coupling, and draw joints together so that bells or couplings and spigots are fully engaged with uniform contact to gasket.

6. Do not swing or "stab" joint and do not suspend pipe and swing into bell or coupling.

7. Fit pipe units together in a manner to avoid twisting or otherwise displacing or damaging elastomeric gasket.

8. After joining pipe units, insert feeler gauge between pipe bell and pipe spigot, move it around periphery of pipe to determine that position of elastomeric gasket is correct and there are no fish-mouth problems. If adjustment of position of a length of pipe is required after installation, remove and relay length of pipe as new pipe.

H. Changes in Alignment and Grade:

1. Make changes in alignment and grade with miter bends as shown on drawings.

2. Make other minor changes in alignment and grade by providing small deflections between adjacent pipe:

a. Do not exceed manufacturer's deflection tolerances.

b. Pipelaying diagrams shall only deflect joints no more than 50-percent of manufacturer's maximum deflection tolerances.

3. Provide restrained joint lengths upstream and downstream of bends or thrust blocks as shown on drawings. Ductile iron fittings with restrained joint lengths as limited by drawings may be used if Contractor submits revised plan and profile drawings for approval.

4. Do not encase rubber gasket joints in concrete.

5. Refer to individual pipe Sections for additional requirements. If requirements conflict, use most stringent requirement.

I. After pipelaying and joining operations are completed, clean inside of pipe and remove debris.

J. Schedule work so that at no time pipe remains in trench more than 7-days before backfill is placed to original ground surface or to other specified backfill limits shown on drawings.

K. Joints under Maintained and Unmaintained Road Crossings, and Wash Crossing banks and waterway shall be restrained for length shown on drawings. Joints shall have hoop stress and longitudinal stress capacity equal to or greater than adjacent pipe.

3.04 THRUST RESTRAINT

A. Restrained joint couplings or concrete blocking and collars as shown on drawings. Refer to Section 03 30 00 – Cast-in-Place Concrete and in accordance with applicable sections listed in 2.01.A.

B. Plan, profile, and restraint system shown on drawings require modification if alternate methods are used.

C. Alternate methods of restraint may not be used unless submitted and approved by COR.

3.05 TRACER WIRE

A. Install continuous length of tracer wire for full length of each run of non-metallic pipe,

B. Attach wire to top of pipe using suitable methods to ensure tracer wire will not be displaced during construction operations.

C. Locate tracer wire terminal posts at suitable locations to provide testing and/or jumper points for entire length of non-metallic pipe.

D. Verify tracer wire continuity prior to performing backfill operations.

3.06 BACKFILL

A. Backfill pipe in accordance with Section 31 23 22 – Pipe Trench Earthwork:

1. Place backfill about pipe carefully to avoid lateral displacement of pipe and damage to joints.
2. In certain pipeline reaches, where determined necessary by COR to prevent possibility of flotation, do not lay more than 300-linear feet of pipe ahead of backfilling operations.
3. If pipelaying operations are interrupted for more than 24-hours, cover pipe laid in trench with backfill.

3.07 PIPE DIAMETER DEFLECTION

A. For pipe greater than 24-inches:

1. Measure short term deflection of internal diameter:

a. Within 2-weeks after completion of backfill.

b. When interior bracing required, remove before making measurements.

2. Measurement Frequency:

a. One pipe unit out of 3 for first 30 units laid. 1 pipe unit out of 10 thereafter.

b. In deep burial or problem areas, frequency of measurements may be increased at discretion of COR.

3. Measurements:

a. Measure vertical and horizontal diameter at approximate midpoint of pipe unit.

b. Record pipe deflections and station where measurements were taken.

c. Mark inside of pipe so that future comparisons can be made.

B. Deflection limitations apply per individual pipe sections.

C. Take corrective action if required limits are not meet, including removing and replacing pipe that exceeds allowable deflection tolerance.

3.08 FIELD EXAMINATION

A. Flush pipe before filling.

1. Flush foreign material from pipeline prior to testing.

2. Flush using a minimum velocity of 3-feet per second toward low points in reach.

3. Flush minimum of 1 pipe volume until water is clean or approved by OGR.

4. Dispose of flush water in accordance with permits in Section 01 57 30 – Water Pollution Control.

5. Operate valves several times during flushing period.

3.09 FILLING AND DRAINING PIPELINE

A. Notify COR 4 days before filling and testing.

B. Water for filling and testing pipeline in accordance with Section 01 51 00 – Temporary Utilities.

C. Pipeline fill rate, maximum: 2 cubic feet per second.

D. Maintain pipeline completely filled for at least 72-hours before testing.

E. Dispose of testing water by approved method.

3.10 DISINFECTION

A. Disinfect NTUA 4-inch waterline in accordance with Section 51 00 42 – NTUA Waterline Relocation Requirements, ***Section TP-3.11***.

3.11 CONTRACTOR FIELD QUALITY TESTING

A. Leak testing pipeline:

1. Notify COR at least 7-days before applying pressure to pipeline.
2. Do not start leak testing when snow or standing water is on the ground. Suspend testing as directed by OGR if precipitation accumulates on the ground.
3. Furnish pumps, power, pressure gages, calibrated flow meters and air valves as needed each end of pipeline test segment, including through the San Juan Lateral Water Treatment Plant Regulating Tanks site. Contractor may utilize water storage tanks to maintain pressure during testing.
4. Comply with applicable test standard except as noted below:
   a. AWWA C605 for PVC.
   b. AWWA C600 for Ductile Iron.
   c. AWWA C604 for Steel.
   d. AWWA C906 and M55 for HDPE.
5. Test pipeline with hydrostatic pressure equal to hydraulic grade line elevations listed for each Reach segment:
   a. Reach 2;
      1) Upstream of Pumping Plant No. 1: Elevation 5,280 feet.
      2) Downstream of Pumping Plant No. 1: Elevation 5,460.9 feet.
   b. Reach 3; Elevation 5,460.9 feet.
   c. Test Segment: Each pipe segment between sectionalizing valves.
   d. First test segment: Between start of Reach 2 pipeline and first sectionalizing valve.
   e. Last test segment: From last sectionalizing valve and end of Reach 3 pipeline.
   f. Manifold pipe for the San Juan Lateral Water Treatment Plant Regulating Tanks to be tested with the connecting line pipe.
   g. Sectionalizing valves shall be removed for testing unless test pressures are less than rated pressure for valve.
6. Prior to starting test, maintain pressure in pipe for 24-hours.
7. Test for 96-hours or as approved by COR.
8. Measure volume of water required to maintain pressure during test:

a. Acceptance criteria:

1) Zero leakage:

a) Test using digital gauge with data logger.

b) Test pressure shall not drop by more than 5 psi during test period.

c) Repair any pipeline leakage detectable by any means as approved by COR.

b. If criteria are not met, repair or replace pipe or fitting and repeat test until acceptance criteria is achieved.

9. Drain pipe using both gravity flow and sump pump at blowoffs or as approved by COR.

10. Seal openings to pipe as approved by COR.

B. Pipeline leakage discovered after leak testing:

1. Repair any pipeline leakage detectable by any means as approved by COR.

2. Retest pipeline test segment containing repair to prove zero leakage at test pressure for 96-hours.

C. Locate tracer system testing:

1. Perform test of tracer wire system using applicable equipment along entire length of pipe to ensure proper performance.

2. Repair any identified breaks or separations and retest applicable section of system.

END OF SECTION

SECTION 33 16 51
CONCRETE WIRE WRAPPED TANK

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of furnishing and installing concrete wire wrapped tank in price offered in Price Schedule 2 for San Juan Lateral Water Treatment Plant Regulating Tanks.

   a. Includes:

      1) Designing and installing, tank, tank foundation, ladders, railings, pipes, fittings, and accessories.

      2) Waterstops.

      3) PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks.

      4) Providing tank testing and associated equipment testing.

1.02 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1.	ACI 350-20	Building Code Requirements for Environmental Engineering Concrete Structures
2.	ACI 350.1-22	Tightness Testing of Environmental Engineering Concrete Containment Structures and Commentary
3.	ACI 350.3-20	Seismic Design of Liquid-Containing Concrete Structures and Commentary
4.	ACI 372R-13	Design and Construction of Circular Wire- and Strand-Wrapped Prestressed Concrete Structures
5.	ACI 506R-16	Guide to Shotcrete
6.	ACI 506.2-13(18)	Shotcrete

B. ASTM International (ASTM)

1.	ASTM A185/A185M-07	Steel Welded Wire Reinforcement, Plain, for Concrete
2.	ASTM A227/A227M-17	Steel Wire, Cold-Drawn for Mechanical Springs

3.	ASTM A416/A416M-18	Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
4.	ASTM A421/A421M-21	Uncoated Stress-Relieved Steel Wire for Prestressed Concrete
5.	ASTM A475-03(2020)	Zinc-Coated Steel Wire Strand
6.	ASTM A497/A497M-07	Steel Welded Wire Reinforcement, Deformed, for Concrete
7.	ASTM A586-18	Zinc-Coated Parallel and Helical Steel Wire Structural Strand
8.	ASTM A603-19	Zinc-Coated Steel Structural Wire Rope
9.	ASTM A615/A615M-15a	Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
10.	ASTM A648-18	Steel Wire, Hard-Drawn for Prestressed Concrete Pipe
11.	ASTM A653/A653M-20	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
12.	ASTM A722/A722M-18	Uncoated High-Strength Steel Bars for Prestressing Concrete
13.	ASTM A821/A821M-21	Steel Wire, Hard-Drawn for Prestressed Concrete Tanks
14.	ASTM A882/A882M-20	Filled Epoxy-Coated Seven-Wire Prestressing Steel Strand
15.	ASTM A1008/A1008M-21a	Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
16.	ASTM A1064/A1064M-18a	Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
17.	ASTM C881/C881M-20a	Epoxy-Resin-Base Bonding Systems for Concrete
18.	ASTM D1056-20	Flexible Cellular Materials-Sponge or Expanded Rubber
19.	ASTM D1752-18	Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
20.	ASTM D2000-18	Standard Classification System for Rubber Products in Automotive Applications

21. ASTM D2240-15(2021) Standard Test Method for Rubber Property: Durometer Hardness

C. American Water Works Association (AWWA)

1. AWWA D110-13(R18) Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks

D. Code of Federal Regulations

1. 29 CFR 1910.27 Fixed Ladders

E. International Building Code (IBC)

1. IBC-12 International Building Code

F. Post Tensioning Institute (PTI)

1. PTI DC10.7-83 Post-Tensioned Commercial and Industrial Floors
2. PTI TAB.1-06 Post-Tensioning Manual, Sixth Edition
3. PTI DC20.8-04 Design of Post-Tensioned Slabs Using Unbonded Tendons
4. PTI M10.2-00 Specification for Unbonded Single Strand Tendons
5. PTI M10.3-00 Field Procedures Manual for Unbonded Single Strand Tendons
6. PTI M50.3-12 Specification for Grouting of Post-Tensioned Structures
7. PTI CRT20 Manual for Certification of Plants Producing Unbonded Single Strand Tendons, Sixth Edition.

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 33 16 51-1, Approval Drawings and Data:

1. Shop drawings, show details:
   a. Used in fabrication of tank components and tank construction.
   b. Show details that shall be used in the preparation of the tank foundation.
   c. Show details that shall be used in the layout of the tank foundation drain.
2. Manufacturer's installation instructions.
3. Tank surface finishes and coating materials.
4. Concrete design mixes, including shotcrete.

5. Structural design calculations or analyses sealed by registered professional engineer in the State of New Mexico.

6. Provide 2- by 2-foot area of shotcrete finishes to be used as the standard for acceptance of installed construction.

C. RSN 33 16 51-2, Test Reports:

1. Submit certified mill test reports indicating ultimate and yield strength of all reinforcing bars, prestressing and post tensioning steel, and any other steel components.

D. RSN 33 16 51-3, Documentation:

1. Furnish applicable "Affidavits of Compliance" to building codes.

E. RSN 33 16 51-4, Final Drawings and Data:

1. Submit final drawings and data consisting of approved detailed shop drawings.

2. Submit Operation and Maintenance Manuals.

F. RSN 33 16 51-5, Qualifications:

1. ACI Nozzleman certification.

1.04 DESIGN REQUIREMENTS

A. Tank:

1. Refer to Section 33 16 00 – Water Storage Tanks.

2. Design one of the following in accordance with ACI 350, and AWWA D110:

a. Type I: Cast-In-Place Concrete with Vertical Prestressed Reinforcement.

b. Type II: Shotcrete with a Steel Diaphragm.

c. Type III: Precast Concrete with Steel Diaphragm.

3. Design foundation/floor slab for single concrete placements, no joints are allowed.

4. Foundation/floor slab design shall take into account concentrated loads from the roof column supports.

5. Perimeter wall shall be wire-wound and vertically prestressed as applicable. If cast in place, full-height placements not to exceed 75-feet in length.

6. Design core wall for initial compressive forces applied by prestressing and other applicable loadings.

7. Tank foundation drain to be installed under tank foundation/floor slab. See Drawing 1695-D-62473.

B. Foundation/Floor Slab:

1. Refer to Section 33 16 00 – Water Storage Tanks.
2. Refer to Section 31 23 11 – Earthwork for Structures for subgrade conditions.

C. Design for earthquake resistance based on ACI 350.3 and requirements of AWWA D110.

D. Base design on AWWA D110 and ACI 350 load combinations, with basis for loadings as defined herein:

1. Load combinations for prestressed or post-tensioned items: In accordance with AWWA D110 and ACI 350.
2. Load combinations for non-prestressed/post-tensioned items: In accordance with ACI 350.
3. Snow load: See drawings for definitions of snow loads.
4. Wind Loads (during construction and prior to backfilling):
   a. See drawings for definition of wind loads.
5. Uniform live load over roof area: 20 psf. (non-reducible).

E. Design and detail wall, foundation and roof per ACI 350 and AWWA D110 and the requirements noted herein.

F. Design for lowest mean ambient temperature and for temperature differential required for project location.

1. Foundation/Floor Slab:
   a. Refer to Section 33 16 00 – Water Storage Tanks.
   b. Refer to Section 31 23 11 - Earthwork for Structures for subgrade conditions.
   c. Minimum concrete thickness:
      1) Footing: 12-inches.
      2) Other Cast-in-Place Concrete elements: 8-inches or as required by ACI 350 if greater than 8-inches.
   d. Minimum Concrete Cover: In accordance with ACI 350:
      1) Top cover for membrane floors: 1 1/2-inch.
      2) Bottom cover for membrane floors: 2-inch.
      3) Pre-stressed or post-tensioned concrete exposed to earth, water, or liquid: 1 1/2-inch for floor and roof, 1-inch for walls.
   e. Provide foundation drainage system to collect leakage from tank foundation and discharge freely to daylight away from tank as shown on drawings.

G. Roof Design Criteria:

1. Conventionally reinforced construction: In accordance with ACI 350 relative to spacing between joints, minimum reinforcement ratios, and cracking serviceability (including serviceability load factors).
2. Prestressed/post-tensioned construction: In accordance with AWWA D110 and ACI 350.

H. Waterstops:

1. Adhesive waterstops are not permitted.
2. For sliding joints, deflection data shall be submitted and summarized from tank analysis for these locations.
3. Shear, load and deflection capabilities for the proposed waterstop shall be certified in writing by waterstop manufacturer and shall be adequate for movement indicated in tank analysis.
4. Continuous waterstops shall be used at all wall/footing and roof/wall joints. These joints shall be specifically detailed to remain watertight.

1.05 QUALIFICATIONS

A. Prestressing, Post-tensioning Supplier/Installer:

1. In addition to qualifications listed in Section 33 16 00 – Water Storage Tanks:
   a. Provide post-tensioning systems from a Post-Tensioning Institute (PTI) Certified Plant.
   b. Erection engineer shall be a full-time employee of the pre-stressing and post-tensioning and wire-winding supplier/installer.

B. Shotcrete Nozzlemen Certification.

PART 2 PRODUCTS

2.01 TANK

A. AWWA D110 Tank as manufactured by DN Tanks, Incorporated, 351 Cypress Lane, El Cajon, CA, 92020; The Crom Corporation, 250 SW 36th Terrace, Gainsville, FL 32607, Preload, Incorporated, 49 Wireless Blvd #200, Hauppauge, NY 11788, Precon Tanks, 115 SW 140th Terrace, Newberry, FL 32669; or equivalent with the following essential characteristics:

1. Materials:
   a. General requirements:
      1) Comply with AWWA D110, PTI TAB.1 and ACI 350.
   b. Concrete:

1) Materials: Conform to Section 03 30 00 – Cast-In-Place Concrete.

2) Wall, interior columns, and roof: 28-day compressive strength not less than 4,500 pounds per square inch and air entrained.

3) Floor: 28-day compressive strength not less than 4,500 psi and no air entrainment.

4) Cement: In accordance with Section 03 30 00 – Cast-In-Place Concrete Article 2.01 Cementous Materials.

5) Superplasticizer and water reducing admixture shall be incorporated into floor concrete.

c. Shotcrete:

1) 28-day compressive strength not less than 4,500-psi.

2) Cement: Conform to Section 03 30 00 – Cast-In-Place Concrete.

3) Conform to ACI 506.2.

2. Prestress wire or strand for circumferential wrapping:

a. Cold drawn, high-carbon wire shall conform to ASTM A821, ASTM A227, ASTM A421, and ASTM A648 Class II, as applicable.

b. Strand: Conform to ASTM A416 or A475, as applicable.

3. Reinforcing bars, wire mesh:

a. Reinforcing Bars: ASTM A615, Grade 60.

b. Wire Mesh: ASTM A185 or ASTM A497.

c. Conform to Section 03 20 00 – Concrete Reinforcing.

4. Wedges:

a. Conform to PTI TAB.1. Wedge shall not break into separate pieces upon stressing.

b. Designed to securely anchor strand without significantly reducing ductility of strand or tendon.

c. Strand slip after anchoring is not permitted.

d. Prevent breaking of individual strand wires in wedges during stressing.

e. Achieve dynamic fatigue and impact loading resistance without strand slippage or wire breakage.

5. Steel diaphragm:

a. Provide vertically ribbed steel sheets with adjacent and opposing channels that provide mechanical bond to concrete.

b. Conform to ASTM A653 or A1008.

c. Minimum thickness: 26 gauge.

d. Uncoated sheet steel shall comply with ASTM A1008.

e. Galvanized sheet steel shall comply with ASTM A653 and have a minimum G90 coating per table 1 of ASTM A653.

6. Elastomeric materials:

a. Bearing pads conforming to ASTM D2240 or ASTM D2000.

b. Sponge filler conforming to ASTM D1056 or ASTM D1752.

c. Epoxy-ASTM C881 Type III, Grade I.

7. Strand for earthquake cables:

a. Galvanized or epoxy coated with a fusion-bonded, grit-impregnated coating according to ASTM A882.

b. ASTM A416, grade 250 or 270 before galvanizing, ASTM A586, ASTM A603, or ASTM A475 after galvanizing. Only hot-dipped galvanizing shall be permitted for zinc coating.

8. Vertical/Roof/Floor prestressed reinforcement (as required):

a. Strand: ASTM A416, grade 250 or 270.

b. Threadbar: ASTM A722, grade 150 or 160.

c. Post-tensioning systems: Produced by PTI certified plant and tested to meet requirements of ACI 350 for corrosion protection.

d. Post-tensioning systems: Fully encapsulated.

9. Prestressed reinforcing left in ducts for more than 10-days prior to grouting shall be corrosion-protected in accordance with AWWA D110Ducts for bonded tendons:

a. Manufactured ducts for bonded tendons from corrosion-resistant materials and comply with PTI Guide Specification, “Acceptance Standards for Post-tensioning Systems.”

10. Grout fitting:

a. Grout fittings: Conform to PTI M50.3.

b. Tendons shall have grout openings at stressing anchorages.

c. Provide grout vents or drain holes at low and high points.

d. Prevent grout leakage at grout openings or vents.

11. Grout materials: PTI M50.3 and AWWA D110.

12. Couplings:

a. Couplings for bonded tendons shall not reduce elongation of rupture below requirements of tendon itself.

b. Use where approved by Erection Engineer.

2.02 FOUNDATION DRAIN

A. Materials:

1. Gravel Drain Material: Conform to Section 31 24 18 – Gravel Drain for Water Storage Tanks.
2. HDPE Geomembrane, HDPE Embedment Strip, Rubber Gaskets, Stainless Steel Clamps, and Sealant: Conform to Section 31 32 36 – HDPE Geomembrane for Water Storage Tanks.
3. PVC Pipe: Conform to Section 33 11 17 – PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks.

2.03 ACCESSORIES

A. Refer to Section 33 16 00 – Water Storage Tanks.

B. Interior Ladder:

1. Type 304 stainless steel.
2. Requirements for interior ladder: Comply with 29 CFR 1910.27 and IBC.
3. Supports on tank interior: Stainless steel.

C. DELETED

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Comply with AWWA D110, ACI 372 and ACI 350.

B. Do not place concrete foundation/floor slab until subgrade is approved by Erection Engineer.

C. Core Wall:

1. Provide continuous and full-length steel diaphragm between tank contents and prestressing wires:
   a. With no horizontal joints.
   b. Mechanically seam vertical diaphragm joints except where located between wall panels, where either mechanical seaming or sealing with epoxy may be employed.
   c. Seal vertical diaphragm joints to be full watertight.
   d. Piercing of diaphragm is not permitted except by design.

e. Do not allow form ties to pierce diaphragm.

2. Fabricate precast panels to curvature of tank radius:

a. Tolerance in panel wall thickness: 0- to plus 1/4-inch.

b. Place concrete for each panel in one continuous operation.

3. Locate bearing pads and hold them in position prior to erection of wall panels. Do not nail pads.

4. Properly secure sponge filler pads. Caulk voids around bearing pads and sponge with non-toxic sealant to prevent mortar seepage.

5. Field-placed concrete or shotcrete shall be form and/or water cured until prestressing begins.

D. Horizontal Prestressing:

1. Term "wire" signifies either wire or strand.

2. Place prestressing wire on wall with wire winding machine capable of consistently producing stress in wire within range of 0 percent to ±2 percent of stress required by design:

a. No circumferential movement of wire along tank wall will be permitted during or after stressing wire.

3. Stressing may be accomplished by drawing wire through die or other means that result in uninterrupted elongation, thus assuring uniform stress throughout length and over periphery of tank.

4. Temporarily anchor each coil of prestressing wire at enough intervals to minimize loss of prestress in case wire breaks during wrapping.

5. Minimum spacing (center to center) of prestressing wires is 3/8-inch and minimum clear space between wires of 5/16-inch or 1.5 wire diameters, whichever is greater:

a. Respace wires not meeting spacing requirements.

b. Do not place prestressing closer than 3-inch from base of walls or floors where radial movement may occur.

6. Displace band of prestressing normally required over height of opening into circumferential bands immediately above and below opening to maintain required prestressing force. Bundling of wires is prohibited.

7. Splicing of wire: Only permitted when completing application of a full coil of wire, or when removing defective section of wire:

a. Join ends of individual coils by suitable steel splicing devices capable of developing full strength of wire.

8. Use calibrated stress recording device, which can be recalibrated, in determining wire stress levels on wall during and after prestressing process.

E. Take at least one stress reading per foot or one stress reading for every roll of wire, whichever is greater, immediately after wire has been applied on wall:

1. Record readings referring to applicable height and layer of wire for which stress is being taken.
2. Contractor to keep written record of stress readings and deliver record to Owner.
3. Make stress readings on straight lengths of wire.
4. If applied stresses fall below design stress in steel, provide additional wire to bring stress up to required design stress.
5. If stress in steel is more than 7 percent over required design stress, wrapping operation should be discontinued and adjusted.

F. Foundation Drain:

1. Install to limits as shown on drawings and in accordance with approved installation plan.
2. Install foundation drain components in accordance with Sections 31 24 18 – Gravel Drain for Water Storage Tanks, 31 32 36 – HDPE Geomembrane for Water Storage Tanks, and 33 11 17 – PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks.

G. Foundation/Floor Slab:

1. No construction joints are permitted.
2. Minimum thickness of 8-inches of concrete required over pipe encasements in concrete floor (if applicable).
3. Reference Section 31 23 11 – Earthwork for Structures for subgrade conditions
4. Consolidate foundation/floor slab so no air pockets or voids are present.

H. Shotcrete:

1. Weather limitations: Comply with AWWA D110.
2. Placement: Comply with ACI 506.2 and AWWA D110.
3. Shotcrete: Applied by ACI certified nozzle men.
4. Use vertical screed wires to ensure uniform and correct thickness of shotcrete.
5. Test wall for hollow spots and repair defective areas.
6. Each shotcrete layer: Broomed prior to final set to effect satisfactory bonding for subsequent layer.
7. Do not apply shotcrete to reinforcing steel or diaphragm which is encrusted with overspray.
8. Coating of steel diaphragm:
    a. Cover steel diaphragm with layer of shotcrete at least 1-inch thick prior to prestressing.

b. Total minimum coating over steel diaphragm: 3-inches including diaphragm cover, wire cover and finish covercoat.

9. Coating over prestressing wire:

a. Individually encase each prestress wire in shotcrete of thickness enough to provide clear cover over wire of at least 1/2-inch.

b. Apply finish coat of shotcrete as soon as practicable after last application of wire coat:

1) Total thickness of shotcrete covercoat: Not less than 2-inches over wire or strand.

c. Provide natural gun finish.

I. Tolerances:

1. Out-of-plumb in total wall height: ±1/2-inch.

2. Out-of-round in diameter: ±1-inch.

J. Roof:

1. Cast-in-place or precast concrete free spanning dome roof:

a. Dome roof shall have rise to span ratio within range of 1:8 to 1:14.

b. Minimum concrete thickness: 5-inches for both precast dome and cast-in-place dome with minimum 1 1/2-inches cover to any reinforcement.

c. For cast-in-place dome:

1) Do not remove formwork for roof until concrete is of enough strength. Refer to ACI 350.

2) Give roof soffit form finish. Give exterior roof surface floated finish.

d. Dome: Fixed to tank wall.

e. Columns or interior supports will not be permitted.

f. Base dome designs on elastic spherical shell analysis.

2. Cast-in-place prestressed/post-tensioned concrete roof:

a. No construction joints are permitted.

b. Construct roof to be supported by perimeter walls and interior columns:

1) Locate and design interior columns and roof system to result in adequate strength and limit deflections in accordance with ACI 350 and IBC as applicable.

2) Minimum slope at top surface: 1.5 percent center to edge.

c. Do not remove any portion of formwork for roof until concrete is of enough strength and tendons have been fully tensioned (as applicable). Refer to ACI 350.

d. Give roof soffit form finish. Give exterior roof surface floated finish.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Test concrete in accordance with ACI 350.

B. Shotcrete:

1. Test in accordance with ACI 506.2.
2. Make tests from shotcrete while being placed.
3. Sounding of shotcrete cover-coat: As recommended in AWWA D110.

C. Watertightness Testing:

1. Tank supplier shall perform watertightness testing.
2. Upon completion of tank, Supplier shall perform watertightness testing of tank:
   a. Watertightness testing shall be performed prior to application of water proofing, if applicable, to tank walls.
   b. Water for watertightness testing shall be supplied by Contractor.
   c. Level for watertightness testing shall be high water level as shown on drawings.
   d. Procedures and criteria for watertightness testing and acceptance shall be as defined in ACI 350.1. Maximum allowable loss shall be 0.0125 percent of tank volume per day.
   e. The wall and wall-floor joint shall have no measurable seepage and shall be watertight.

   Damp spots on the exterior wall surface or measurable leakage of flowing water at the wall base where the source is from inside of the tank shall not be permitted. Damp spots are defined as spots where moisture can be picked up on a dry hand.

END OF SECTION

This page intentionally left blank.

SECTION 33 16 52
CONCRETE PRESTRESSED TANK

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of furnishing and installing concrete prestressed tank in price offered in Price Schedule 2 for San Juan Lateral Water Treatment Plant Regulating Tanks.

   a. Includes:

      1) Designing and installing, tank, tank foundation, ladders, railings, pipes, fittings, and accessories.

      2) Waterstops.

      3) PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks.

      4) Providing tank testing and associated equipment testing.

1.02 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1.	ACI 350-20	Building Code Requirements for Environmental Engineering Concrete Structures
2.	ACI 350.1-22	Tightness Testing of Environmental Engineering Concrete Containment Structures and Commentary
3.	ACI 350.3-20	Seismic Design of Liquid-Containing Concrete Structures and Commentary

B. ASTM International (ASTM)

1.	ASTM A185/A185M-07	Steel Welded Wire Reinforcement, Plain, for Concrete
2.	ASTM A416/A416M-18	Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
3.	ASTM A497/A497M-07	Steel Welded Wire Reinforcement, Deformed, for Concrete
4.	ASTM A615/A615M-20	Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

5.	ASTM A722/A722M-18	Uncoated High-Strength Steel Bars for Prestressing Concrete
6.	ASTM C881/C881M-20a	Epoxy-Resin-Base Bonding Systems for Concrete
7.	ASTM D1056-20	Flexible Cellular Materials - Sponge or Expanded Rubber
8.	ASTM D1752-18	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
9.	ASTM D2000-18	Standard Classification System for Rubber Products in Automotive Applications
10.	ASTM D2240-15(2021)	Standard Test Method for Rubber Property - Durometer Hardness

C. American Water Works Association (AWWA)

1.	AWWA D115-24	Tendon-Prestressed Concrete Water Tanks

D. American Welding Society (AWS)

1.	AWS D1.1/D1.1M-20	Structural Welding Code, Steel
2.	AWS D1.3/D1.3M-18	Structural Welding Code, Sheet Metal

E. Code of Federal Regulations

1.	29 CFR 1910.27	Fixed Ladders

F. International Building Code (IBC)

1.	IBC-2021	International Building Code (IBC)

G. Post Tensioning Institute (PTI)

1.	PTI DC10.7-20	Post-Tensioned Commercial and Industrial Floors
2.	PTI TAB.1-06	Post-Tensioning Manual, Sixth Edition
3.	PTI DC20.8-04	Design of Post-Tensioned Slabs Using Unbonded Tendons
4.	PTI M10.2-17	Specification for Unbonded Single Strand Tendons
5.	PTI M10.3-16	Field Procedures Manual for Unbonded Single Strand Tendons
6.	PTI M50.3-12	Specification for Grouting of Post-Tensioned Structures

7. PTI CRT-G1120-21 Manual for Certification of Plants Producing Unbonded Single Strand Tendons, Sixth Edition

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 33 16 52-1, Approval Drawings and Data:

1. Shop drawings:
   a. Show all details used in fabrication of tank components and tank construction.
   b. Show details used in preparation of tank foundation.
   c. Show details used in layout of tank foundation drain.
2. Manufacturer's installation instructions.
3. Tank surface finishes and coating materials.
4. Waterstop product information, samples, and certifications as requested by Contract Documents.
5. Concrete design mixes.
6. Structural design calculations or analyses sealed by a professional engineer registered in the State of New Mexico, for record purposes only.

C. RSN 33 16 52-2, Test Reports:

1. Submit certified mill test reports indicating ultimate and yield strength of reinforcing bars, prestressing and post tensioning steel, and any other steel components.

D. RSN 33 16 52-3, Documentation:

1. Furnish applicable "Affidavits of Compliance" to building codes.

E. RSN 33 16 52-4, Final Drawings and Data:

1. Submit final drawings and data consisting of approved detailed shop drawings.
2. Submit Operation and Maintenance Manuals.

1.04 DESIGN REQUIREMENTS

A. Tank:

1. Refer to Section 33 16 00 – Water Storage Tanks.
2. Design in conformance with ACI 350, and AWWA D115 and PTI TAB.1:
   a. Cast-In-Place Concrete with internal tendons.

3. Design foundation/floor slab for single concrete placements, no joints are allowed.
4. Foundation/floor slab shall consider concentrated loads from roof column supports for floor design.
5. Tank foundation drain to be installed under tank foundation/floor slab. See drawings.
6. Perimeter wall: Horizontally and vertically prestressed and cast in full-height placements:
   a. Refer to 33 16 00 – Water Storage Tanks for concrete thickness.
   b. Thickness of concrete wall: As required by AWWA D115, and applied loading, not less than 9-inches.
   c. Do not use backfill loads in design of tank to counteract hydraulic loads or provide residual compression in wall.
   d. Consider tank analysis and design on all required openings and penetrations through tank elements.
   e. Slope of floor: 1 percent center to edge.

B. Foundation/Floor Slab:
1. Refer to Section 33 16 00 – Water Storage Tanks.
2. Refer to Section 31 23 11 – Earthwork for Structures for subgrade conditions.
3. Conventionally reinforced cast-in-place concrete foundation/floor slab is not permitted.
4.
5. Post-tensioned floor membrane slab:
   a. Designed for prestressed/post-tensioned construction in accordance with AWWA D115 and ACI 350:
      1) Minimum concrete thickness in accordance with ACI 350.
      2) Minimum concrete cover in accordance with ACI 350.
6. Post-tensioned structural slab:
   a. Designed for prestressed/post-tensioned construction in accordance with AWWA D115 and ACI 350.
      1) Minimum concrete thickness: 8-inches.
      2) Minimum concrete cover in accordance with ACI 350.
   b. Provide foundation drainage system to collect leakage from tank foundation and discharge freely to daylight away from tank as shown on drawings.

C. Design for earthquake resistance based on ACI 350.3 and requirements of AWWA D115.

D. Base design on AWWA D115 and ACI 350 load combinations, with basis for loadings as defined herein:

1. Load combinations for prestressed or post-tensioned items: In accordance with AWWA D115 and ACI 350.
2. Load combinations for non-prestressed/post-tensioned items: In accordance with ACI 350.
3. Snow load: See drawings for definitions of snow loads.
4. Uniform live load over roof area: 20-psf. (non-reducible).

E. Wind Loads (during construction and prior to backfilling):

1. See drawings for definition of wind loads.

F. Design for lowest mean ambient temperature and for temperature differential required for project location.

G. Roof Design Criteria:

1.
2. Roof design for prestressed/post-tensioned construction: In accordance with AWWA D115 and ACI 350.

H. Waterstops:

1. Adhesive waterstops are not permitted.
2. For sliding joints, deflection data shall be submitted and summarized from tank analysis for these locations.
3. Shear, load, and deflection capabilities for the proposed waterstop shall be certified in writing by waterstop manufacturer and shall be adequate for movement indicated in tank analysis.
4. Continuous waterstops shall be used at all wall/footing and roof/wall joints. Joints shall be specifically detailed to remain watertight.

1.05 QUALIFICATIONS

A. In addition to qualifications listed in Section 33 16 00 – Water Storage Tanks:

1. Post-tensioning components and systems shall be provided by PTI CRT-G11120 Certified Plant.
2. Superintendent:
   a. Full-time employee of post tensioning supplier
   b. Be present during construction of tank:
   c. Holder of current Certified Grouting Technician certificate from American Segmental Bridge Institute.

PART 2 PRODUCTS

2.01 TANK

1. Materials
   a. General Requirements:
      1) Comply with AWWA D115, ACI 350, PTI TAB.1.
      2) Materials used shall conform to Section 03 30 00 – Cast-In-Place Concrete, Part 2.
   b. Concrete:
      1) Wall, interior columns, and roof: 28-day compressive strength not less than 4,500 pounds per square inch (psi) and shall be air entrained.
      2) Floor: 28-day compressive strength not less than 4,500 psi and no air entrainment.
      3) Incorporate superplasticizer and water reducing admixture into floor concrete.
2. Prestress Strand for Circumferential Tendons:
   a. Comply with ACI 350.
   b. Strand: Conform to ASTM A416, ASTM A722, or ASTM A582.
3. Reinforcing Bars, Wire Mesh:
   a. Reinforcing Bars: ASTM A615, Grade 60.
   b. Wire Mesh: ASTM A185 or ASTM A497.
4. Wedges:
   a. Conform to PTI TAB.1.
   b. Not break into separate pieces upon stressing.
   c. Designed to securely anchor strand without significantly reducing ductility of strand or tendon.
   d. Strand slip after anchoring not permitted.
   e. Prevent breaking of individual strand wires in wedges during stressing.
   f. Achieve dynamic fatigue and impact loading resistance without strand slippage or wire breakage.
5. Elastomeric Materials:
   a. Bearing pads: ASTM D2240 or ASTM D2000.
   b. Sponge filler: ASTM D1056 or ASTM D1752.
   c. Epoxy: ASTM C881 Type III, Grade I.

6. Vertical/Roof Prestressed Reinforcement (as required):
   a. Strand: ASTM A416, grade 250 or 270.
   b. Threadbar: ASTM A722, grade 150 or 160.
   c. Corrosion protect vertical prestressed reinforcing left in ducts for more than 21-days prior to grouting in accordance with AWWA D115.
7. Ducts for Bonded Tendons:
   a. Ducts for bonded tendons:
      1) Manufactured from corrosion-resistant materials
      2) Comply with PTI Guide Specification, "Acceptance Standards for Post-tensioning Systems."
8. Grout Fitting:
   a. Grout fittings: Conform to PTI M50.3.
   b. Tendons shall have grout openings at stressing anchorages.
   c. Provide grout vents or drain holes at low and high points.
   d. Prevent grout leakage at grout openings or vents.
9. Grout Materials: PTI M50.3 and AWWA D115.
10. Couplings:
    a. Couplings for bonded tendons shall not reduce elongation of rupture below requirements of tendon.
    b. Used where approved by Erection Engineer.

2.02 FOUNDATION DRAIN

A. Materials:

1. Gravel Drain Material: Conform to Section 31 24 18 – Gravel Drain for Water Storage Tanks.
2. HDPE Geomembrane, HDPE Embedment Strip, Rubber Gaskets, Stainless Steel Clamps, and Sealant: Conform to Section 31 32 36 – HDPE Geomembrane for Water Storage Tanks.
3. PVC Pipe: Conform to Section 33 11 17 – PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks.

2.03 ACCESSORIES

A. Refer to Section 33 16 00 – Water Storage Tanks.

B. Access Doors:

1. Materials:
   a. Aluminum.
   b. Stainless steel or aluminum bolts.

C. Interior Ladder:
1. Type 304 stainless steel.
2. Requirements for interior ladder: Comply with 29 CFR 1910.27 and IBC.
3. Supports on tank interior: Stainless steel.

D. DELETED

PART 3 EXECUTION

3.01 CONSTRUCTION

A. General:
1. Comply with AWWA D115.
2. Do not place concrete foundation/floor slab until subgrade approved by Erection Engineer.
3. For wall base joints with bearing pads, locate bearing pads and hold in proper position prior to erection of wall panels. Do not nail pads. Properly secure sponge filler pads. Caulk voids around bearing pads and sponge with non-toxic sealant to prevent mortar seepage.
4. Form and/or water cure field-placed concrete floors and roofs until prestressing begins.
5. Do not place concrete floor and foundation until subgrade is approved by Erection Engineer.

B. Foundation Drain:
1. Install to limits as shown on drawings and in accordance with approved installation plan.
2. Install foundation drain components in accordance with Sections 31 24 18 – Gravel Drain for Water Storage Tanks, 31 32 36 – HDPE Geomembrane for Water Storage Tanks, and 33 11 17 –PVC Gravity Drain for San Juan Lateral Water Treatment Plant Regulating Tanks.

C. Foundation/Floor Slab:
1. No construction joints are permitted.

2. Minimum thickness of 8-inches concrete required over all pipe encasements in concrete floor (if applicable).
3. Reference Section 31 23 11 – Earthwork for Structures.
4. Consolidate foundation/floor slab so no air pockets or voids are present.

D. Refer to ACI 350 for curing, hot and cold weather concreting, forming and troweled finish.

E. Tolerances:
1. Out-of-plumb in total wall height: ±1/2-inch.
2. Out-of-round in diameter: ±1-inch.

F. Roof:
1. Support roof by perimeter walls and interior columns.
   a. No construction joints are permitted.
   b. Locate and design interior columns and roof system to result in adequate strength and to limit deflections in accordance with ACI 350 and IBC as applicable.
   c. Minimum slope at top surface: 1 percent center to edge.
   d. Design forms to resist forces acting, including forces with respect to sloped surfaces.
2. Do not remove portions of formwork for roof until concrete is of enough strength and tendons have been fully tensioned (as applicable).
3. Form finish roof soffit. Exterior roof surface floated finish.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Test concrete in accordance with ACI 350.

B. Watertightness Testing:
1. Tank supplier shall perform watertightness testing.
2. Upon completion of tank, tank supplier shall perform leak testing of tank:
   a. Watertightness testing shall be performed prior to application of water proofing, if applicable, to tank walls.
   b. Water for watertightness testing shall be supplied by Contractor.
   c. Level for watertightness testing shall be high water level as shown on drawings.
   d. Procedures and criteria for watertightness testing and acceptance shall be as defined in ACI 350.1. Maximum allowable loss shall be 0.0125 percent of tank volume per day.

e. The wall and wall-floor joint shall have no measurable seepage and shall be watertight.

f. Damp spots on the exterior wall surface or measurable leakage of flowing water at the wall base where the source is from inside of the tank shall not be permitted. Damp spots are defined as spots where moisture can be picked up on a dry hand

END OF SECTION

SECTION 51 00 42

NTUA WATERLINE RELOCATION REQUIREMENTS

PART 1 GENERAL

IHS/NECA SPECIFICATIONS

GENERAL CONDITIONS		PAGE
GC-01	Character of Work	1
GC-02	Climatic Conditions	1
GC-03	Preconstruction Conference and Site Investigation	2
GC-04	Operation and Storage Area	2
GC-05	Other Contractors	2
GC-06	Cost Data	3
GC-07	Safety and Health	3
GC-08	Changes	3
GC-09	Clean-up	4
GC-10	Suspension of Work	4
GC-11	Protests	4
GC-12	Materials and Equipment to be furnished by NECA	4
GC-13	Protection of Materials During Handling & Storage	5
GC-14	Reference Specifications	5
GC-15	Responsibility for Damage to NECA's Equipment	5
GC-16	Supervision by Foreman	5
GC-17	Rights-of-Way and Archeological Clearances	6
GC-18	Engineer's Responsibility	6
GC-19	NECA Responsibilities	7
GC-20	Pre-Final Inspection	7
GC-21	Moving Fences and Minor Structures	7
GC-22	Blasting	8
GC-23	As-Built Records and Markers	8
GC-24	NECA Monthly Invoices	8
	Definitions	9

TECHNICAL PROVISIONS

Section 1	Clearing and Grubbing	1-1
Section 2	Excavation, Trenching and Backfilling	2-1
Section 3	Installation and Testing of Waterlines	3-1
Section 4	Installation and Testing of Sanitary Sewer Lines	4-1
Section 5	Water Storage Tank Construction	5-1
Section 6	Waste Stabilization Pond Construction	6-1
Section 7	Treatment Building Construction	7-1
Section 8	Individual Waste Disposal Systems	8-1
Section 9	Concrete Work	9-1

SPECIFICATIONS
IHS/NECA General Conditions

GC-01 CHARACTER OF WORK

The work to be accomplished under these specifications includes all labor, equipment, and materials to complete the sanitation facilities as set forth in the specific project drawings and these specifications. The work performed is to be conducted on a cooperative basis by the Navajo Area Indian Health Service (NAIHS) and the Navajo Engineering and Construction Authority (NECA). NECA shall provide the equipment, labor, logistical support, administration, and equipment and labor supervision and IHS shall reimburse NECA for all actual costs of construction including payroll, payroll burden, materials, equipment, and all appropriate overhead. The NECA Foreman shall be responsible for production, methods, and quality control of construction (see GC-17). IHS shall provide all materials and an Engineer who will be responsible for general supervision of the project, planning, technical direction, and liaison with outside entities, such as the Tribe, the operating utility or other contractors (see GC-19). Because of the unique relationship between IHS and NECA, it is imperative that the IHS Engineer and NECA Foreman work together with frequent consultations and joint decisions on matters affecting project scheduling, equipment usage, crew size make up, project cost accounting, and quality control.

The work shall be executed in the best and most workmanlike manner by qualified, careful, and efficient workers in strict accordance with the project drawings and specifications.

GC-02 CLIMATIC CONDITIONS

After consultation with the NECA Foreman, the IHS Engineer may order the NECA crew to suspend work due to inclement weather. Factors to be considered include project time schedules, efficiency and productivity, equipment damage, and overall project costs.

When NECA workmen have been told to report for work but work is suspended due to adverse weather or other reasons, the workmen shall be paid 2 hours show-up time with the concurrence of the Engineer. No charge shall be made for hourly equipment except for a maximum 2 hr. charge for the foreman's pick-up. When work is suspended during a shift, NECA workman shall be paid for all hours worked with a minimum of 2 hours pay and equipment shall be paid for based on the current policy. The Engineer and NECA Foreman are to jointly discuss the resumption of work at the time work is suspended.

Any crew whose work has been suspended because of climatic conditions shall not report for work until told to do so by the crew foreman. It shall be the crew foreman's responsibility to check with the Engineer and inform his crew when to return to work.

GC-03 PRE-CONSTRUCTION CONFERENCE AND SITE INVESTIGATION

No construction on any part of this project shall begin until a pre-construction conference has been held with all interested parties. Copies of the plans and the JCA should be provided to the NECA Foreman and Field Superintendent at least two weeks prior to the pre-construction conference. Those invited to the pre-construction conference should include appropriate NECA and IHS representatives, chapter officials, representatives of the future utility operator, in particularly critical areas an archaeologist and officials from other funding agencies. Topics to be discussed should include, but not be limited to, detailed review of construction plans, right-of-way limits, known archaeological sites and procedures to follow if new sites are uncovered, NECA camp/yard location and utilities for same, material yard set-up, working hours, crew size and makeup, equipment to be used, weather conditions, schedules and deadlines, existing utilities, source of construction water, project staking methods to be used, general responsibilities by all involved parties, timesheets, JCA budget and these specifications including the General Conditions and Technical portions. The pre-construction conference is to be documented by the Engineer and copies of the documentation is to be sent to all attendees within one week after the meeting.

During the pre-construction conference, the NECA Foreman and the Project Engineer are to visit the site and inform themselves of all the conditions under which the work is to be completed and satisfy themselves as to the nature and location of the work, the general and local conditions, particularly those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electrical power, roads, river or wash conditions or similar physical conditions at the site, the conformation and condition of the ground, the character of equipment and facilities needed before and during the work, and all other matters upon which information is reasonably obtainable and which can in any way affect the work or the cost thereof. The Foreman shall also familiarize himself with regard to the existence of old car bodies, abandoned houses, fences, driveways, sidewalks, approaches, archaeological sites, existing utilities and other miscellaneous obstacles to construction.

GC-04 OPERATION AND STORAGE AREA

All operations of NECA (including storage of materials) upon Tribal or other lands shall be confined to areas authorized by the Engineer. No unauthorized or unwarranted entry upon or passage through or storage or disposal of materials shall be made upon Tribal lands.

NECA shall arrange for temporary facilities for personnel quarters and storage of material and equipment. Arrangements for temporary facilities shall be made with the approval of the Engineer. Costs of temporary facilities shall be an allowable project charge.

NECA shall use only established roadways or approved Right-of-Ways. Where materials are transported in the course of the work, load limits of existing bridges and roadways shall not be exceeded. When it is necessary to cross curbing or sidewalks, protection against damage shall be provided by NECA.

GC-05 OTHER CONTRACTORS

GC-05.01 Cooperation

It shall be the obligation of NECA to cooperate with other contractors (including grading, paving, house construction, and plumbing contractors) in order to facilitate the smooth and successful completion of the project.

GC-05.02 Negotiations

If equipment or other construction services are required, which are not available under existing NECA-IHS equipment schedules, NECA shall obtain the Engineer's approval of purchase or rental arrangements.

GC-05.03 Complaints

Any complaints related to the project involving other contractors or individuals not in NECA's employ shall be directed to the Engineer.

GC-06 COST DATA

Because of the NECA/IHS non-profit relationship, the IHS Engineer shall have access to all payroll, records of personnel, invoices of materials, records of plant and equipment and all other data relevant to the equipment, and all data relevant to the performance of the work or necessary to determine its costs. Records kept on the project shall be available to the Engineer at any time. Records kept at NECA headquarters shall be available to the Engineer upon reasonable notice.

In addition to payroll access, the Engineer shall have submitted to him the weekly Job Cost Accounting reports. Changes to approved NECA-IHS wage and equipment rental rate schedules shall only be made with the concurrence of the IHS Area Office. The Area Office will be responsible for notifying the Field Engineer of any such approved changes. The timesheets shall be prepared daily and the Engineer or his representative shall be available daily to sign the timesheets. A regular schedule for timesheet review and approval shall be established at the preconstruction meeting.

GC-07 SAFETY AND HEALTH

In order to protect life and health of the employees and other persons, prevent damage to property, materials, supplies and equipment, and to avoid work interruptions, NECA shall, in the performance of all project work, comply with the 1970 Federal Occupational Safety and Health Act and all regulations adopted pertaining thereto and all other State and Tribal safety, health, and sanitation laws and codes.

NECA shall also comply with all pertinent provisions of the manual "Accident Prevention in Construction", published by the Associated General Contractors of America, Inc., and amendments thereto. The Engineer shall notify the NECA Safety Officer of any uncorrected non-compliance. NECA shall, after receipt of such notice, immediately correct the conditions to which attention has been directed. Such notice, when served to NECA or its representative at the site, shall be deemed sufficient.

If NECA fails or refuses to comply promptly with requirements, the Engineer may issue an order to suspend all or any part of the work. However, if a life jeopardizing condition exists, the Engineer shall have the authority to stop work immediately by oral instruction. When satisfactory corrective action has been taken, an order to resume work will be issued.

GC-08 CHANGES

The Engineer has the right to make changes in the plans at any time either orally or in writing. NECA shall adhere to any changes originated by the Engineer. The IHS Technician shall not have the authority to make verbal changes to project plans or specifications unless agreed to by the Engineer

at the pre-con.

If the plans and specifications differ (e.g., the plans call for a different material, method of installation or mode of construction), the plans shall be binding unless a written change order is received from the Engineer. Any conflict between these specifications and the plans shall be brought to the attention of the Engineer.

GC-09 CLEAN UP

The NECA crew shall at all times keep the construction areas, including storage areas, free from accumulation of waste material or rubbish and prior to completion of the work remove any rubbish from the premises and all tools, scaffolding, equipment, and materials not the property of the Government.

Upon completion of the construction and before the final inspection NECA shall leave the work and premises in a clean, neat, and workmanlike condition satisfactory to the Engineer. All rubbish shall be disposed of in an appropriate site approved by the Engineer. Waste that may be considered hazardous should be disposed of only after clearance and recommendations from the Engineer.

GC-10 SUSPENSION OF WORK

The Engineer may order NECA, orally or in writing, to suspend, delay, or interrupt all or any part of the work, for any reason, for such period of time as he may determine to be appropriate for the convenience of the Government. Weather related suspensions shall be handled in accordance with Section GC-02.

If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted by an act of the Engineer during this project (or if no time is specified within a reasonable time), a protest may be called by NECA.

GC-11 PROTESTS

All misunderstandings, other problems, and disputes should be discussed between the Engineer and the NECA Foreman and be settled as quickly as possible. If a solution cannot be reached between the Engineer and Foreman, a meeting will be held with the Engineer, NECA Foreman, appropriate IHS District Engineer, and the NECA Field Superintendent. At NECA's option, the NECA General Superintendent may participate. The meeting shall be documented in writing.

If the second level meeting fails to resolve the problem, the above parties shall request a meeting to include the NECA General Manager and the Director, DSFC. The meeting is to also be documented in writing by IHS. If the final decision involves a change in policy or clarifies an existing policy, written documentation on the decision will be sent to all IHS and NECA personnel by the Director, DSFC, and NECA General Manager.

GC-12 MATERIALS AND EQUIPMENT TO BE FURNISHED BY NECA

Under the Memorandum of Agreement for the project, NECA is charged with providing "labor, tools, and equipment" which shall be interpreted to include all supplies necessary to operate such tools and equipment, and all other supplies required for the efficient administration of the project.

Such items include, but are not limited to, gas, oil, grease, and other maintenance materials for the

machinery, also bits, blades and buckets, payroll slips, any common specialty tools normally used in waterline, sewerline, and interior plumbing installation, and any other related items. The current IHS/NECA "Equipment Reporting Policies and Procedures" and equipment rental schedules shall govern payment for NECA equipment.

The Memorandum of Agreement allows NECA "to procure and install materials, equipment, and supplies, as authorized by IHS, necessary for the proper installation of facilities...". This clause allows NECA to purchase materials required for construction. All NECA purchases shall be in accordance with DSFC Guideline 9.3, Ordering Materials, Supplies, and Services through NECA. NECA maintains supplies at their headquarters in Shiprock, New Mexico, to provide most materials required for construction of P.L. 86-121 projects. The Engineer is responsible for the orderly planing of the project, materials list development, scheduling and ordering of materials required for a particular project, and providing adequate lead time for purchase and shipment of materials either through the government system or through NECA purchasing.

GC-13 PROTECTION OF MATERIALS DURING HANDLING AND STORAGE

NECA shall be responsible for the efficient and orderly pick-up and transport of materials supplied for project construction. This material delivery responsibility shall require reasonable care for protection from damage, loss, or theft during pick-up, delivery, and off-loading at project storage areas. All materials are to be verified against the shipping invoice at each project yard at the time of delivery by the Engineer or his representative.

Materials delivered to the project sites shall be stored in fenced compounds or temporary storage sheds to prevent theft, vandalism, or damage unless immediately incorporated into project construction. All furnished materials should be protected with reasonable care at all places of project construction by methods agreed upon between NECA and the Engineer. Due to the non-profit method of construction, the IHS is ultimately responsible for replacement of any materials lost or damaged during project construction. The cost of all protection methods, such as night watchmen, shall be a cost to the IHS project.

GC-14 REFERENCE SPECIFICATIONS

Where reference is made to Federal, American Water Works Association, or Navajo Area Specifications, copies of said specifications are available to NECA from the Office of Environmental Health, Window Rock, Arizona.

NECA is directed to follow the manufacturer's descriptive information regarding installation of materials. These guides are available at the Office of Environmental Health, Window Rock, Arizona.

GC-15 RESPONSIBILITY FOR DAMAGE TO NECA'S EQUIPMENT

NECA shall take reasonable precaution to prevent damage to its equipment or any rental equipment from vandalism, misuse, or the weather. Any employee found to be negligent in this respect will be subject to disciplinary action which could include dismissal. The cost of repair of damage shall be paid from the equipment account.

GC-16 SUPERVISION BY FOREMAN

The NECA Foreman shall provide personal supervision to the work at all times during its progress. At the pre-construction conference, the NECA Foreman shall designate personnel to act in his behalf

in his absence. NECA crews shall be supervised at all times. In order for NECA to provide adequate supervision, concurrence of the appropriate NECA Field Superintendent shall be obtained prior to the establishment of subcrews operating in scattered locations.

GC-17 RIGHTS-OF-WAY AND ARCHAEOLOGICAL CLEARANCES

It shall be the duty of the Engineer to inform NECA at the pre-construction conference of all archaeological clearances and rights-of-way including easements, land withdrawals, and publicly designated rights-of-way for the construction of water and sewer facilities within the project area including the storage yard. It is understood by NECA that these lands and these lands alone will be subject to clearing, grubbing, or disturbing and only to the extent that may be necessary for the construction of the project facilities. NECA shall take every precaution necessary to avoid damage to other utilities as may be shown on the drawings or indicated by the Engineer. When crossing any type of utility with water and sewer facilities installed under this project, the Project Engineer shall inform the owner of said utilities at least five (5) calendar days prior to the crossing. If such lines are not shown on the drawings or sited by the Engineer, NECA, immediately upon detecting these lines, shall inform the owner and Engineer and stop all work in the area except such emergency repairs as may be necessary to preserve life or property until notice to proceed has been given by the owner.

The Engineer shall flag all archaeological sites on the project with orange flags. The NECA crews foreman should be made familiar with these sites at the pre-construction conference and shall be responsible for informing all the members of his crew of the location of each site.

Archaeological sites are not to be excavated or otherwise disturbed. All borrow pits, road construction or road improvements, or any dirt work outside the normal 30 foot pipeline right-of-way shall have archaeological clearance and shall be properly staked by the Engineer before NECA work is to commence in the areas.

If a hidden archaeological site is discovered within the approved right-of-way boundary, NECA is to stop work at that site and notify the Engineer. The Engineer will contact the Area Office as quickly as possible to obtain instructions. The NECA crew should wait for instructions from the Engineer before moving equipment to another area of the project, however, crew members may be shifted to other construction activities on the project.

The Historic Preservation Act of 1966 is very explicit about the protection of archaeological sites and all persons working under these specifications must be aware of individual responsibilities. While accidental damage to sites may occur, any individual responsible for knowingly and purposefully damaging sites or removing artifacts can be prosecuted, and NECA and IHS will not protect an individual from prosecution arising from these criminal acts.

GC-18 ENGINEER'S RESPONSIBILITY

In addition to supplying NECA with a minimum of two (2) complete sets of plans and any revisions there to, the Engineer shall also be responsible for the following:

1. System Design - This is to include all calculations, the design of all components, and the production of a complete set of plans. NECA is responsible for building according to those plans.

2. Acquisition of All Clearances and Permits - This is to include rights-of-way, archaeological clearance, road crossing permits, use of areas for borrow pits, disposal of materials or

excess fill, storage or temporary camps, and any other clearance or permits necessary to complete the construction.

3. Procurement of Supplies and Materials - This is to include all supplies and materials to be installed on the project. This does not include the equipment, supplies, and materials used to actually perform the installation which will be provided by NECA.

4. Project Management and Inspection - The Engineer has overall responsibility for project planning and scheduling including project start-up, material scheduling, cost monitoring, coordination with outside entities, surveying, layout, inspection, project documentation, revisions to plans and specifications, archaeological coordination, and project correspondence. He shall also consult with NECA Foreman on decisions concerning project scheduling, equipment usage, crew size and make up, project cost, and quality control.

5. Consultation - The Engineer shall be available to NECA at all times for consultation on any phase of the project.

GC-19 NECA RESPONSIBILITIES

The NECA Foreman shall be responsible to coordinate scheduling manpower utilization on the project with the Engineer, to coordinate the scheduling and use of equipment on the project with the Engineer, to determine efficient and productive work methods and techniques, to advise the Engineer of requirements for materials or outside services, and to keep accurate project as-builts. The NECA Foreman is responsible for managing construction operations to provide proper levels of quality assurance and cost control.

The NECA Field Superintendent shall be responsible for the operation of projects in his district and shall have line authority over the NECA Foreman. The Field Superintendent shall be responsible for scheduling the requested equipment in and out of projects and shall be responsible for compliance with NECA policies and procedures by NECA field crews. The Field Superintendent shall be responsible, on behalf of NECA, for establishing guidelines for construction methods and techniques at the pre-construction meeting. He shall also be consulted by the Project Engineer and NECA Foreman for methods and techniques to be used in specialized situations. Coordination or communication difficulties between IHS Engineers and NECA Foreman are to be referred to the Field Superintendent and IHS District Engineer for resolution. The Field Superintendent shall be kept advised of matters such as project shutdown or changes to the guidelines developed at the pre-construction meeting.

GC-20 PRE-FINAL INSPECTION

A pre-final inspection shall be called by the Engineer as soon as possible after completion of construction. The pre-final inspection shall be held at the job site and attendees shall consist of the NECA Foreman, the Engineer, the IHS District Engineer, the NECA Field Superintendent, and any other interested parties. After the deficiencies found at the pre-final inspection are corrected by NECA, a final inspection will be arranged.

GC-21 MOVING FENCES AND MINOR STRUCTURES

NECA shall make the temporary openings in fences and make the necessary repairs to replace the existing fences to their original locations and conditions. Culverts, drainage pipes, or other minor structures which may have to be moved temporarily from the alignment of the work shall be removed,

cared for, and reset by NECA in a satisfactory manner. The Engineer shall be responsible for informing the owner of work to be performed on the property.

GC-22 BLASTING

Where blasting is required, NECA shall use reasonable care to protect life and property and shall comply with all laws, ordinances, applicable safety code requirements, and regulations relative to the handling, storage, and use of explosives. NECA shall secure all necessary permits and shall take all necessary precautions to avoid damage to all adjacent structures and land. All rock which cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with other backfill materials except as approved by the Engineer. NECA shall dispose of all rock excavated as directed by the Engineer.

NECA shall erect suitable barricades and/or warning signs on all public thoroughfares leading to the site of blasting operations and shall give adequate audible warning before each discharge.

GC-23 AS-BUILT RECORDS AND MARKERS

During the project, record keeping for as-builts showing locations of all facilities installed is NECA's responsibility. This record shall include, but not be limited to, locations of all valves, hydrants, cast iron fittings, corporation stops, curb stops, tapped couplings, manholes, and sewer wyes.

An accurate copy of the "as-constructed" information shall be reviewed daily or weekly by the Engineer.

A site sketch showing stationing along sewer, water, and force main lines shall be prepared showing locations of corporation stops, hydrants, valves, fittings, sewer wyes, and manholes as actually installed. The locations of water and sewer mains shall be referenced to the center lines of streets or roads. The locations of hydrants, valves, curb stops, and manholes shall be referenced to the houses. The data collected shall be to the satisfaction of the Engineer.

Where water and sewer lines cross, both vertical and horizontal measurement shall be taken and shown on the "as-constructed" drawings.

NECA shall place water line and valve markers as noted on the plans.

GC-24 NECA MONTHLY INVOICES

GC-24.01 Progress Reports

Monthly reporting in the form of an invoice per project will be required of the NECA Headquarters. These invoices will be a compilation of the past month's costs to each project. These invoices will show the total labor, payroll burden, equipment, supplies and management costs incurred on each project each month. Detail supporting data with each invoice will include weekly accounts of each person's total hours worked, hourly rates, hours per duties performed, subtotal of cost per duty performed, and total cost of all duties. All supplies and materials used on the job will be itemized. The Engineer will verify the invoices' charge, sign approval, and submit it to the Director, DSFC, in the IHS Area Office for payment. Any discrepancies will be noted in writing by the Project Engineer in a request for a credit memo sent to the NECA Headquarters for adjustment and issuance of a credit memo.

GC-24.02 System Testing

The Foreman will perform all standard and special system testing required by the Engineer. These tests include but are not limited to: line flushing, gate valve operation, control valve adjustments, water and sewer main pressure testing, manhole testing, and chlorination of facilities. The Engineer will supply the Foreman with the appropriate forms and timetables.

Definitions

Engineer	The project manager as established by Navajo Area Director of Indian Health Service.
NECA	Navajo Engineering and Construction Authority
Tribe	The Navajo Tribe
Government	The United States Government
NECA Foreman	The project foreman or superintendent designated by NECA as the on-site person responsible for construction activities.

TECHNICAL PROVISIONS

Section 1 - Clearing and Grubbing

TP-1.01 General

This work shall consist of clearing, grubbing, removing, and disposing of vegetation and debris in accordance with these specifications, except such objects as are designated to remain. This work shall also include the preservation from injury or defacement of all vegetation and objects designated to remain.

TP-1.02 Scope of Work

The Engineer will establish right-of-way lines and construction lines and designate all trees, shrub, plants, and other things to remain. NECA shall preserve all things designated to remain.

Right-of-Way lines will be established by staking and marking with colored flagging all points of intersections of proposed water and sewer lines. Clearing of right-of-way shall be performed so as to disturb only the minimum path required to install the pipeline but no area outside of a path 15 feet on either side of the marked centerline of the proposed line.

Offset markers (hubs) are set at every point of intersection so that the originally surveyed point may be reset after the clearing and grubbing process. NECA will take particular care not to disturb these reference points.

TP-1.03 Construction Requirements

Prior to commencing work, the Engineer shall contact all utility operators in the vicinity to inform them of intention to begin work. Care shall be taken to protect existing utilities during clearing and grubbing and markers indicating location of existing utilities will be repositioned if disturbed during the clearing and grubbing process.

If combustible materials are burned, they shall be burned under the constant care of competent watchmen and in accordance with applicable laws and ordinances and in such a manner that things designated to remain on the right-of-way, the surrounding forest or grass cover, and other adjacent property will be protected from damage.

Non-combustible materials and rubbish shall be removed to a site designated by the Engineer.

Marketable timber, small timber, and slashings felled during the clearing of right-of-way shall be removed from the right-of-way and disposed of in accordance with grant of easement stipulations. The Engineer is responsible for all arrangements required to dispose of marketable timber in accordance with current Tribal regulations. Please refer to GC-18 for archaeological and right-of-way provisions.

TECHNICAL PROVISIONS

Section 2 - Excavation, Trenching, and Backfilling

TP-2.01 Scope

The work covered by this section includes the furnishing of all plant, labor, tools, and equipment, and performing of all operations in connection with the excavation, trenching and backfilling of all water pipe lines, sanitary sewerlines, manholes, structures, accessories, and lines connected thereto, complete including sheathing and shoring, dewatering, grading, top soiling, seeding, and clean up, all in accordance with these specifications and the applicable drawings.

TP-2.02 Protection and Safety

NECA shall provide suitable sheathing, shoring, and bracing to protect all excavations as required to provide safe working conditions in conformance with Construction Industry Standards, OSHA 220 7, 1983, or latest revision, including Sub-part P - Excavations, Trenching, and Shoring.

NECA shall obtain an approved traffic plan from the state transportation department or Bureau of Indian Affairs, Branch of Roads, when required. NECA shall provide signs, barricades, red lights, and watchmen, and take all necessary precautions for the protection of the work and the safety of the public. All barricades and obstructions shall be protected at night by signal lights which shall be kept burning from sunset to sunrise. Barricades shall be of substantial construction and shall be painted white or reflective to increase their visibility at night. Suitable signs shall be so placed as to show in advance where construction, barricades, or detours exist.

NECA shall at all times perform its work so as to insure the least possible obstruction to traffic or inconvenience to the general public and the residents of the vicinity of the work and to insure the protection of persons and property in a manner satisfactory to the Engineer. No road or street shall be closed to the public except with the permission of the Engineer and proper Governmental authority. Fire hydrants on or adjacent to the work shall be kept accessible to fire fighting equipment at all times. Temporary provisions shall be made by NECA to insure the use of sidewalks and the proper functioning of all gutters, sewer inlets, drainage ditches, and irrigation ditches.

The maximum length of open trench, where the construction is in any stage of completion (excavation, pipe laying, or in backfilling), shall be 500 ft. or as determined by the Engineer. With the approval of the Engineer, pipe laying may be carried on at more than one location. The restrictions on open trench applying to each location.

TP-2.03 Excavation

NECA shall perform all excavation of every description and of whatever substances encountered to the depths indicated by these specifications or on the drawings. Excavated materials shall be piled a sufficient distance from the banks of the excavation to avoid overloading and to prevent slides or cave-ins.

Excavation for structures and other accessories shall be sufficient to leave at least 12-inches clearance between their outer surfaces and the embankment or shoring which may be used to hold the banks.

All excavation shall be made by open cut except as shown on the plans. The banks of trenches shall be kept as nearly vertical as soil conditions permit below the level of the top of the pipe. Trenches shall be as narrow as possible and not more than 30-inches wider that the outside of the diameter of the pipe laid therein and shall be excavated true to line. The pipe shall be centered in the trench. The maximum width of the trench specified applies to the width at and below the level of the top of the pipe. The width of the trench above that level may be as wide as necessary to avoid slides or cave-ins or for the installation of sheathing and bracing and proper installation of the work, but care shall be taken not to injure abutting property. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length, except for portions of the pipe sections where it is necessary to excavate for bell holes. Bell holes shall be excavated only to an extent sufficient to permit accurate work in the making of the joints and to insure that the pipe, for a maximum of its length, will rest on the prepared bottom of the trench. In rock excavation, NECA shall excavate approximately 6-inches deeper than the required level and bed the pipe or appurtenances in clean sand or a gravel with maximum size of 3/4-inch crushed rock that will provide uniform bedding throughout the length of pipe installed. The bedding material shall be added to extend upward at least half the diameter of the pipe. The bedding material and procedure will be used in all cases of over excavation.

TP-2.04 Grading

All grading in the vicinity of the trench excavation shall be controlled to prevent surface water from flowing into the trenches. During excavation, materials suitable for backfilling shall be piled in an orderly manner a sufficient distance back from the edges of the trenches to avoid overloading and to prevent slides or cave-in. Materials unsuitable for backfilling shall be wasted as directed by the Engineer.

TP-2.05 Removal of Water

NECA shall remove and dispose of all water entering the trenches and shall keep the trenches water free until the water mains, fittings, valves, sewerlines, manholes, and other appurtenances are in place and sealed against the entrance of water. Every attempt shall be made to prevent foreign materials from entering the water mains or sewer lines.

TP-2.06 Protection of Existing Utilities

It shall be the Engineer's responsibility to determine the locations of any existing underground utilities not shown on the drawings and to confirm the exact locations of those existing utilities shown on the drawings. All existing utilities shall be protected from damage during excavation and backfilling of trenches and, if damaged, shall be repaired.

TP-2.07 Trench Backfilling

After the jointing is completed and the pipe has been approved by the Engineer, the trench shall be backfilled by hand to a depth one foot over the crown of the pipe with dry or damp selected material free from clods or stones larger than 3/4-inch. The backfilled materials shall be placed evenly around and over the pipe in six-inch layers and thoroughly compacted by hand tamping. After the initial backfill has been placed in the manner specified, the remaining backfill shall be machine placed and mounded unless otherwise specified by the Engineer. Surplus materials shall be disposed of as directed by the Engineer.

TP-2.08 Roadway Crossings

Whenever existing roadways are disturbed during the normal course of construction, NECA shall restore the roads to their original condition.

The Engineer shall obtain written permission from the necessary agencies prior to beginning any roadway excavation. Trench backfill within the limits of a roadway shall require special compaction in accordance with the requirements of the road crossing permit and/or the NAIHS Design Criteria.

Surfacing shall be placed where the roadway has gravel or asphaltic surfacing. Gravel shall be replaced in quantities and locations as directed by the Engineer.

TP-2.08.1 Regraveling

Where regraveling is required after crossing of existing roads, the following procedures shall be followed. NECA shall remove existing gravel surfacing, stockpile the materials, and restore the road surface after installation of the pipe. The stockpiled materials shall be used for backfilling to within two-inches of finished level. The final two-inches of gravel surfacing shall conform to the requirements of BIA Branch of Roads. This material shall be placed only in the amount and at the locations designated by the Engineer.

TP-2.08.2 Asphalt Resurfacing

Asphalt mix surfacing shall be placed in the roadway to a minimum depth equal to that of the existing roadway over a 6-inch compacted stabilized gravel sub-base. All opening shall either be cut square or sawed straight. Patches shall be placed as soon as possible after the trench is backfilled.

TP-2.9 Excavating Unsuitable Foundation Material and Select Backfill

Where shown on the plans and authorized by the Engineer, foundation materials which are unsuitable to carry the pipe or structure to be placed on it shall be excavated and replaced with material approved by the Engineer. The backfilled materials shall be deposited and spread in layers not to exceed six-inches and each layer shall be thoroughly compacted by tamping. Selected bedding material shall be added to extend upward at least one-half the diameter of the pipe.

TP-2.10 Finish Grading

After the structures have been constructed and installed, all piping installed, and all backfilling and embankments have been completed, areas on the site of the work shall be brought to the true grades. All slopes shall be trimmed and dressed and all surfaces graded so that effective drainage is secured. All machine backfilled trenches shall be mounded.

TP-2.11 Disposal of Excess Materials

All excess excavated material shall be disposed of by NECA in areas designated for that purpose by the Engineer.

TECHNICAL PROVISIONS

Section 3 - Installation and Testing of Water Lines

TP-3.01 General

The scope of this section includes the performance of all pipe laying operations as called for on the plans and as directed by the Engineer. Included is the placing of all valves, fittings, and appurtenances and all other operations necessary for placing and testing of the water lines and preparing them for use.

All lines and grades for the excavation will be staked out by the Engineer or by others under his supervision. All work shall conform to these lines and grades.

TP-3.02 Trench Excavation

Mainline water line trench shall be excavated to sufficient depth to provide a minimum of 42-inches between the top of the pipe and the finished grade unless specified otherwise on the plans. All trenching shall be done in accordance with Technical Provision, Section 2 - Excavation, Trenching, and Backfilling.

TP-3.03 Laying Pipe

Pipe shall be laid in accordance with the pipe manufacturer's recommendations. Particular care should be given to using the proper lubricant for each type of pipe and joint. Pipe sections shall be carefully lowered into the trench in a safe manner and joined in the trench by experienced craftsmen.

TP-3.04 Casing

Water pipe installed within the steel casing shall be supported continuously between couplings with wooden spacers to centralize the water pipe within the casing and to decrease the effect of rubbing of the water pipe against the casing during periods of water hammer. A minimum of three bands per joint shall be used for attaching spacers to the pipe. The bands shall be located with one near each end and one near the center of the pipe joint. Casing ends shall be sealed with an approved seal to exclude all dirt and debris from casing. Casing pipe shall be placed as shown on the plans. Casing pipe may be straight welded steel pipe unless otherwise specified. All welds shall be watertight in accordance with AWWA Standard (C206) Mill-Type Water Pipe. An alternate casing for open cut crossings can be galvanized corrugated metal pipe (CMP). For gas line crossings PVC SDR 26 pipe shall be used for casing.

TP-3.05 PVC Pipe

Procedures for handling and installation of PVC pipe shall be those recommended by the Uni-Bell Plastic Pipe Association Handbook of PVC Pipe, Chapter VI, Construction, unless otherwise directed by the Engineer, plans, or specifications.

No more that 5° deflections shall be allowed at any one point. If the plans call for a greater angle, fittings shall be used to achieve the result even though such fittings may not be called for on the plans. Thrust blocks shall be placed on all fittings as indicated on the standard details.

Where required, the pipe shall be cut square using a tubing cutter or a carpenter's fine tooth hand saw or hacksaw. Once cut, the pipe shall be machine or hand bevelled to give a one-half inch tapered end.

TP-3.06 Valves and Markers

Gate valves, air-release valves, pressure reducing valves, blow-off valves, and any other valves shown on the drawings or indicated by the Engineer shall be installed and marked. Marking shall be accomplished using five-foot fence posts when not in a paved road or concrete walk way. When located within a housing area, temporary wooden lathes shall be used to mark the valves until construction on the housing site is completed. When located in housing areas where construction on roadways is either not started or not completed, NECA shall locate each valve and box from two permanent markers as it is installed so that if the marking is disturbed or destroyed the valve and box can be relocated.

Gate valves, two-inches and larger, shall be anchored with a minimum of two cubic feet of concrete (approx. 3-80 lb. sacks of concrete pre-mix) and a minimum #4 rebar firmly wrapped around each end of the gate valve and encased in the concrete unless the Engineer directs otherwise.

Valve vaults shall be cleaned free of dirt and debris after construction and sealed sufficiently to prevent infiltration of dirt and water. All pipe and appurtenances inside the vaults shall be painted to protect against corrosion.

The concrete collar for each valve shall show the size of the valve and the direction of flow inscribed on its surface as per the standard detail.

TP-3.07 Hydrants

Hydrants shall be placed so that the barrel is plumb and the outlets are easily accessible at least 12-inches above the finished grade. Where required, risers shall be placed on the hydrant barrel to bring the outlets up to an acceptable level.

It shall be NECA's responsibility to inform the Engineer of the necessity for risers when the need for such becomes apparent.

Adequate gravel seepage area shall be provided around the weep hole near the hydrant (a minimum of 8.5 cubic feet per hydrant). Gravel shall be installed as per the standard detail. A suitable concrete thrust block shall be constructed at the base of each hydrant in accordance with the drawings. Once the hydrant is set, concrete shall be poured against undisturbed earth in such a manner that the weep hole is kept free from all concrete or mortar. If the weep hole is covered either partially or wholly, the hydrant shall be removed and cleaned and the gravel and concrete removed and replaced with new gravel and concrete.

Hydrant guards shall be placed by NECA as shown on the plans at every hydrant. Guards shall be placed to allow easy operation of the operating nut of the hydrant's gate valve and to provide hose clearances for all nozzles. Hydrant guard shall be painted with two coats of red enamel.

TP-3.08 Service Lines

The water service lines shall be installed from the main to a location near each home as shown on the plans or as specified by the Engineer. If the water service line from the home has been

installed and stubbed out, NECA shall connect the plastic service line to the existing water line in such a manner as to comply with the drawings, these specifications, applicable plumbing codes, and accepted standards of good workmanship. If the water line has not been stubbed out from the home, NECA shall terminate the service line with a plug or cap within five (5) feet of the home and mark the end with a 2" x 4" stud. The stud shall be located from at least two permanent landmarks. An alternate can be to bring the PE pipe above the ground and crimp it. The measurements from the permanent landmarks shall be given to the Engineer within one week of the completion of the installation of the service line.

The minimum cover allowed over water service lines is 42-inches in roadways and 36-inches in all other places.

Sleeves, saddles, or tees can be utilized for taps. However, saddles are not to used on 2-inch mains or when the diameter of the main is less than 2 times the service line diameter. All sleeves, saddles, and tees shall be specific for the type, size, and pressure rating of mainline pipe.

Service line installation shall be complete except for meters and connections to houses without stubouts. Meters will be installed by the system operator. After pressure testing, the service lines shall be individually flushed for removal of dirt and debris through the meter yoke. Curb stops shall be left in the off position upon completion of construction.

Water and sewer lines shall be laid in accordance with Section TP 3.10 of these specifications.

TP-3.09 Pressure Tests

Water Line Test Procedure

All pipelines shall be tested for water tightness up to the individual service meter. The test equipment will be provided by IHS or NECA but is subject to inspection by NTUA or the designated operator of the system. Arrangements for water used in pipeline testing and payment for the water shall be coordinated with the appropriate operating utility. Pressure gauges used in testing shall be graduated at a maximum of 5 psi increments. Two gauges will be used simultaneously for verification of the gauges' functionality. Prior to the test, the pipeline will be pressured to 10 psi above the test pressure. The pressure will then be decreased to the test pressure so that gage responsiveness can be observed.

The test pressure shall be 100 percent of the pressure rating of the pipe under test (measured at the lowest point of elevation in the test section). It is to be understood that in the case of two-inch nominal diameter water line, only 200 psi pressure rated pipe is specified. This pipe may be tested as though it were 160 psi pressure rated pipe. A lower test pressure may be authorized in writing by the Engineer if line valving, saddles, etc. are a limiting consideration in pipeline pressure capability. At no time will two different pipe pressure ratings be tested simultaneously in the same test section. No section greater than one mile or with a 25 psi pressure change due to elevation shall be tested without written authorization from the Engineer. The test shall be conducted in such a manner that existing lines and service user's plumbing is not damaged. All connections, blow offs, hydrants, house services up to the meter yoke, and valves shall be tested with the main as far as is practicable.

No air testing shall be allowed.

The test section shall be slowly filled with potable water and all air shall be vented from the line. The rate of filling shall be as determined by the Engineer. The test shall not begin until the pipe has been filled with water for at least 24 hours to allow for absorption. The test shall have a minimum duration of two hours with the two hour period beginning when the test pressure is attained and the pump ceases operation.

No pipe installed will be accepted if the leakage is greater than determined by the following formula:

$$Q = \frac{N*D*\sqrt{P}}{7400}$$

in which,

Q = allowable leakage in gallons per hour
N = number of joints in the pipe line being tested, this "N" being the standard length of pipe furnished divided into the length being tested with no allowance for double gasketed joints caused by use of couplings instead of integral bell pipe or for joints at branches, blow offs, fittings, etc.
O = nominal diameter of pipe in inches
P = the test pressure in psi gauge as discussed in the second paragraph of this procedure

During the test, the test pressure should not lose more than 5 psig without being pumped back up to the test pressure. The totals of the gallons of water required to hold the test pressure during the two hours and the amount of water required to return the line to the test pressure at the end of the test period is the total leakage. This must be recorded. If the total leakage is less than the allowable, the line can be accepted. All visible leaks will be repaired regardless of the amount of leakage. Should the test on any section of the pipeline show leakage greater than the allowable leakage, NECA shall locate and repair the defective pipe, fitting, or joint until the leakage is within the allowable leakage for the two hour test duration.

The Engineer shall establish the test section schedule and shall make any necessary contacts and coordinate the testing with the operating utility.

No pressure test shall be performed until all thrust blocks have set for at least 48 hours.

TP-3.10 Water and Sewer Line Separation Requirements

TP-3.10.01 General

Water lines located near sewers present conditions for serious potential cross contaminations. Protection from cross contamination can be provided by separation of the facilities and use of special piping materials. For measuring separation between pipes, all measurements shall be the clearance between pipes (pipe O.D. to pipe O. D.).

For the purposes of this section, the term "lines" shall include mains, laterals, and service lines for both water and sewer.

TP-3.10.02 Horizontal Separation of Water and Sewer Lines

When water and sewer lines are located adjacent to each other, the horizontal distance between the water and sewer lines shall be 10 feet or greater, measured at the closest point. Each line shall be laid in a separate trench or the space between shall be filled with compacted fill.

When physical conditions, such as an existing obstruction, will not allow the required 10 foot horizontal separation, the water and sewer lines may be laid closer than 10 feet if installed in accordance with TP-3.10.03.

TP-3.10.03 Vertical Separation of Water and Sewer Lines

Water Above Sewer

When water lines cross above sewer lines, the water line shall cross above the sewer line with a minimum vertical separation of 12 inches. The preferred installation is water lines above sewer lines. If necessary, the depth of bury for the water line can be reduced to 36 inches (normally 42 inches) at the crossing to maintain the 12 inch vertical separation. When the minimum 12 inch vertical separation is not possible, the water line must cross below the sewer line.

Water Below Sewer

When a water line must cross below a sewer line, the minimum vertical separation between the lines is 12 inches. Backfill of the trenches shall be compacted to provide adequate support to prevent settling of the sewer line.

For new watermain construction, the water lines shall be water distribution pipe with a 20-foot (minimum) pipe section centered on the sewer crossing. No joints in new water line construction shall be permitted within 9 feet of a sewer line. While it is desirable to have all crossings perpendicular, new water line (centered on the crossing) can cross under a sewer line at a maximum of 25° from perpendicular.

Water Service Lines constructed of 1-inch HDPE may cross below sewer lines with 12-inch vertical separation but there shall be no fittings, connections, or adaptors within 10 feet of sewer line crossing.

For new sewer construction, the sewer line shall be ductile iron pipe with gasketed joints, or approved equal, with an 18-foot section centered on the crossing. No joints in new sewer line construction shall be permitted within 8 feet of a water line. While it is desirable to have all crossings perpendicular, new ductile iron sewer line (centered on the crossing) can cross over a water line at a maximum of 25° from perpendicular.

TP-3.10.04 Water Line Separation from Sewer Manholes

No water line shall pass through, under, or come in contact with any part of a sewer manhole.

TP-3.10.05 Water and Sewer Service Line Separation Within 5 Feet of a House

This section shall apply to that portion of water and sewer service lines located within five feet of the house. All lines within five feet of the house shall be considered as a part of the house plumbing and TP-3.10.02 and TP-3.10.03 do not apply.

TP-3.10.06 Water Line Separation from Septic Tanks and Drainfields

The minimum separation between water lines and septic tanks is 10 feet. The minimum separation between water lines and drainfields is 25 feet.

TP-3.11 Disinfection

Any of the methods given in AWWA-M-20 or the following method shall be used for disinfection of water lines. Chlorination material shall be introduced continuously into one end of the system and the flow directed along and through all lines and appurtenances to be disinfected until a minimum of fifty ppm of chlorine is detected at representative points throughout the line. A contact period of twenty-four hours will be maintained before the system is flushed out with clean water. Flushing shall continue until a maximum of 0.4 ppm chlorine residual is detected. All valves shall be operated several times during the twenty-four (24) hour contact period.

Disinfection shall be carried out after pressure testing except as the Engineer may direct.

Bacteriological test samples shall be taken and submitted by the Engineer.

TECHNICAL PROVISIONS

Section 4 - Installation and Testing of Sanitary Sewer Lines

TP-4.01 General

The work covered by this section consists of furnishing all labor, equipment, and transportation of materials necessary for the construction and testing of sewers, including manholes and appurtenant structures, connection of the sewers to existing structures, and any and all other work associated with this project as shown on the drawings. All work shall be performed in strict accordance with these specifications and shall be subject to the terms and conditions of the Memorandum of Agreement and General Conditions for this project.

TP-4.02 Installation

All pipe shall be laid as detailed in Section 2 - Excavation, Trenching, and Backfilling. The manufacturer's recommendations shall be strictly followed in making connections, handling, and storing the pipe. At all times, when work is not in progress, all open ends of pipe shall be plugged so that no water, dirt, or other substances can enter the pipe. Upon completion, the sewer main shall be flushed to remove all foreign matter. PVC sewer pipe shall be installed in accordance with the manufacturer's recommendations. Any sewerline with less than 2 feet cover shall be ductile iron.

TP-4.03 Crossings

TP-4.03.1 Roads

When possible, roads shall be open cut and trenched for sewerline construction. Boring is to be used only when required by the crossing grantor.

TP-4.03.2 Wash Crossings

Sewer main shall be placed as shown on the plans. NECA shall divert any flow, as necessary, to maintain proper bedding conditions and alignment.

TP-4.04 Manholes

Manholes/cleanouts will be required at places shown on the plans and as designated by the Engineer. Manholes are required at any point where the flow line changes direction and/or slope. Manholes shall be located not more than 400 feet apart. Straight through manholes shall maintain the sewerline slope. Cleanouts may be installed on terminal sewers at a maximum distance of 200 feet from the last manhole. Excavation for manholes shall be sufficient to leave at least 12-inches clear width between their outer surfaces and the face of the excavation. Excavation shall be a minimum of 12-inches below the lowest invert elevation for each manhole in order that a 6-inch minimum concrete and 6-inch minimum compacted gravel base can be installed as shown on the standard details. If over excavation occurs, grade shall be obtained with suitable backfill compacted to 95% of the maximum dry density. Pipe may be laid through the manhole to form the invert if no change of alignment or slope occurs or it may be formed using cement mortar. If cement mortar is used, a smooth semicircle shall be formed in the invert and a straight and uninterrupted through shall extend from the inlet to the outlet pipe and a full-depth invert shall be constructed. Where pipe is laid through the manhole the top half shall be cut out from inside wall to

inside wall. A mortar lining shall cover any uneven edges of the cut. In all cases the flow channel shall be a full pipe diameter in depth. If there is a change in alignment or slope within the manhole, a minimum 0.1 foot drop shall occur between the inlet and the outlet pipes.

To insure a water tight connection between PVC sewer pipe and manhole walls, a snugly fitting rubber gasket shall be placed by NECA around the pipe at a point approximately midway through all manhole walls or as supplied by the pre-cast manhole contractor. The annular space remaining between the pipe and wall shall then be sealed with non-shrink grout on both sides of the gasket, unless otherwise recommended by the pre-cast manhole contractor.

Concrete pre-cast sections for the manhole barrel shall be laid plumb and true and in full beds of mortar with "flush joints." Vertical joints shall be completely filled and rodded to remove entrapped air. A Ram Neck type sealant or equivalent may be used between pre-cast sections and the inside of the joint shall be filled smooth with mortar.

All concrete block manholes shall be mortared at all vertical and horizontal joints. The inside of all concrete block sewer structures shall be neatly plastered with mortar ½-inch thick consisting of one part cement and three parts fine sand. The outside of concrete block structures shall be plastered with mortar only at the instruction of the Engineer.

When two or more lines flow into the same manhole or when the alignment of the sewer changes, a smooth continuous through shall be built to form the invert to redirect the flow of sewage. The radius of the center line of the invert shall be no less than half the diameter of the manhole.

NECA shall build the manhole so that the top of the cone or flat top lies so that no less than one 2-inch or no more than 12-inches of grade rings are required to obtain the final rim elevation. The opening shall be temporarily covered (when plans indicate that the manhole will be in a paved road) until paving is completed. Once completed, the manhole frame and cover shall be built up with no more than two grade rings and the rim set so that the rim and surrounding pavement are at the same elevation (within 0.01 feet). A concrete collar may be a requirement of the permitting public utility. In areas not in streets, rims should extend 6-inches above ground level.

Connection to an existing manhole shall be accomplished by breaking through the manhole walls above the existing invert by at least 0.1 feet. The manhole floor shall be reshaped to provide a channel for the flow.

For pre-cast manholes, steps may be cast-in-place aluminum or steel and plastic. If steel and plastic steps are used, NECA shall insure the steps are correctly and securely fixed in the appropriate pre-cast holes.

TP-4.05 Steel Encasement

The sewerline shall be laid through steel casing where shown on the drawings. The casing shall be straight welded steel pipe. All welds shall be water-tight in accordance with Section 5 of AWWA Standard (C 202-64) Mill-Type Steel Water Pipe.

When PVC pipe is installed in casing, wood skids must be used to prevent damage to the pipe and bell during placement and to provide proper line support once the system is in operation. PVC pipe shall be laid within a casing using a minimum of four skids for carrier pipes twelve inches in diameter or less. The pipeline should be circumferentially braced in the casing to prevent movement in any direction, with the skids spaced 90° apart and offset 45° from vertical. The skids shall extend the full length of a pipe section, with the exception of the bell and spigot area. Skids should be attached securely to pipe with aluminum, galvanized heavy steel strapping, wire, or

clamps. Creosote treated wood shall not be used for skids as the chemical can weaken PVC. Installation should conform to the NAIHS standard detail which is a part of the project drawings. To ease installation NECA may use either "flax soap" or drilling mud as a lubricant between the skids and the casing wall. Petroleum products shall not be used as they can damage the pipe gaskets.

The annular space between the pipe and casing shall be sealed at both ends using plastic sheeting and stainless steel clamps.

TP-4.06 Testing

TP-4.06.01 Alignment

Alignment testing by lamping shall be performed by the Engineer on all sections of line during the progress of the project. Any deviation from true line or grade causing less than a full lamped circle may be cause for rejection. Any ponding of water in the sewerline may be cause for rejection.

TP-4.06.02 Exfiltration Testing

NECA shall, utilizing one of the methods outlined below, conduct an exfiltration test on each section of sewer between manholes. All necessary equipment and materials required for the tests is to be provided by NECA.

Air Testing

Testing equipment shall be equal to the "Air-Loc" low pressure air testing system manufactured by Cherne Industrial, Inc. of Edina Minnesota. The gauge used for the air test shall have a minimum division of 0.10 psi.

Testing shall be conducted in accordance with ASTM C-924 (Testing Sewer Lines by the Low-Pressure Air Test Method), except as modified herein. Air testing shall be done between consecutive manholes throughout the entire length of the installed line. Air shall be added to the plugged test section until the internal air pressure reaches 4.0 psig. At least two minutes shall be allowed for the air pressure to stabilize. The air supply shall then be disconnected and the time required for the pressure to drop from 3.5 to 3.0 psig shall be measured with a stopwatch. No one shall enter a manhole when a line into it is pressurized. If the groundwater level is above any portion of the test section, the test pressures shall be increased by an amount equal to the average hydrostatic pressure of the groundwater.

The test section will be accepted if the time required for the pressure to decrease from 3.5 to 3.0 psig is equal to or greater than the time in the following table. The pipe diameter shall be based on the nominal size of the sewermain. If the time measured is less than the time specified in the table, NECA shall locate and repair any leaks and retest the sewer until it is acceptable.

Minimum Duration for Pressure Drop (400 feet Max.)	
Pipe Diameter (Inches)	Time (Minutes)
4	2.5
6	4.0
8	5.0
10	6.5
12	7.5

The following formula should be utilized to determine the minimum duration for pressure drop for test sections greater than 400 feet.

$T = 0.000371 \cdot D^2 \cdot L \div 2$

Where: T = Time in Minutes
D = Nominal Diameter in Inches
L = Pipe Length in Feet

Water Testing

One gallon of water may be lost in 2 hours per each section between manholes when testing any size of main up to 12 inches. The line shall not be tested with the manhole. At least 4 feet of head shall be used for the test. Service lines need not be tested, but they must be plugged to conduct the test of the main. If any leakage in excess of the allowable occurs in any section of the sewerline, that section(s) shall be retested after the leaks are located and the sewer repaired.

TP-4.06.03 Infiltration

Infiltration of groundwater in excess of 200 gallons per day per inch diameter per mile of sewer line shall indicate that the sewer is not watertight. If excess infiltration is noted after exfiltration tests have been completed, it shall be considered as evidence that the original test was in error or that subsequent failure of the pipeline has occurred.

TP-4.06.04 Manhole Testing

NECA shall conduct testing on manholes for water tightness. Each manhole shall be tested by itself. All lift holes shall be plugged with an approved non-shrink grout. All mains into and out of the manhole shall be stoppered with a suitable device. If the manholes fails the initial test, necessary repairs shall be made and the manhole shall be retested. One of the two methods outlined below shall be utilized.

Vacuum Testing

Vacuum testing should be conducted in accordance with ASTM C-1244 (Vacuum Test for Concrete Manholes), except as modified below. The vacuum test head shall be placed inside the top section and the seal inflated in accordance with the manufacturers' recommendations. A vacuum of 10

inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass if the time is greater than 60 seconds for 48-inch diameter, 75 seconds for 60-inch, and 90 seconds for 72-inch diameter manholes.

Hydrostatic Testing

Hydrostatic testing shall be conducted in accordance with ASTM C-969 except as modified below. The manhole shall be filled with water to the ring. The maximum loss shall be 5 gallons in a 2-hour test regardless of the manhole depth. The amount of loss shall be determined by measuring the volume of water required to maintain the water level in the manhole within 2 inches of the top of the cone or flat top throughout the entire duration of the 2-hour test.

TP-4.07 Saddles and Wye Connections

Wyes shall be installed at a maximum 45° angle either to the left or to the right of vertical according to the direction of the house service. Wyes may be installed with the opening facing directly up where the sewer main is greater than eight-feet deep and where the sewer service line will be on a slope of greater than two percent (2%). Ninety degree sewer tee saddles shall not be used.

When saddles are required, NECA shall use the gasketed sewer saddle as a template to mark the sewer pipe at the point of connection. The diameter of the hole shall be larger than the inside diameter of the saddle stem at all points. If the hole is made so that any part of it exceeds the outside diameter of the saddle stem by more than 1/4-inch, or if the pipe itself is cracked beyond the inside lip of the saddle gasket, that section of pipe shall be cut out and removed. The section to be removed shall be large enough to allow the placement of the new pipe section with sewer saddle and repair couplings.

TP-4.08 Sewer Service Lines

Sewer service lines shall be of PVC and shall meet the same requirements of pipe laying as the sewer main. The grade from the building sewer to the main shall be uniform and not less than 0.75. Any changes in direction shall be made with 45° bends or less or a combination there of. In no instances shall a single bend or elbow greater than 45° be used in constructing sewer service lines. Requirements for excavation, bedding and backfill, and compaction for the main line shall apply to sewer service lines.

Minimum cover at the building shall be two feet unless otherwise directed by the Engineer.

The service lines shall be connected to the house service lines and a two-way cleanout installed or shall be capped and marked before being backfilled. In either case, the responsibility of NECA shall end at a point five feet from the existing house or at the point specified by the Engineer or shown on the plans in the case of future homes or dwellings. The end of the line, when not connected, shall be marked with a lath and located in distance from two permanent land markers.

Sewer service line cleanouts shall be installed at the house, at intervals of approximately 100 feet, and at each aggregate change of direction greater than 45°. Depth of cover shall be 2 feet minimum.

TP-4.09 Separation of Water and Sewer Mains

Refer to TP-3.10 Water and Sewer Line Separation Requirements.

TECHNICAL PROVISIONS

Section 5 - Water Storage Tank Construction

TP-5.01 General

This section of the specifications covers performing all operations for the construction and painting of water storage reservoirs and all accessories including foundation, inlet-outlet lines, drain and overflow lines, grading and all other items shown on the shop or construction drawings for this project. All materials and workmanship shall conform with all applicable requirements of AWWA D-100 Standard for "Welded Steel Tanks for Water Storage" as jointly adopted by the American Water Works Association and the American Welding Society in the latest amended form. Shop drawings will be available from the Engineer 30 days before materials are delivered.

TP-5.02 Welding

Welding shall be of the type and size as shown on the shop drawings. Surfaces to be welded shall be free from loose scale, slag, heavy rust, grease, paint and any other foreign material.

Precautions shall be taken when welding is done during periods of wet weather, low temperatures, and high winds to ensure that a quality end product is constructed.

After completion of field welding, NECA shall grind to a radius all sharp edges, weld seams, spot welds, and bore steel areas.

TP-5.03 Foundation and Earth Work

The tank site grading and foundation work shall be performed by NECA to conform with the drawings and specifications. The site around the tank shall be graded so as to slope away from the tank foundation at a minimum of 2% slope. The area to be within the tank ringwall shall be graded level to within ± 0.2 feet before placement of the final pad. Special precautions must be taken to avoid potential differential settlement. The tank sub-base should be existing earth and not fill or combination of cut and fill unless compaction methods approved by the Engineer are used.

The site grading shall include an access road to be built to the tank site before delivery of tank materials. The NECA Tank Erection Foreman shall notify the NECA Warehouse 10 days in advance of the expected delivery date of the tank materials. The completed access road shall have slopes and drainage acceptable to the Engineer.

If the existing earth is considered to be of poor quality for sub-base, sub-base material will have to be hauled in and compacted at the direction of the Engineer.

The foundation shall be as shown on the construction drawings and shall be of steel ringwall and rounded rock pad construction unless otherwise shown. The ringwall material will be specified and will usually be of 3/16-inch steel plate construction and shall be installed to prevent the erosion of the material used as foundation beneath the reservoir.

The steel ringwall will generally be supplied with a primer paint coat. Any scratches in the paint should be repainted. After welding, a heavier primer coat should be added or an asphalt base

paint applied to protect it from future corrosion. The ring should then be installed so as to extend no more than 4-inches above ground and shall be level within ± 1-inch.

Generally, the foundation within the ringwall will be a 6-inch minimum naturally rounded rock pad laid directly on earth. The naturally rounded rock shall have the gradation specified in standard detail W-22.

A crown shall be provided at the center of the rock pad of one-inch for each 10-feet of radius. On large tanks, the crown should be limited to 6 to 8-inches. Before placement of the floor steel, the rock pad shall be checked to within ± 1-inch vertical deviation by a radial stringline.

The ringwall shall be notched as shown on the drawings to allow drainage.

Excess earth and waste materials shall be disposed of in a manner acceptable to the Engineer.

TP-5.04 Appurtenances

All appurtenances shall be attached as shown on the shop drawings and positioned as shown on the construction drawing site plan. Appurtenances shall be assembled and permanently installed prior to painting and shall be painted in a manner similar to the rest of the tank.

TP-5.05 Piping and Excavation

The inlet-outlet and overflow piping shall be of the size shown on the tank drawings and shall be attached to the tank. The inlet-outlet piping (and overflow piping if installed through the reservoir floor) shall be installed prior to placement of the foundation so that proper compaction can be maintained around and above the piping. The vertical portion of the piping shall extend above the final foundation elevation by 6 to 8-inches and the reservoir floor constructed around it. The piping will generally be pre-painted with a primer coat of paint. Scratches or abraded areas in the paint shall be repainted. The underground portion of the piping shall be wrapped with 2-4 mil thick 2-inch wide plastic tape for cathodic and corrosion protection.

Trenching under the tank to make final connections or to install inlet-outlet piping shall be avoided if at all possible.

TP-5.06 Scaffolding

Scaffolds shall be constructed for welding of all surfaces over six feet above the foundation of the tank. NECA is reminded to follow all other requirements of the Safety and Health Regulations for Construction, 29 CFR Part 1926, Section 451, sub-part L - Ladders and Scaffolding.

TP-5.07 Inspection

All inspections shall conform with all applicable requirements of AWWA D-100 Standard for "Welded Steel Tanks for Water Storage" as jointly adopted by the American Water Works Association and the American Welding Society in its latest amended form.

TP-5.07.01 Testing

On completion of the welding of the tank, the floor joints shall be vacuum tested. The vacuum test is performed by means of a suitable testing box. The open bottom is sealed against the tank

surface be a sponge-rubber gasket. About 30 in. of the seam under test is brushed with a soapsuds solution or linseed oil. In freezing weather, a nonfreezing solution may be necessary. The vacuum box is placed over the coated section of seam, and a vacuum is applied to the box. The presence of porosity in the seam is indicated by bubbles or foam produced by air sucked through the welded seam. The gauge should register a vacuum of at least 2 psi.

TP-5.08 Fencing

Chain link fencing shall be installed around the tank by NECA in accordance with the plans and these specifications. Where galvanized coating is worn or burned off, NECA shall paint the affected area with paint approved by the Engineer. The fence is to be installed with evenly spaced posts, straight and true to line.

At locations where breaks in a run of fencing are required or at intersections with existing fences, appropriate adjustment in post spacing shall be made to conform to the requirements for the type of closure indicated.

When the plans require that posts, braces, or anchors be embedded in concrete, NECA shall install temporary guys or braces as may be required to hold the posts in proper position until such time as the concrete has set sufficiently to hold the posts. Unless otherwise permitted, no materials shall be installed on posts or strain placed on guys and bracing set in concrete until seven days after placing the concrete.

Chain link fences shall be constructed around the tank site in conformity with the details and at locations shown on the plans or staked by the Engineer. Posts shall be spaced at not more than 10 foot intervals. The intervals shall be measured from center to center of posts.

TP-5.09 Painting

TP-5.09.01 Introduction

The following specifications outline the procedures and materials to be used for the painting of steel water storage tanks.

TP-5.09.02 Field Surface Preparation

General

All field surface preparation shall be in accordance with these specifications and the cited specifications of the Steel Structures Painting Council (SSPC).

All standards published by OSHA and AWWA which relate to blasting shall apply and be enforced at the job site.

After completion of field welding and prior to blast cleaning, NECA shall grind to a radius (not smooth) all sharp edges, weld seams, and spot and skip welds. All slag and dingleberries are to be removed and all pinholes (porosity) dished-out. The surfaces of the tank shall then be dry blasted using compressed air blast nozzles and an approved blasting media. The blasting media shall be suitable for providing the specified anchor pattern (mil profile) on the blasted surface.

All compressed air shall be free from oil and condensed water. Oil and water separator traps shall be provided for all compressed air used at the job site. A compressor and blasting equipment capable of delivering at least 250 CFM with a 90 psi minimum nozzle pressure shall be on-site at all times. Nozzle size shall be the largest possible to maintain 90 to 100 psi nozzle pressure with the available compressor capacity.

Nozzle liners shall be replaced when the openings wear to 50 percent greater than the original diameter. The blast hose inside diameter shall be 3 to 4 times the nozzle orifice diameter with minimum 1-1/4" diameter. The Inspector shall have access to all blasting materials and equipment to test for media size and quality and pressure of the compressed air stream. Tests may include, but are not limited to, media size sieve tests, blotter tests of the air stream, nozzle pressure tests with a hypodermic pressure gauge, and abrasive cleanliness tests.

The anchor pattern (mil profile) of all blasted interior surfaces shall be not less than two and one-half (2.5) mils nor greater than four (4.0) mils.

The Inspector will check the initial blasting work taking three (3) readings per one hundred (100) square feet per the SSPC specified method. If the readings conform to the SSPC requirements (overall average within the specified anchor pattern range and no more than 25% outside the range), then additional abrasive blasting inspection will be done at the Inspector's discretion. If the required anchor pattern is not evident, the Inspector will continue to check the work by taking three readings per 100 square feet until he is satisfied the specification is being met.

Blast cleaning shall not be allowed when the steel surface temperature is less than 50°F and at least 5° F above the dewpoint temperature of the air in contact with the steel surface nor if the relative humidity of the air in contact with the steel surface is greater than 85 percent.

Abrasive blast cleaning shall be stopped in sufficient time to permit removal of all residual dust, spent abrasive, and other foreign matter from and within close proximity to all blasted surfaces (including rigging and equipment) and to allow the atmosphere to clear before any painting is done. Removal of these materials shall be by clean brush and suitable industrial vacuum with particular attention given to welds, pockets, poorly accessible areas and overhead areas.

All surfaces to be painted shall be clean and dry and free from rust, scale, dirt, oils, or other foreign materials. No painting or priming of any blasted surfaces shall take place until the blasted area has been approved for coating by the Inspector. Approval of any blasted areas shall occur only after the areas have been tested by the Inspector for conformance to the specified surface preparation cleaning and profile depth. All inspection of blasted areas shall be in accordance with SSPC guidelines and specifications. IHS shall provide a set of Swedish Standards as described in SSPC Guide To Visual Standard No. 1 to aid in surface inspection.

All blasted surfaces shall have the first coat of paint applied before rust or contamination can occur. In no case will finished blasted areas remain unprimed for more than 12 hours. If local weather conditions change such that rusting of the blasted surface may occur during the 12 hours (i.e., the relative humidity of the air in contact with the steel is greater than 85% or the steel surface temperature drops to less than 5°F above the dewpoint temperature of the air), the steel surface should be reblasted prior to painting. At the end of each painting day there shall remain unpainted a 6-inch to 12-inch border of blasted steel.

When blast cleaning resumes the following work day this border shall be re-blasted up to and including 1-inch to 3-inches of the previously applied coating.

TP 5-4

4/13/2009

During all blasting operations extra care shall be taken to prevent damage to or abrasive impingement upon previously coated areas except for the above noted 1 to 3-inch border.

The use of the following safety items will be required.

1. Air pressure hose of type that will prevent static electricity discharge.
2. Blast hoses equipped with dead man control devices to provide direct cut-off blasting equipment.
3. Air hoods with positive pressure type breathing for all personnel conducting blasting inside the tank.
4. Adequate explosion proof lighting to provide a well lighted working environment.
5. Adequate ventilation to provide a safe working atmosphere inside the tank during all blasting operations.
6. Scaffolds shall be constructed for blasting and painting of all surfaces over six feet above the floor of the tank. NECA is reminded to follow all other requirements of the Safety and Health Regulations for Construction, 29 CFR Part 1926, Section 451, sub-part L - Ladders and Scaffolding.
7. Wearing of Personal Protective Equipment is required during all blasting operations.

Interior Surfaces

All interior surfaces shall be cleaned in accordance with SSPC Surface Preparation No. 10, "Near White Blast Cleaning" or as directed by the Engineer.

Field surface preparation of the floor and bottom five (5) feet of the walls shall be completed prior to the surface preparation and coating of the remainder of the interior. No additional work will be performed on the floor and the bottom (5) feet of the walls until the final epoxy top coat has been fully applied and eighteen (18) equivalent cure hours have elapsed.

Exterior Surfaces

All exterior surfaces shall be cleaned in accordance with SSPC Surface Preparation No. 6, "Commercial Blast Cleaning".

TP-5.09.03 Field Painting

General

After completion and approval of field surface preparation NECA shall provide field painting in accordance with these specifications and latest revision of AWWA D102, "Painting Steel Water Storage Tanks".

All paint to be applied in the field shall be delivered to the job site in the original containers marked with the name of the manufacturer, batch number, and the specification number of the

paint contained therein and shall comply with all established specifications and the paint schedule. Safety precautions shall be taken in accordance with AWWA D102-78, Section 7.

Prior to use, all coating materials shall be stored in an area approved by the Inspector. The storage area shall be secure and shall provide the coating materials with protection from weather and temperature extremes below 32°F and above 110°F. NECA shall maintain the area in a safe, neat, and clean manner, and free from fire, explosion, and other hazards.

All paints shall be applied in accordance with these specifications and the manufacturer's recommendations regarding application rates and methods and curing time and conditions. In any instance where these specifications are more restrictive than the manufacturer's recommendations NECA shall follow these specifications.

Application of paint during construction which differ from the written recommendations of the paint manufacturer or the conditions required herein shall be cause for rejection.

Paint shall be applied only to clean surfaces free from dirt, rust, scale, grease, oil and moisture. The finished paint coatings on all surfaces shall be free from cracks, runs, blisters, pinholes, crazing, overspray, and other defects. All defects shall be corrected by applying additional coats or by grinding down, sanding, and re-coating until all requirements of these specifications are met.

The minimum and maximum dry film thicknesses herein specified are given as a basis for acceptance or rejection by the Inspector. The intent of the maximum thickness is to account for a reasonable amount of unavoidable overlap during spray application. NECA shall exercise care to apply each coat of paint to the specified dry film build thickness. Any areas above the maximum thickness shall be sanded, ground, or otherwise trimmed and repainted to the approved thickness. All areas of under thickness shall have additional coats applied to bring them to the specified thickness.

A brush applied "stripe" coat shall be applied to all weld seams and irregular edges, corners and crevices prior to spray application. Paint may be thinned up to 20% for the stripe coat. NECA shall have prior approval from the Inspector for all thinning of paint used for brushing or spraying. Thinning will be done in accordance with the manufacturer's specifications. (Tnemec allows up to 10% thinning for paint spraying if conditions require, although in most cases little or no thinning is necessary). If paint is diluted it shall be built up to the same dry film thickness as to be achieved with undiluted material.

Both components must be above 50°F prior to mixing. Coating application shall proceed only when the air and steel temperature is between 50°F and 135°F, the surface temperature is at least 5°F above the dewpoint temperature of the air in contact with the steel, and the relative humidity is below 85%.

Interior Surfaces

All field primer and finish paints applied to tank interior surfaces shall be Tnemec, Series N140 Pota-Pox Plus, N140-1255 Beige Primer and N140-15BL Tank White Finish.

Coating application shall proceed only when air and steel surface temperatures are above 35°F and below 120°F and the relative humidity is below 85 percent.

The coating shall be applied moving the gun parallel to the surface using a 50 percent overlap

followed by another full wet spray coat at right angles (if practical) to the first. Arcing of the gun shall be avoided.

Adequate explosion-proof lighting shall be provided during all coating operations. This lighting shall be sufficient to illuminate clearly the working area without shadows.

Adequate explosion-proof ventilation shall be continuously maintained in the tank interior or in other enclosed work areas during all coating operations and all recoat and curing periods. Ventilation equipment shall be of the suction type and shall be of sufficient capacity to maintain throughout the tank interior or enclosed area a clear atmosphere that is well below the Lower Explosive Level (LEL). During coating application the capacity of ventilating fans shall be at least 300 CFM per gallon of coating applied per hour. During curing the ventilation equipment shall provide for a minimum of two (2) air changes every hour. The ventilation system, including all fans and temporary duct work, shall be arranged such that fresh air is drawn into the top of the tank and is exhausted at the bottom with a downward air movement pattern that permits no still air spaces to exist at any area. Particular attention shall be given to floor level and low spaces and pocket areas where heavier-than-air solvents and particulate matter are likely to accumulate.

The cumulative dry film build mil thickness shall be in accordance with the following schedule.

INTERIOR PAINT APPLICATION SCHEDULE
(Tnemec N140 Pota-Pox Plus)

Coat Description	Cumulative Dry Film Mil Thickness Minimum	Maximum
1. Primer N140-1255, Beige	2	6
2. Finish Top Coat N140-15BL, Tank White	8	12

All grease, oil, dirt, grit from abrasive, dry spray, and the like shall be removed from the primer coat prior to the application of the top coat.

TP-5.09.04 Curing

General

The epoxy paint system cures as a function of temperature, with the paint curing faster at higher temperatures and slower at lower temperatures. Therefore, cure time will be specified in "equivalent hours" which reflects this relationship.

Cure Between Coats

Minimum cure between coats shall be 12 equivalent hours for the ceiling and side walls to within approximately five feet of the floor. Minimum cure between coats for the floor and the lower five feet of the side walls shall be 18 equivalent hours. Equivalent hours can be computed from Table I.

For example, 12 hours cure at 62°F would be equal to 12 x 0.67 = 8 equivalent hours. IHS shall

provide a recording thermometer to document temperature during cure. Ventilation equipment shall be continuously operated at the rate of two (2) exchanges per hour during cure. Air ducts should be provided on larger tanks as needed to maintain air flow through the whole tank without "dead spots".

TP 5-8

4/13/2009

Table I

Temperature (°F)	Actual Cure Hours	Equivalent Cure Hours
70	1	1
60-70	1	0.67
50-60	1	0.4
50	1	0

Final Cure

Minimum final cure time shall be 168 equivalent hours. Equivalent hours will be computed as with cure between coats but using the values given in Table II. Ventilation equipment will be operated for the first 100 equivalent hours at an exchange rate of two (2) changes per hour. The roof hatch and manholes will be left open for the remainder of the final cure.

Table II

Temperature (°F)	Actual Cure Hours	Equivalent Cure Hours
110	1	5
100-110	1	3.4
90-100	1	2.3
80-90	1	1.5
70-80	1	1.0
60-70	1	0.67
50-60	1	0.45
50	1	0

Exterior Surfaces

The tank exterior shall be blast cleaned in accordance with these specifications. The exterior prime paint to be used in all field prime painting shall be Tnemec No. N140-1255 "Pota-Pox" Beige Epoxy primer. The exterior finish paint to be used shall be Tnemec Series 30 Spray-Saf EN unless otherwise directed by the project engineer. The final coat color shall be as directed by the Engineer.

The cumulative dry film mil thickness shall be in accordance with the following schedule.

EXTERIOR PAINT APPLICATION SCHEDULE

Coat Description	Cumulative Dry Film Mil Thickness Minimum	Maximum
1. Epoxy Primer N140-1255, Beige Tnemec N140 Pota-Pox Plus	4	6
2. Spray-Saf EN Finish Topcoat Tnemec Series 30	8	10

TP 5-9

4/13/2009

Cure time between the primer coat and the finish coat shall be twelve (12) hours.

TP-5.09.05 Paint Inspection and Testing

The Inspector shall have access to the work in progress at all times to inspect for compliance with all requirements of these specifications. NECA shall supply necessary rigging, lighting, and other equipment to facilitate this inspection.

The Inspector will test dry film thickness in accordance with AWWA D102 and SSPC-PA2-73T, "Measurement of Dry Paint Thickness with Magnetic Gauges". Dry film thickness shall be measured by magnetic pull off or fixed probe magnetic flux Type II gauges. These gauges shall be calibrated in the desired thickness range of use. Calibration shall be done using non-magnetic shims or National Bureau of Standards plates. Calibration shall be verified prior to, during, and after each use to assure they are reading correctly. These tests are non-destructive to the coating. Optical testing (destructive test to the coatings) will be conducted by the Inspector if the dry film thickness of the paint cannot be agreed upon by NECA and the Inspector.

The Inspector will test for holidays with a Holiday Detector as outlined in AWWA D102, Section 8, "Testing". Holiday testing will only be done on the finish topcoat and then only after 12 equivalent hours of cure. All holidays shall be corrected by NECA.

The Inspector shall also inspect and document on forms shown as attachment A:

1. Pre-surface preparation
2. Ambient conditions
3. Compressed air and abrasive cleanliness
4. Nozzle pressure
5. Surface cleanliness and profile
6. Coating mixing and thinning
7. Dry and Wet film thicknesses
8. Cleanliness between coats
9. Specified cure time

The frequency of these tests will be as directed by the Engineer.

TP-5.09.06 Disinfection

Disinfection of interior surfaces shall be accomplished in the presence of the Project Manager in accordance with AWWA Standard C652 Section 4.3, Chlorination Method 2, as modified herein:

1 Disinfection shall be accomplished after the final cure period of the interior protective coating.

2. Prior to disinfection, the complete interior shall be cleaned by hosing with clean water. Residual water and contamination removed during the washing process shall be flushed from reservoir.

3. If required to remove dust, spent abrasive, or other surface contaminants, all surfaces shall be cleaned with an approved cleaner or detergent applied via high pressure or hot solution method. Cleaned surface shall then be rinsed with clean water. Residual water and contaminants shall be flushed from reservoir.

4. After completion of curing and cleaning cycles, as noted above, all interior surfaces shall be brushed or spray washed with a chlorine or chloramine solution having a content of 200 ppm. Chlorine or chloramine solution which accumulates on the bottom shall be drained to waste. Rinsing with clean water is not required unless directed by the Engineer.

TP 5-11

4/13/2009

Attachment A
Page #1 of 8

Project Information

Project Identification and Location:

Responsible Individuals

Owner	(Organization)		Phone:
	(Contact)		Phone:
Engineer	(Organization)		Phone:
	(Contact)		Phone:
Inspector	(Organization)		Phone:
	(Contact)		Phone:
Contractor	(Organization)		Phone:
	(Contact)		Phone:
Site Foreman	(Organization)		Phone:
	(Contact)		Phone:

Pre-Job Conference - Notes:

Pre-Inspection of Project

General Description:

Surface Condition:

Paint contains lead _____ Yes _____ No

Initial Surface Condition _____ Bare Metal _____ Previously Painted

Pre-Cleaning

Surface Contaminants and Weld Conditions					
			Repair or Remove		
	Present	Removed		Present	Removed
Mud on Surface			Weld Splatter		
Mill Scale			Sharp Edges		
Tar			Rough Welds		
Oil			Laminations		
Grease					
Soluble Contaminants					

* Note * Grinding steel surfaces on some structures may not be acceptable due to metallurgical properties. Competent persons must be contacted prior to conducting operations which may be detrimental.

Surface Preparation

_____ _____
Date Inspector

Area of Work:

_____
Date

SUMMARY OF AMBIENT CONDITIONS						
Time						Weather Conditions: _____
Air Temperatures						Maximum Temperature: _____
Wet Bulb Temperature						Minimum Temperature: _____
Relative Humidity %						Wind Speed:
Dew Point						( ) High ( ) Moderate
Steel Temperature						( ) Low ( ) Nice

Abrasive Blast Tests			
	Clean	Dirty	Surface Profile Achieved: _____
Compressed Air Blotter			Degree of Surface Preparation: _____
Abrasives (Vial Test)			
Blast Nozzle Size (Orifice Gauge)			
Blast Pressure (Needle Gauge)			

Page 4

Primer Coating Application
Area of work (normally should be the same areas of work as listed for surfaces preparation).

Coating information:

Product Name/Designation _____
Product (Generic) Description _____
Batch Number _____
Designated Thinner I.D. _____

Primer Coating Material			
Mixing and Thinning		Batch	Application Information
Product	Component A Component B		Time Start/Stop ____/____
Thinner	Amount		WFT Applied _____
Sweat in Time ___ ___ Yes No			Stripe Coat Yes No

Appearance of Surface at time of Coating Application	Interior Surfaces
	Ventilation Yes No
	Forced Air Yes No

Dry Film Tests of Applied Coatings
Average Dry Film Thickness _____ (Report DFT for Total System)
Appearance Poor Soft Hard Time Since Application _____

Page 5

Coating Application: Intermediate Finish
(Circle One)

Appearance of Surface at time of Coating Application	SUMMARY OF AMBIENT CONDITIONS					
_____	Time					Weather Conditions: _____ Maximum Temperature: _____
	Air Temperatures					Minimum Temperature: _____
	Wet Bulb Temperature					
	Relative Humidity %					Wind Speed: { } High { } Moderate { } Low { } Nice
	Dew Point					
	Steel Temperature					

Coating Application	
Mixing and Thinnin	Interior Surfaces
Component A Component B	Ventilation Yes No
Thinner Amount ____ ____	Forced Air Yes No
Sweat in Time ___ ___ Yes No	

Application Information	Dry Film Tests of Applied Coatings
Time Start/Stop _____/_____	Average Dry Film Thickness _____ (Report DFT for Total- System)
WFT Applied _____	Appearance: Poor Soft Hard
Stripe Coat Yes No	Time Since Application

Attachment A
Page 1 of 4

Reference Information

SURFACE PREPARATION METHODS AND STANDARDS

NACE INTERNATIONAL

1. White Metal Blast Cleaning
2. Near White Metal Blast Cleaning
3. Commercial Blast Cleaning
4. Brush Off Blast Cleaning

STEEL STRUCTURES PAINTING COUNCIL

SSPC_SP1	Solvent Cleaning
SSPC_SP2	Hand Tool Cleaning
SSPC_SP3	Power Tool Cleaning
SSPC_SP5	White Metal Blast Cleaning
SSPC_SP6	Commercial Blast Cleaning
SSPC_SP7	Brush-Off Blast Cleaning
SSPC_SP8	Pickling
SSPC_SP10	Near White Blast Cleaning
SSPC_SP11	Power Tool Cleaning to Bare Metal

Materials and Supplies on Site

Abrasive Blasting Media				
Product	**Type**	**Grade**	**Quantity**	**Date Received**

Coating Materials					
Product Name	**Generic Description**	**Color**	**Batch Number**	**Quantity**	**Shelf Life**

Page 2

Surface Preparation

_____ _____
Date Inspector

Area of Work:

_____
Date

SUMMARY OF AMBIENT CONDITIONS						
Time						Weather Conditions: _____
Air Temperatures						Maximum Temperature: _____
Wet Bulb Temperature						Minimum Temperature: _____
Relative Humidity %						Wind Speed:
Dew Point						( ) High ( ) Moderate
Steel Temperature						( ) Low ( ) Nice

Abrasive Blast Tests			
	Clean	Dirty	Surface Profile Achieved: _____
Compressed Air Blotter			Degree of Surface Preparation: _____
Abrasives (Vial Test)			
Blast Nozzle Size (Orifice Gauge)			
Blast Pressure (Needle Gauge)			

Page 3

Primer Coating Application
Area of work (normally should be the same areas of work as listed for surfaces preparation).

Coating Information:

Product Name/Description_____

Product (Generic) Description _____

Batch Number _____

Designated Thinner I.D. _____

Primer Coating Material		
Mixing and Thinning	Batch	Application Information
Product Component A Component B		Time Start/Stop____/_____
Thinner Amount _____ _____ _____ _____		WFT Applied _____
Sweat in Time ____ ____ Yes No		Stripe Coat Yes No

Appearance of Surface at time of Coating Application	Interior Surfaces
	Ventilation Yes No
	Forced Air Yes No

Dry Film Tests of Applied Coatings
Average Dry Film Thickness _____ (Report DFT for Total System)
Appearance Poor Soft Hard Time Since Application _____

Page 4

Coating Application: Intermediate Finish

Appearance of Surface at time of Coating Application

Summary of Ambient Conditions					
Time:					Weather Conditions:
Air Temperatures:					Maximum Temperature:
Wet Bulb Temperatures:					Minimum Temperature:
Relative Humidity %:					Wind Speed: { } High
Dew Point:					{ } Moderate { } Low
Steel:					{ } Nice

Coating Application	
Mixing and Thinning	Interior Surfaces
Component A Component B	Ventilation Yes No
Thinner Amount _____ _____	Forced Air Yes No
Sweat in Time _____ _____ Yes No	

Application Information	Dry Film Tests of Applied Coatings
Time Start/Stop _____/_____	Average Dry Film Thickness_____ (Report DFT for Total-System)
WFT Applied _____	Appearance:
Stripe Coat Yes No	Poor Soft Hard Time Since Application:

TECHNICAL PROVISIONS

Section 6 - Waste Stabilization Pond Construction

TP-6.01 General

The work under this section consists of furnishing all labor, tools, and equipment required in the construction of stabilization ponds, drainage ditches, fencing and incidentals in accordance with the plans and specifications furnished by the Engineer.

TP-6.02 Stripping

Vegetation shall be removed from the area designated on the drawings to be graded. All vegetation shall be disposed of outside of the actual lagoon and all soil which cannot be stabilized shall be removed and disposed of in a similar manner. The disposal location shall be determined at the preconstruction conference.

TP-6.03 Excavation and Embankment

Excavation and embankments shall be made true to the depths, slopes, grades, and lines as called for in the plans and as otherwise ordered and staked by the Engineer. During the construction the Engineer will inspect the work to insure conformance with all depths, slopes, and grades as specified in the plans. All excavation material, insofar as practical, shall be used in formation of embankment of the ponds. However, because of the variety of soils that can be encountered, it is imperative that NECA contact the Engineer to determine the proper material to use for the pond bottom and embankment.

NECA, in conjunction with the Engineer, shall make prior arrangements to have sufficient water on-site for compaction. Water, in such amounts as may be necessary to attain the required compaction, shall be uniformly applied by tank trucks equipped with satisfactory sprinkling devices. Compaction rolling shall be done on layers not to exceed 8-inches in thickness. Each layer shall be satisfactorily compacted before the next layer is applied. The Engineer will test for compaction at random locations and levels to assure that required compaction is achieved. Compaction to densities of 95% of optimum density as determined by Modified Proctor test is required in all fill areas.

The optimum moisture range of all fill material should not be exceeded. If it is exceeded, the fill material should be dried before proceeding with compaction.

Frozen snow and ice shall be removed from the construction area. Frozen soil shall be removed and stockpiled for future use or mechanically worked until thawed prior to final placement.

If reseeding is required on the lagoon site, it shall be accomplished by NECA. Seed and seeding methods shall meet the recommendations of the BIA Branch of Land Operations (BLO). IHS will provide the seed and application instructions.

Construction of access to the lagoon site shall be the responsibility of NECA. The Engineer shall secure any easements that are required prior to construction. NECA shall not excavate or dispose of material outside of the designated lagoon disposal area.

TP-6.04 Appurtenances

All appurtenances shall be of the size and located as shown on the drawings. No changes shall be made unless they are directed by the Engineer. The concrete and reinforcement shall be as specified in Section 9 of these specifications and as shown on the plans.

TP-6.04.01 Distribution and Transfer Facility

The distribution and transfer facility shall be constructed in a manner similar to that of manholes and shall be constructed after final grading of the lagoon is complete.

Shear gates, where required, shall be set as shown on the plans. Gates shall be mounted true, plumb, and level and shall not crimp or bind after installation.

TP-6.04.02 Piping

Mechanical joint ductile iron pipe shall be used for all exposed piping. All piping shall be laid to the grade shown on the plans or as established by the Engineer. All above ground piping shall be supported on piers at a maximum of ten foot (10') intervals or as shown on the plans. Piers shall be concrete supports with reinforcement as shown on the plans or as indicated by the Engineer and the pipe shall be positively secured to the piers as shown on the plans.

Piers for piping shall be installed per standard detail S-13.

TP-6.04.03 Backfill Around Appurtenances

Backfill around all structures in pond embankment shall be compacted to 95% compaction as described in these specifications. Care shall be exercised to insure a water-tight backfill in all embankment cuts. Backfill around all concrete structures shall only be performed after the concrete has been cured for at least 24-hours.

TP-6.05 Bentonite Sewage Lagoon Seal

TP-6.05.01 General

This work entails furnishing all labor and machinery, tools, and other items necessary for the satisfactory installation of a bentonite lagoon liner, if called for in the construction plans. These specifications cover the sealing of the lagoon with bentonite in accordance with the cross sections and dimensions shown in the plans or as directed by the Engineer.

TP-6.05.02 Materials

The bentonite material will be provided by the Indian Health Service to the job site. It will be bagged and pelletized for removal by the NECA crew from the transport truck or it will be delivered in bulk from and dropped at the job site. The NECA crew will be responsible for covering the material with plastic to protect it from the weather and will be responsible for its protection for the duration of the project. The material will be high swelling sodium or calcium bentonitic clay designated as bentonite crumble, 3/8-inch to minus 100 mesh, with a swell factor of 1,200 to 1,350.

TP-6.05.03 Installation

The lagoon surfaces upon which the liner is to be installed shall be graded to the specified contours as shown on the construction plans or per the Engineer's instructions.

The soil shall be thoroughly tilled and reduced to its native particle size. All roots or vegetation, boulders and other deleterious materials which would penetrate through the thickness of the liner shall be removed. No debris larger in diameter or in length than ½ of finish thickness of the proposed liner shall remain within the soil that is to be add-mixed with the bentonite to form the liner.

The sealant shall be spread uniformly across the base surface at the specified application rate using an agriculture seed or lime spreader or other equipment as approved by the Engineer. Premeasured tarpaulins of cloths spread in different locations shall be weighed after spreading material over them to check the spreading operation. The sealant may also be applied at the appropriate application rate by distributing the bag(s) of material or premeasured loads of material (if delivered in bulk) in a pre-marked grid pattern on the lagoon surfaces. Each bag shall be broken open and the material spread evenly within each grid square using hand rakes. The grid square dimensions will be determined in advance by the Engineer and will be based on predetermined application rate and convenience for application. A grid pattern of 10 feet by 10 feet may be manageable (e.g., 2 bags per square).

After each area has been covered, the bentonite shall be thoroughly disked or rototilled into the soil to a depth of 4 to 6-inches to form a homogenous soil-bentonite mixture. A rototiller is preferred but all equipment is subject to the Engineer's approval. Any implement employed in the operation shall have the capability of adjusting for depth of tillage.

The soil bentonite mixture shall be compacted to 85% of the Modified Proctor density using a turtle tamper or vibratory drum. A sheepsfoot roller or heavy equipment rubber tires shall not be used.

Areas adjacent to penetrating structures such as standpipes, inlet support columns, or other areas inaccessible to spreading and tilling equipment will demand special care. NECA shall hand apply and hand compact a mixture of one part bentonite to three parts soil by volume blended dry along all construction appurtenances.

NECA shall only work on an area that can be completed in one working day. Completion shall be defined as spreading of the specified bentonite, the mixing of the soil with the bentonite sealant, and the compaction of the soil/bentonite layer.

Vehicle or equipment travel on the completed surface will be prohibited.

TP-6.05.04 Tests for Water Tightness

Tests are at the discretion of the Engineer.

Testing of the liner for water tightness should be completed prior to operation of the lagoon system. Two 55 gallon drums will be required to test the seal. One drum should have the top and bottom removed, creating a hollow tube. The second drum should have only the top removed. The drum with both ends removed should be forced through the bentonite seal to a depth of 1-1/2 times the seal thickness. A bead of bentonite approximately 1-inch thick should

be placed around the periphery where the drum side penetrates the seal. Place the drum with the bottom next to the drum that penetrates the seal. Both drums are to be filled with water, exercising care with the seal of the penetrating drum so as to not disturb the bentonite ridge that is in place. Allow the drums to stand a minimum of 48 hours prior to taking the reading to allow the seal to hydrate and stabilize. For a period of one week or longer, if necessary, measure once a day how much water is lost from each drum. A yardstick may be fastened to the inside of the drum to facilitate measurement for the amount of water lost to evaporation. The additional water lost from the drum that penetrates the seal represents seepage in inches per day.

The drum test is an indicator of gross deviation from the required permeability specifications. Data from this type of test is normally not of sufficient accuracy to allow for precise permeability estimations. A qualified independent soils laboratory should be consulted for such work.

TP-6.06 Fencing

Fencing shall be installed according to the standard fencing and gate detail S-20.

TP-6.07 Rip-Rap

If rip-rap or erosion protection is required, it shall be installed as shown on the drawings.

TP-6.08 Signs

Signs shall be installed on the lagoon fencing to warn the public. One sign shall be installed on the gate and one in each quadrant and/or every 1300 feet. Signs shall be furnished by the Engineer and shall read: "DANGER-CONTAMINATED WATER".

TECHNICAL PROVISIONS

Section 7 - Treatment Building Construction

TP-7.01 General

In cases where it is necessary to build a two-room pumphouse, the construction will be in accordance with standard detail W-29, Precast Two-room Pumphouse. If it becomes necessary to deviate from this standard design, NECA shall construct a concrete block water treatment building in accordance with the highest standards of the construction industry and according to the plans and specifications. Concrete and mortar shall meet the requirements as set forth in Section 9 of these specifications. The work shall include all labor and equipment necessary to perform the excavation, backfilling, grading, construction of footings, slab, and structure, and waste drain line for the treatment building. The final clean-up and start-up operations including painting, pipe connection (outside of the building) and removal of dirt or water from the treatment building shall be the responsibility of NECA.

TP-7.02 Site Grading

Site grading and composition for the standard two-room precast pumphouse shall be that as outlined on the standard detail. For all other treatment structures, excavation shall be made by NECA to permit placing of the grade beams and footings as indicated on the plans. The area of the treatment building shall be backfilled to the foundation and brought to natural grades with slopes not to exceed five percent, except as may be noted on the plans. A slope away from the building shall be provided on all sides of the building. If the existing soil is susceptible to wind erosion, the Project Engineer may direct NECA to place two-inches of drainfield rock on all exposed dirt inside of the fence around the treatment building to prevent wind erosion.

All backfill around the structure shall be compacted in one-foot lifts. Unstable material not shown on the drawings but which is encountered adjacent to or underlying the footings, foundation walls, or floor slab shall be immediately reported to the Engineer who will define the limit and depth of removal of such unstable material and the replacement with suitable granular material in its place or the relocation of the treatment building.

TP-7.03 Structure

NECA shall build the treatment structure according to the plans and with the materials supplied. Should the materials delivered be different from those needed for the construction according to plans, NECA shall stop work on the building and contact the Engineer immediately. The Engineer will then decide whether work will proceed with a change in the plans or whether work on the building will cease until the proper materials are delivered.

The floor shall be poured with holes for piping as shown on the drawings so as to avoid drilling the finished concrete floor. All subsurface electrical conduits, piping, and drains shall be installed before concrete is placed.

The floor shall be finished to a smooth and even grade sloping toward the floor drain as shown on the drawings. If called for, platforms shall be poured at the same time as the floor slab. Reinforcing bars and mesh shall be positioned as noted on the drawings.

All block shall be laid in a full bed of mortar, applied to the shell only. Each unit shall be placed and shoved against the block previously laid so as to produce a well-compacted vertical mortar joint for the full shell thickness. Blocks shall be set with all cells in a vertical position. Cores of corner blocks and blocks abutting the door frame are to be filled with concrete. The top course of blocks of the walls shall be constructed of bond beam blocks with No. 4 rebar reinforcement and concrete fill as shown on the plans.

Horizontal mortar joint reinforcing shall be installed in each second horizontal joint, well bedded in mortar. All block cavities shall be filled with masonry fill insulation as each block course is laid, unless specified otherwise.

Doors shall be hung plumb and true. Windows, brackets, and pipes shall be placed plumb and true at a locations shown on the drawings. All exposed lumber in the pumphouse shall be painted with one coat of primer and one finish coat of paint. All concrete block shall be painted with one coat of block filler paint and then the finish coat of paint.

TP-7.04 Piping

All piping except drain piping will normally be done by NECA or others at the Engineer's discretion except that all galvanized pipe shall be painted by NECA after installation. Spaces shall be left in the wall to accommodate piping as indicated on the drawings or called for by the Engineer.

The Engineer may direct NECA to install the interior piping in the pumphouse, and if so, the installation shall be in accordance with the construction drawings.

Drain piping shall be installed as shown on the drawings except that the drain may be terminated in a wash or other low lying area if sufficiently screened and protected. Where exposed to daylight, drain piping shall be galvanized steel pipe. The Engineer shall direct NECA in the placement of the drain except when placed as shown in the drawings.

TP-7.05 Electrical

All electrical work shall be performed by other than NECA.

TP-7.06 Fencing

Where the standard two-room pumphouse is constructed, fencing shall be erected in accordance with standard detail W-23, Prefab Pumphouse Exterior Facilities Layout. For other treatment structures, chain link fencing shall be installed around the treatment building as shown on the drawings. Where galvanized coating is worn or burned off, NECA shall paint the fencing with one coat of paint acceptable to the Engineer. The fence is to be installed with evenly spaced posts, straight and true to line.

When plans require that post, braces, or anchors be imbedded in concrete, NECA shall install temporary guys or braces as may be required to hold the posts in proper position until such time as the concrete has set sufficiently to hold the posts. Unless otherwise permitted by the Engineer, no material shall be installed on posts or strain placed on guys and bracing set in concrete until seven days have elapsed from the time of placing of the concrete.

All posts shall be set vertically. All corner and terminal posts shall be set in nine-inch diameter holes, 36-inches deep, and filled with concrete. Concrete shall crown at the top to shed water.

Corner and terminal posts shall be embedded 36-inches into the concrete. All line posts shall be driven into the ground 24-inches.

Chain link fabric shall be placed on the side of the fence away from the treatment building. Rolls of wire fabric shall be joined by weaving a single strand into the ends of the rolls to form a continuous mesh.

Chain link fabric shall not be attached to posts until the concrete footings have set a minimum time of 7 days. Braces, tension rods or cable, hardware, and appurtenances shall be installed as shown on the plans.

Chain link fabric shall be stretched by mechanical stretcher or other devices designed for such use. Stretching by motor vehicle will not be permitted.

TP 7-3

9/14/94

TECHNICAL PROVISIONS

Section 8 - Individual Waste Disposal Systems

TP-8.01 General

NECA shall furnish all labor, equipment, and supplies necessary for the installation of house sewer, septic tanks, and adsorption fields or ponds at dwellings as indicated on the drawing or by the Engineer. The layout for drainfields and ponds shall be staked by the Engineer. NECA shall not install any facilities which are not staked. As-built data shall be collected immediately after construction.

TP-8.02 Septic Tanks

TP-8.02.01 General

All septic tanks shall have a minimum liquid capacity of 1,000 gallons and double compartment. Liquid capacity shall be split with two-thirds in the first compartment and one-third in the second compartment. The liquid depth of the septic tanks shall be at least 4 feet but not more than 5 feet.

The inlet and outlet on all tanks shall be provided with vertical tee fittings of PVC plastic or, in concrete tanks, cast iron vertical tee fittings or oval, box shaped, or slab type baffles of pre-cast reinforced concrete with a minimum thickness of 2-inches may be used. The inlet tee or baffle must penetrate at least 5-inches below the liquid level but in no case shall it be greater than the penetration of the outlet baffle or tee. Both inlet and outlet tees or baffles shall extend 6-inches or more above the liquid level and end 1-inch from the underside of the tank top to allow gases to escape. The outlet baffle or tee shall extend below liquid level 40 percent of the liquid depth for rectangular tanks and 35 percent for circular tanks. The common wall passage shall also be located at the 40 percent liquid level depth. The inlet invert should be at least 2-inches above the liquid level in the septic tank.

TP-8.02.02 Septic Tank (Concrete)

Concrete septic tanks shall be of pre-cast, mechanically vibrated, 4,000 psi minimum strength, watertight concrete containing adequate steel reinforcement to facilitate handling. Minimum wall thickness shall be 3-inches. The top and bottom shall have a minimum thickness of 4-inches. Minimum steel reinforcement will be No. 3 reinforcing bars spaced 2 feet on centers in both directions in the top, bottom, and sides. The equivalent shall be used around manhole inspection ports and construction joints. Minimum steel reinforcement of the access cover or lid shall be No. 4 rebars spaced 6-inches on center in both directions. The manhole and inspection opening covers shall be provided with steel lifting handles of No. 3 rebar.

Tanks shall be free of cracks from casting or handling (including placement). No wire mesh and/or rebar shall be exposed at any point on the tank interior or exterior.

Inspection openings with a minimum of 7-inches in the least dimension shall be provided above the inlet, outlet, and the inter-compartment piping. Adequate access shall be provided into the septic tank either through a removable section or manhole with a minimum of 20-inches in the least dimension. The access manhole shall be over the first compartment and may be placed partially over the inlet or inter-compartment piping to serve as an inspection hole. The access

manhole shall be provided with a 6-inch PVC coupling that extends through the center. A 6-inch diameter inspection pipe shall be installed so that it is connected to the access manhole coupling and extends to a point 12-inches above the ground surface. The pipe shall be 160 psi, SDR 26, PVC, terminate above ground surface with a 6-inch slip joint PVC cap, and painted red on those portions above the ground surface.

TP-8.02.03 Septic Tank (Polyethylene)

Polyethylene septic tanks shall be one piece, rotationally molded. Tanks shall conform to Canadian Standards Association Standard CANS-B66-M-79, Section 8.2.2, except the requirements of Subsection 8.2.2.4 of the specification shall be modified to require a minimum top load test weight of 5,000 pounds.

The polyethylene resin used shall comply with ASTM Specification D-1248, "Polyethylene Plastics Molding and Extrusion Materials", Class B (requiring an ultraviolet stabilizer) or Class C (requiring a minimum of 1% carbon black), and shall have a stress crack resistance of at least 150 hours when measured in accordance with ASTM Specification D-1693, "Environmental Stress-Cracking of Ethylene Plastic."

There shall not be any metal parts in the polyethylene tanks, except on the manhole lids where stainless steel screws will be acceptable. The wall thickness of the side walls, top, bottom, and covers shall be at least 5 mm.

Inlet and outlet baffles shall be provided with the polyethylene tank and shall be solvent-weld PVC pipe and tees conforming to ASTM Specification D-3033 or D-3034. The inlet and outlets of the tanks shall be gasketed to provide a leak-proof seal between the tank and the 4-inch, SDR 35, PVC inlet and outlet piping. Gaskets shall be neoprene rubber and comply with ASTM Specification C-564.

Each septic tank shall have 2 manholes for interior access for maintenance. One of the access lids shall have a 24-inch long by 7-3/4-inch OD riser. The lid and riser shall be molded as a single unit and shall meet the same polyethylene requirements as the tank. The lid shall twist lock or be secured with stainless steel screws onto the tank's access manhole. The riser shall be capped with a cap secured with a minimum of 3 stainless steel screws or with a MIPT plug and shall be painted red on those portions above the ground surface.

TP-8.03 Septic Tank Installation

Excavation shall be approximately 1 foot wider and longer than the tank. All tanks shall be set on a smooth level surface. The septic tank shall be placed plumb and true so that the inlet and outlet are at the highest possible elevations and so that the outlet pipe is not less than 2 inches nor more than 5 inches below the inlet pipe. The minimum bury for the septic tank inlet pipe shall be 18 inches. The maximum dirt cover for the septic tank shall be 36 inches in accordance with the standard detail. Where over excavation occurs, the bottom shall be raised to final elevation in 6-inch compacted lifts. Any water in the excavation must be removed and elevations checked before setting the tank. At the Engineer's discretion, tanks shall be filled with water to preclude the possibility of floating. Both the septic tank inlet and outlet lines shall be grouted to the septic tank. Backfill around the tank shall be compacted and shall be sufficient to allow for no settlement.

TP-8.04 Sewer Pipe and Fittings

All 4-inch pipe and fittings, except cleanout tees, risers, hub adapters, and plugs, shall be PVC, SDR 35, solvent-weld joints and shall comply with ASTM Specifications D-3033 and D-3034. All PVC shall be Type 1, Grade 1, PVC 1140 conforming to ASTM Specification D-1784.

Cleanout tees, risers, hub adapters, and plugs shall be PVC/DWV and comply with ASTM Specification D-2665.

TP-8.05 Sewer Pipe Installation

NECA shall install house sewers from two or five feet outside the house to the septic tank inlet, including a two-way cleanout. The four inch solid PVC shall be laid in a trench at least 12-inches wide and at a minimum slope of 1/4-inch per foot unless otherwise directed. Care shall be taken to provide a bed free of rocks. The backfill shall be carefully placed in six-inch layers until the pipe is covered with one-foot, and in two-foot layers above that. The excavation shall be wheel rolled and mounded and wheel rolled again so there will be little settlement in the trench. The minimum depth for the solid pipe shall be twelve inches from the existing ground to the top of the pipe.

Cleanout tees shall be two-way, 4" x 4" x 4", all solvent-weld hubs, PVC/DWV fittings. Cleanout risers for DWV cleanouts shall be 4-inch PVC/DWV and shall terminate 3 to 6-inches above the ground surface with a PVC/DWV 4-inch hub adapter (solvent-weld hub by FIPT) and a MIPT plug.

Sewer service line cleanouts shall be installed at the house, at intervals of approximately 100 feet, and at each aggregate change of direction greater than 45° (no single fitting greater than 45° allowed) between the house and the septic tank. Fitting restrictions and cleanout installations are not applicable for sewer service line constructed between the septic tank and the disposal system.

TP-8.06 Drainfield Materials

TP-8.06.01 Gravel

Drainfield gravel shall comply with the requirements for coarse aggregate under Federal Specification SS-A-281b, "Aggregate; (for) Portland-Cement-Concrete", and shall be Size 3 (2" to 1" nominal size). The amount of deleterious substances in the coarse aggregate shall not exceed the limits given in Section 3.2.3 of Federal Specification SS-A-281b.

TP-8.06.02 Pipe and Fittings

All PVC shall be Type 1, Grade 1, PVC 1140 conforming to ASTM Specification D-1784.

All 4-inch solid PVC pipe and fittings shall be PVC, SDR 35, solvent-weld joints and shall comply with ASTM Specifications D-3033 and D-3034.

All 4-inch perforated PVC pipe shall be solvent-weld joints and shall comply with ASTM Specification D-2729 or D-3033 and D-3034. Perforations shall be ½ to 5/8 inch diameter holes on 5-inch centers in two rows spaced 90 to 120 degrees apart.

TP-8.06.03 Drainage Fabric

The drainfield gravel shall be covered with a drainage fabric prior to backfilling of the drainfield trench with soil. The fabric shall be nonwoven and composed of polypropylene filaments and shall be inert to biological degradation and naturally encountered chemicals, alkalies, and acids. The fabric shall have a minimum average grab tensile strength of 120 pounds, a minimum average burst strength of 285 psi, a minimum average coefficient of permeability of 0.3 cm/sec, and a minimum thickness of 60 mils. The drainage fabric shall be equal to the Mirafi 140N nonwoven fabric as manufactured by Mirafi, Inc., P.O. Box 240967, Charlotte, North Carolina.

TP-8.07 Drainfield Installation

The trench width in the drainfield shall normally be 24-inches and shall not exceed 36-inches nor be less than 12-inches without the consent of the Engineer. Trench bottoms shall be smooth and level from beginning of trench to end. All smeared or compacted surfaces of the trenches or bed shall be raked to expose the natural texture of the soil. All loose material shall be removed from the trench before the gravel is placed. The drainfield trench shall be kept as shallow as possible but with a minimum depth of 24-inches and a maximum depth of 60-inches.

Drainfields shall be built so that all lines are looped.

Where rock, clay, or ground water are encountered, the NECA shall immediately notify the Engineer and shall cease work on the drainfield installation.

The bottom of the trench shall be covered with a 6-inch minimum depth lift of gravel. The lift shall be leveled (but not compacted) by hand to within ± 1-inch throughout the entire length of the trench. The 4-inch perforated plastic pipe shall then be laid level ± 1 inch by hand and centered in the trench. After the pipe has been laid, a second 6-inch lift of gravel shall be placed by hand and not compacted. The gravel shall be placed so that it extends 2-inches above the pipe. A layer of synthetic drainage fabric or untreated building paper shall then be placed over the gravel and folded up the sides of the trench to prevent backfill soil from coming in contact with the gravel.

The trench shall then be backfilled and not compacted. The top shall be mounded with an 8 to 12-inch uncompacted crown. No mechanical or vehicular traffic shall be used to compact the trench. Backhoes shall not be allowed on trenches during or after the backfilling operation.

Four, red T-type, steel posts shall be placed at the outside corners of the drainfield. The post shall be driven a minimum of 14-inches into the ground and shall extend a minimum of 36-inches above the ground.

The NECA shall leave the premises in a neat and orderly condition. Excess dirt shall be spread evenly over the ground in the immediate area or disposed of in a manner approved by the Engineer.

Care shall be taken by NECA to avoid damage to lawns, gardens, and crops during the installation process.

TP-8.08 Graveless Drainfield

TP-8.08.01 Graveless Drainfield Materials

The graveless drainfield shall consists of interlocking leaching chamber units, opened end plates, and closed end plates constructed from molded high density polyethylene. Each chamber shall have a knockout access port sized to receive a four inch diameter PVC pipe. Graveless drainfield components shall be equal to the Infiltrator as manufactured by Infiltrator Systems Inc., P.O. Box 768, Old Saybrook, CT 06475.

TP-8.08.02 Graveless Drainfield Installation

In place of perforated pipe and gravel for distribution and storage of waste water, leaching chambers or graveless drainfield systems can be employed.

The trench width for a graveless drainfield shall normally be 36-inches or as specified by the manufacturer. Trench bottoms shall be smooth and level from beginning of trench to end. All smeared or compacted surfaces of the trenches or bed shall be raked to expose the natural texture of the soil. All loose material shall be removed from the trench before the chamber units are installed. The trench shall be kept as shallow as possible but with a minimum depth of 24-inches and a maximum depth of 36-inches.

The installation of the graveless system shall be per the manufacturer's recommendations.

Where rock, clay, or ground water are encountered, NECA shall immediately notify the Indian Health Service Project Engineer and shall cease work on the drainfield installation.

The area between the leach chamber and trench wall shall be backfilled and compacted. The minimum cover for the graveless drainfield is 12-inches. The top shall then be mounded with an 8 to 12-inch crown and shall not be compacted. No mechanical or vehicular traffic shall be used to compact the trench. Backhoes shall not be allowed on trenches during or after the backfilling operation.

A 4-inch solid sewer PVC/DWV inspection port with adapter hub and plug shall be installed at the end of each line per standard detail S-19.

The NECA shall leave the premises in a neat and orderly condition. Excess dirt shall be spread evenly over the ground in the immediate area or disposed of in a manner approved by the Engineer.

Care shall be taken by NECA to avoid damage to lawns, gardens, and crops during the installation process.

TP-8.10 Individual Wastewater Pond

TP-8.10.01 Stripping

Vegetation shall be removed from the pond construction site by pushing or otherwise lifting and transporting to an immediately adjacent area. This material shall not be used further in project construction.

TP-8.10.02 Excavation and Embankment

Excavation and embankments shall be made approximate to the depths, slopes, grades, and lines as called for in the plans and as otherwise ordered by the Engineer. Approximate is to be interpreted to mean that the overall orientation and configuration is provided and that dimensional values are within ±10%. This provision allows NECA to accomplish construction with a minimal amount of heavy equipment.

All excavation materials, insofar as practical, shall be used in formation of the pond embankment. All unsuitable materials shall be removed to a depth of not less than six inches below the finished grades or as directed by the Engineer. Unsuitable materials shall include organic materials, rocks, or debris. The resulting area and other low sections shall be brought to grade with suitable material obtained from within the limits of construction. Soil compaction shall be performed by the equipment required for excavation. Compaction lifts are to constructed in 12-inch layers. The top 6-inches of all excavated surfaces within the cell area shall be compacted

Where required, NECA in conjunction with the Engineer, shall make prior arrangements to have sufficient water for compaction. The foundation or layers of embankment shall have a moisture content uniformly distributed throughout which, in the opinion of the Engineer, will provide the required compaction. If the moisture of the soil is such that water is required, such watering may be accomplished by any approved type of water equipment. The amount of sprinkling shall be as directed by the Engineer. If mixing is necessary to obtain a uniform distribution of moisture, such mixing shall be accomplished in any manner which will provide the required uniform distribution.

Soil density in compacted areas shall be such that the heal of the Engineer's boot does not settle less than 3-inches when thrust with his foot. The Engineer may test for compaction at random locations and lifts to assure that required compaction is achieved.

TP-8.10.03 Appurtenances

All appurtenances shall be of the size and located as shown on the drawings. No changes shall be made unless they are directed by the Engineer.

TP-8.10.04 Inlet Piping

Inlet piping shall include one length (approximately 20 feet) of ductile iron pipe of the size specified in the drawings. The inlet piping is to be installed firmly supported within the pond embankment, cantilevered approximately 5 feet into the pond area without further support, and shall terminate approximately 6-inches above the high water level. The service line to inlet piping connection shall be made using a PVC to DI mechanical joint transition coupling.

TP-8.10.05 Bentonite Sealant

Refer to Section 6, Waste Stabilization Pond Construction, for specifications concerning the installation of a bentonite seal.

TP-8.10.06 Fencing

Fencing shall be installed according to the standard fencing and gate detail S-20 except that a 3 foot wide pedestrian gate is required to substitute the 12 foot wide gate shown. Two strands of barbed wire are required to be installed parallel and along the gate top. The gate shall be hinged on one side and latched with a lockable latch on the other.

TP-8.10.07 Rip-Rap

Rip-rap erosion protection is required below the inlet piping. It shall include 4 to 12-inches of rock material placed below the inlet piping covering an area approximately 4 square feet.

TP-8.10.08 Signs

Warning signs shall be furnished and installed by NECA. One sign shall be installed on the gate and one on each fence side other than the side with the gate. Signs shall read: "DANGER-CONTAMINATED WATER".

TECHNICAL PROVISIONS

Section 9 - Concrete Work

TP-9.01 General

It is the intention of this section of the specifications to specify the quality of concrete and mortar and methods of placing same for all work done for this project which requires the use of concrete or mortar. All such work shall strictly conform to the applicable portions of this section and the drawings in all details.

TP-9.02 Materials

The Portland cement shall be supplied by IHS, Type I or Type II (sulfate-resistant) as required.

Fine and course aggregate shall be clean, hard, tough, water sound, and free of deleterious substances. Fine aggregate shall meet all requirements of Federal Specifications SS-A-281 b.

Total Passing Percent by Weight

3/8-inch sieve	100
No. 4 sieve	95-100
No. 8 sieve	80-100
No. 16 sieve	50-85
No. 30 sieve	25-60
No. 50 sieve	5-30
No. 100 sieve	0-10

Course aggregate shall meet all requirements of Federal Specification SS-A-281 b as amended, size number 467 (nominal 1-1/2-inch to number 4).

Total Passing Percent by Weight

2-inch sieve	100
1-1/2-inch sieve	95-100
3/4-inch sieve	35-70
1/8-inch sieve	10-30
No. 4 sieve	0-5

NECA shall be responsible for supplying the water and curing materials for all concrete work. In addition, NECA shall provide all form oil, tie wire, risers, curing materials and other incidentals necessary for the completion of all concrete work except for the cement, sand, gravel, reinforcing bar and plywood. The cutting, welding, or shaping of reinforcing bars and forms shall be the responsibility of NECA.

Water used in mixing mortar, grout, and concrete and/or for curing concrete and/or washing concrete aggregates shall be clear, free from oil, acid, alkali, clay, salt, sugar, vegetation matter or other deleterious material; and shall have a pH value of not less than 4.5 or not to exceed 8.5. Potable water obtained from public utility distribution lines will be acceptable.

Form oil will be used for the purpose of preventing the forms from adhering to the concrete and shall be clean, colorless, mineral oil which will not discolor or otherwise injure the concrete surface. Other materials or methods used for this purpose shall be approved by the Engineer.

TP-9.03 Sacked Pre-Mixed Concrete Mix

The use of sacked pre-mix concrete is a convenient method of supplying materials for small projects where only small quantities of concrete are needed at one time. The pre-mix consists of pre-measured portions of cement, coarse aggregate, and sand. The pre-mix should only be used on projects which require Class B or C mixes.

TP-9.04 Storage

Cement or pre-mix shall be stored in water-tight conditions off the ground. Easy access for inspection and removal shall be provided. Any cement which has partially hardened or set shall be removed from the job site and not used.

Reinforcing steel shall be stored off the ground to protect it from dirt, oil, or grease.

TP-9.05 Placing of Concrete

Water shall be removed from excavations before concrete is placed. Hardened concrete, debris, and other foreign materials shall be removed from the interior of forms and from the inside of mixing and conveying equipment. The sub-grade shall be thoroughly moistened, but not muddy at the time the concrete is deposited.

Concrete shall be conveyed from the mixer to form as rapidly as possible without segregation or loss of ingredients. Concrete that has attained its initial set or has contained its water content for more than 1-1/2 hours shall not be used in the work. Class A and B concrete shall not be allowed to drop freely more than five feet in unexposed work nor more than three feet in exposed work without the use of tremies or other approved methods. Running or working concrete along the forms or any other practice tending to cause segregation of the ingredients will not be allowed.

For job mixed concrete, the concrete shall be mixed in a clean batch machine. All concrete shall be mixed until there is uniform distribution of the materials and the entire batch shall be discharged completely before the mixer is recharged. The mixer shall rotate at the speed recommended by the manufacturer and mixing shall be continued for at least 1-1/2 minutes after all materials are in the drum. Concrete shall be set in place within one-half hour of the addition of water to the mixer.

TP-9.06 Classes of Mixtures

For the purpose of savings on materials and labor, three classes of concrete shall be used in this project. They are delineated in the following tables:

Table I
Concrete Mixes

Class	(Approximate) Gravel:Sand:Cement	Maximum Water Cement Ratio	Bags Cement Per Yd^3	Slump
A	2.5:1.7:1.0	4.6 gal./bag	7.0 bag/yd.	1-3"
B	3.0:2.0:1.0	5.8 gal./bag	6.0 bag/yd.	2-4"
C	3.5:2.5:1.0	6.5 gal./bag	5.5 bag/yd.	2-4"
Mortar	0.0:3.0:1.0	---	---	---

Table II
Concrete Uses

Class	(28 days) Strength (psi)	Uses
A	3500	Reservoir foundation, treatment house foundation, vaults, or other structural foundations.
B	3000	Manholes, sidewalks, curbs, and gutters.
C	2500	Thrust block, posthole concrete, or valve box collars.

TP-9.06.02 Measuring

Measuring for Class A, B, and Class C concrete may be by weight or shovelfuls from experienced concrete workers. All mortar shall be mixed by skilled masons.

The Engineer may change the design of the concrete mixes at any time before the concrete is poured or may require trial design batches to be tested before pouring of any concrete.

TP-9.06.03 Tests

Slump tests shall be performed on representative samples for all Class A concrete poured. Cylinder tests may be taken on Class A concrete wherever so designated. The Engineer shall supply the cylinders for filling and have the sample cured and tested.

TP-9.07 Reinforcing Steel

Reinforcing bars shall be placed as shown on the plans and shall be securely tied in position with No. 14 or No. 16 gauge wire at all intersections except where the spacing is less than one foot in either direction, in which case alternate intersections shall be tied. Metal spacers, hangers, and other approved devices shall be used to hold the reinforcement in position.

Splicing or welding of reinforcing bar shall only be as approved by the Engineer. Reinforcement shall be inspected and approved by the Engineer before concrete is poured.

TP-9.08 Forms

All forms used for exposed surfaces shall be clean, smooth, free of loose knots, dents, wrinkles, bends, warpage, protruding surfaces, and all other imperfections which will mar the smoothness and continuity of alignment.

TP-9.09 Joints

All jointing materials and construction for concrete work shall be approved by the Engineer.

TP-9.10 Cold Weather

Class A and B concrete shall not be placed when the air temperature is at or below 40°F, unless authorized by the Engineer. If so authorized, the aggregates and water shall be heated as herein provided.

If concrete pouring is authorized for temperatures at or below 40°F, NECA shall furnish equipment capable of producing concrete that will have a temperature of not less than 45°F at the time of placement. Heating of aggregates and water used for mixing shall not be heated to a temperature exceeding 120°F.

After the concrete is placed, the air temperature surrounding such concrete shall be maintained at a temperature of not less than 45°F for a period of four (4) days. Following the four day period, the concrete shall be protected from air temperatures below 40°F for an additional four day period. When artificial heating is required, the heating units shall not locally heat or dry the surface of the concrete. Heating procedures that alter or prevent the entrainment of the required amount of air in the concrete will not be permitted. The placing of concrete will not be permitted until the Engineer is satisfied that all the necessary protection equipment and materials are on hand at the site and in satisfactory working condition.

TP-9.11 Vibration

Class A and B concrete shall be placed in horizontal layers not over 12-inches deep and shall be thoroughly consolidated by suitable means during placement such that all voids will be filled and segregation will not occur and also that reinforcing steel and forms will not be displaced.

TP-9.12 Curing

TP-9.12.01 Concrete pavement, floors, floor slabs, the top of bottom slabs of concrete box culverts, sidewalks, footpaths, curb and gutter, drivepads, and other horizontal surfaces shall be cured by one of the following methods:

A. Waterproof paper or sheet plastic method
B. Cotton or burlap mat method
C. Membrane method

All exposed surfaces of formed concrete members (i.e.: beams, girders, columns, walls, etc.) shall, immediately after the forms have been stripped, be cured by one of the three methods above or:

D. Leaving the forms in place method

TP-9.12.02 Methods:

A. Waterproof paper or sheet plastic method: After the final finishing operation and the concrete hardened sufficiently to prevent marring the surface, the top of the slab and sides, if exposed, shall be entirely covered with waterproof paper or polyethylene sheets. The materials shall be of such dimensions that it will extend beyond the edge of the slab at least twice the thickness of the slab or at least 18-inches beyond the enclosed concrete. The material used shall be so placed and weighted as to cause it to remain in intimate contact with the surface covered. The material used shall remain in place at least seven days, unless otherwise provided. All over-lapping sections must be secured by suitable means such that they do not open up or separate during the curing period.

B. Cotton or burlap mats method: After final finishing and the concrete has hardened sufficiently to prevent marring the surface of the slab, the top of the slab and sides shall be covered with cotton or burlap mats. The mats shall be of such length or width and so laid that they will extend to twice the thickness of the slab or at least 18-inches beyond the enclosed concrete. The mat shall be so placed that the entire surface and edges, if exposed, are completely covered. Prior to being placed, the mats shall be saturated with water. The mats shall be placed and weighted to remain in contact with the surface covered. The mats shall be maintained fully wetted and in position for a period of at least seven days, unless otherwise provided.

   An alternative, for use on flat slabs, is a covering of 6-inches of moist earth which can be dampened periodically.

C. Impervious Membrane: Clear or translucent impervious membrane curing compound shall be used for all concrete surfaces when this method is used except that the white pigmented type shall be used for concrete riding pavement surfaces and curbs and gutter. All surfaces shall be given the required surface finish prior to application of impervious membrane curing compound. During the finishing period, the concrete shall be protected by methods approved by the Engineer.

   The minimum rate of application shall be one gallon of liquid to 300 square feet or as recommended by the manufacturer. All concrete cured by liquid curing compound shall receive two applications of such compound. The first coat shall be applied immediately after stripping forms and acceptance of the concrete finish. When the surface is dry, the concrete shall be thoroughly wetted with water and the curing compound shall be applied immediately after the surface film of the water disappears. The second application shall be applied immediately after the first application has set. During curing operations, any unsprayed surfaces shall be kept wet with water.

   The coating shall be protected against marring or traffic for a period of not less than three days after applications. Any coating that is marred or otherwise disturbed shall be given an additional coating.

   When using impervious curing compound, the material shall be thoroughly mixed within one (1) hour before use to recombine any materials that may have become separated.

   When the use of impervious curing compound results in a streaked or blotchy appearance the application shall be discontinued and water curing shall be applied until the cause of the defect in appearance has been corrected.

D. Leaving the forms in place: Curing of formed surfaces may be accomplished by leaving the forms in contact with the concrete surfaces for a period of seven (7) days. The forms will be required to be kept continually moist during hot, dry and/or windy weather.

TP-9.13 Finish

On Class A and B concrete all exposed edges and surfaces shall be straight, smooth, and free of hollows. Exposed edges shall be leveled or rounded as directed. Voids or other defects disclosed upon removal of forms shall be patched. Patching shall be carefully done by experienced workmen and in a manner to match the adjacent concrete. No dry cement or extra water shall be added to any surface to aid in finishing.

On exposed above ground surfaces, all bolts, wires, snap ties, and rods shall be clipped and recessed. All holes, honeycomb, rock pockets and other surface imperfections shall be cleaned out, thoroughly moistened and carefully patched with mortar. Mortar shall be one part cement and two parts fine sand. A portion of the required cement for mortar shall be white as required to match the color of the surrounding concrete. The surface shall be patched, then promptly covered with polyethylene film, wet burlap or cotton mats or impervious membrane for proper curing.

Slab surfaces shall be finished by screeding with straight edges and floating to the required finish level. While the concrete is still green but sufficiently hardened, the surface shall be steel troweled to a uniform smooth surface free from tool marks. All floor surfaces shall then receive a light broom finish.

PART 1 PRODUCTS

Not Used

PART 2 EXECUTION

Not Used

END OF SECTION

SECTION 52 00 00
DRAWINGS

PART 1 GENERAL

1.01 DISCREPANCIES, ERRORS, OR OMISSIONS

A. Inform CO of discrepancies discovered on drawings in accordance with clause at FAR 52.236-21, Specifications and Drawings for Construction.

B. In accordance with clause at FAR 52.236-21, Specifications and Drawings for Construction, in case of discrepancies, written specifications take precedence over drawings unless otherwise specified.

1.02 PROJECT CONDITIONS

A. Where there are differences as determined by CO between details and dimensions shown on drawings and details and dimensions of existing features at jobsite, use details and dimensions of existing features at jobsite.

1.03 SPECIFICATION DRAWINGS

A. Some drawings show details of fabrication or other details and specifications which are not a part of work under this contract. Disregard specifications and details shown on these drawings which are not applicable to work under this contract.

B. Reference drawings referred to on specification drawings and not considered necessary for contract purposes are not included in specifications.

C. Parts of work for which dimensions are not shown have been drawn to scale as nearly too final dimensions as possible before purchase of machinery or equipment and development of final general and detailed designs.

1.04 TYPICAL DRAWINGS

A. Typical drawings show installations and details of construction which are similar to or approximate to those that are part of work under these specifications. Dimensions and details shown on typical drawings may vary from those shown on construction drawings to be furnished after award of contract.

B. Use typical drawings for bidding purposes only.

1.05 ADDITIONAL OR REVISED DRAWINGS

A. Except as provided in these specifications for drawings to be furnished by Contractor, specifications drawings will be supplemented by additional or revised general and detail drawings as necessary or desirable as work progresses.

B. Do not perform work without proper drawings and instructions.

C. Additional or revised general and detail drawings will show dimensions and details necessary for construction purposes more completely than are shown on these specifications drawings for features of work and for equipment or metalwork not yet purchased.

D. Perform work in accordance with additional general and detail drawings or revisions at applicable prices offered in Price Schedule for such work.

1.06 INFORMATION DRAWINGS

A. Drawings marked "For Information Only" in the drawing list are included to show existing features about which knowledge is required to perform work under this contract. These drawings do not show work to be performed under this contract.

B. If there are differences as determined by the CO between details and dimensions shown on these drawings and those of existing features at jobsite, use details and dimensions of existing features at jobsite.

1.07 STANDARD DRAWINGS

A. Standard drawings may show details which are not a part of work under this contract. Disregard details shown on these drawings which are not applicable to work under this contract.

1.08 LIST OF DRAWINGS

A. Drawings listed in Table 52 00 00A – List of Drawings, are made a part of Section C – Description/Specifications.

1.09 DRAWING NUMBERS IN NUMERICAL ORDER

A. Specification drawings are listed in numerical order in Table 52 00 00B – Drawings in Numerical Order.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Table 52 00 00A – List of Drawings		
Sheet No.	Drawing No.	Title
General:		
1	1695-D-60249	San Juan Lateral – Block 2-3 – Line Pipe – Sheet Key – Notes and Symbols
1A	***1695-D-62462***	***San Juan Lateral – Block 2 - 3 – Contractor Use Area – Staging Area 1***
1B	***1695-D-62505***	***San Juan Lateral – Block 2 - 3 – Contractor Use Area – Staging Area 2***
Civil:		
2	1695-D-60776	San Juan Lateral – Block 2 - 3 – Reach 2 – Line Pipe – Plan and Profile – Beginning to Sta. 2050+00
3	1695-D-60777	San Juan Lateral – Block 2 - 3 –Reach 2 – Line Pipe – Plan and Profile – Sta. 2050+00 to Sta. 2100+00
4	1695-D-60778	San Juan Lateral – Block 2 - 3 – Reach 2 – Line Pipe – Plan and Profile – Sta. 2100+00 to Sta. 2150+00
5	1695-D-60779	San Juan Lateral – Block 2 - 3 – Reach 2 – Line Pipe – Plan and Profile – Sta. 2150+00 to Sta. 2200+00
6	1695-D-60780	San Juan Lateral – Block 2 - 3 – Reach 2 – Line Pipe – Plan and Profile – Sta. 2200+00 to Sta. 2250+00
7	1695-D-60782	San Juan Lateral – Block 2 - 3 – Reach 2 – Line Pipe – Plan and Profile – Sta. 2250+00 to END
8	1695-D-60783	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Plan and Profile – Beginning to Sta. 3350+00
9	1695-D-60784	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Plan and Profile – Sta. 3350+00 to Sta. 3400+00
10	***1695-D-60785***	***San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Plan and Profile – Sta. 3400+00 to Sta. 3450+00***
11	1695-D-60786	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Plan and Profile – Sta. 3450+00 to Sta. 3500+00
12	***1695-D-60787***	***San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Plan and Profile – Sta. 3500+00 to Sta. 3550+00***

Table 52 00 00A – List of Drawings		
Sheet No.	Drawing No.	Title
13	1695-D-60788	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Plan and Profile – Sta. 3550+00 to Sta. 3600+00
14	***1695-D-60789***	***San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Plan and Profile – Sta. 3600+00 to Sta. 3650+00***
15	1695-D-60792	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Plan and Profile – Sta. 3650+00 to Sta. 3700+00
16	1695-D-60794	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Plan and Profile – Sta. 3700+00 to End
17	1695-D-60795	San Juan Lateral – Block 2 - 3 – Line Pipe – Pressure Pipe Trench Installation – Sections and Details
18	1695-D-60796	San Juan Lateral – Block 2 - 3 – Line Pipe – Concrete Blocked Miter Bends – Sections and Details
19	1695-D-60797	San Juan Lateral – Block 2 - 3 – Line Pipe – Concrete Encased Miter Bends – Sections and Details
20	1695-D-60798	San Juan Lateral – Block 2 - 3 – Line Pipe – Air Valve Installation – Sections and Details
21	1695-D-60799	San Juan Lateral – Block 2 - 3 – Line Pipe – Air Valves with Manholes – Sections and Details
22	1695-D-60800	San Juan Lateral – Block 2 - 3 – Line Pipe – Manhole with Blowoff – Sections, Details, and Tables
23	1695-D-60801	San Juan Lateral – Block 2 - 3 – Line Pipe – Sectionalizing Valve Installation – Plan, Sections and Tables
24	1695-D-60802	San Juan Lateral – Block 2 - 3 – Line Pipe – Sectionalizing Valve Installation – Plan, Sections and Details
25	1695-D-60803	San Juan Lateral – Block 2 - 3 – Line Pipe – Collars – Details, Sections and Data Tables
26	1695-D-60804	N.A.P.I. Turnout – Plans, Sections, and Details
27	1695-D-60805	San Juan Lateral – Block 2 - 3 – Line Pipe – Typical Buried Manhole – Plans, Sections and Tables
28	1695-D-60806	San Juan Lateral – Block 2 - 3 – Line Pipe – Precast Concrete Manholes – Plans, Sections, and Details

Table 52 00 00A – List of Drawings		
Sheet No.	Drawing No.	Title
29	1695-D-60807	San Juan Lateral – Block 2 - 3 – Line Pipe – Typical Road Crossing – Open Cut and Bored Sections
30	1695-D-60808	San Juan Lateral – Block 2 - 3 — San Juan Lateral Water Treatment Plant Regulating Tanks -Access Road – Plan and Profile
31	1695-D-60809	San Juan Lateral – Block 2 - 3– San Juan Lateral Water Treatment Plant Regulating Tanks Site Plan
32	1695-D- 60810	San Juan Lateral – Block 2 - 3 – Concrete Blocked Miter Bends – Sections and Details
33	1695-D-60811	San Juan Lateral – Block 2 - 3 – Air Valves and Blowoffs – Data Tables
34	1695-D-60812	San Juan Lateral – Block 2 - 3 – Blowoff – Section and Details
35	1695-D-60813	San Juan Lateral – Block 2 - 3 – Wash Crossing - Erosion Control Details
36	1695-D-60814	San Juan Lateral – Block 2 - 3 – Wash Crossing - Erosion Control Details
37	1695-D-62461	San Juan Lateral – Block 2 - 3 – Reach 2 – Lin++e Pipe – Auger Bore - Powerline Crossing Sta. 2016+95
38	1695-D-62463	San Juan Lateral – Block 2 - 3 – Reach 2 – Line Pipe – Auger Bore - State Hwy 64 Crossing Sta. 2108+22
39	1695-D-62464	San Juan Lateral – Block 2 - 3 – Reach 2 – Line Pipe – Auger Bore - Road 6700 Crossing Sta. 2134+23
40	1695-D-62465	San Juan Lateral – Block 2 - 3 – Reach 2 – Line Pipe – Auger Bore - Powerline Crossing Sta. 2184+59
41	1695-D-62466	San Juan Lateral – Block 2 - 3 – Reach 2 – Line Pipe – Auger Bore – ISR N 362 Crossing Sta. 2189+73
42	Deleted	Deleted
43	1695-D-62468	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Auger Bore – Powerline Crossing Sta. 3340+33

Table 52 00 00A – List of Drawings		
Sheet No.	Drawing No.	Title
44	1695-D-62469	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Auger Bore - ISR 36
45	Deleted	Deleted
46	Deleted	Deleted
47	1695-D-62503	San Juan Lateral – Block 2 - 3 – Reach 3 – Line Pipe – Auger Bore - Powerline Crossing Sta. 3478+93
48	***1695-D-62472***	***San Juan Lateral – Block 2 - 3 – Concrete Water Tank - Plan and Sections***
49	1695-D-62473	San Juan Lateral – Block 2 - 3 – Concrete Water Tank - Details and Section
50	1695-D-62474	San Juan Lateral – Block 2 - 3 – Tank Overflow and Drain Apron – Plan and Sections
Mechanical:		
51	***1695-D-62475***	***San Juan Lateral – Block 2 - 3 – Steel Manifold Piping - Plan***
52	***1695-D-62476***	***San Juan Lateral – Block 2 - 3 – Steel Manifold Piping - Sections***
53	1695-D-62477	San Juan Lateral – Block 2 - 3 – Steel Manifold Piping – Details and Schedules
54	1695-D-62478	San Juan Lateral – Block 2 - 3 – Steel Manifold Piping - Details
55	***1695-D-62479***	***San Juan Lateral – Block 2 - 3 – Tank 2 – Plan, Section and Details***
56	***1695-D-62480***	***San Juan Lateral – Block 2 - 3 – Tank 1 - Plan, Section and Details***
57	***1695-D-62481***	***San Juan Lateral – Block 2 - 3 – Welded Steel Tank – Sections and Details***

Table 52 00 00A – List of Drawings		
Sheet No.	Drawing No.	Title
58	***1695-D-62482***	***San Juan Lateral – Block 2 - 3 – Welded Steel Tank – Sections and Details***
59	***1695-D-62483***	***San Juan Lateral – Block 2 - 3 – Overflow - Sections and Details***
Electrical:		
60	1695-D-62484	San Juan Lateral – Block 2 - 3 – Electrical – SCADA – Network Diagram
61	1695-D-62485	San Juan Lateral – Block 2 - 3 – Electrical Installation – Electrical Plan
62	1695-D-62486	San Juan Lateral – Block 2 - 3 – Grounding Plan
63	1695-D-62487	San Juan Lateral – Block 2 - 3 – Electrical Installation -Site Panelboard Schedule
64	1695-D-62488	San Juan Lateral – Block 2 - 3 – Electrical Installation – Single Line Diagram
65	1695-D-62489	San Juan Lateral – Block 2 - 3 – Electrical Installation – Conduit Plan
66	1695-D-62490	San Juan Lateral – Block 2 - 3 – Electrical Installation - Cable and Conduit Schedule
67	1695-D-62491	San Juan Lateral – Block 2 - 3 – Electrical Installation - Panel Elevation Views
68	1695-D-62492	San Juan Lateral – Block 2 - 3 – Electrical Installation - Equipment Connection Schedule
Cathodic Protection:		
69	1695-D-62493	San Juan Lateral – Block 2 - 3 – Corrosion Protection – Test Station and Cable Trench Details
70	1695-D-62494	San Juan Lateral – Block 2 - 3 – Corrosion Protection – Galvanic Anode Cathodic Protection Anode Bed

Table 52 00 00A – List of Drawings		
Sheet No.	Drawing No.	Title
71	1695-D-62495	San Juan Lateral – Block 2 - 3 – Corrosion Protection – Impressed Current Deep Well Anode Bed
72	1695-D-62496	San Juan Lateral – Block 2 - 3 – Corrosion Protection – Joint Bond Details and Cable Identification
73	1695-D-62497	San Juan Lateral – Block 2 - 3 – Corrosion Protection – Welded Water Storage Tank Plan and Profile
P&ID:		
74	1695-D-62498	P&ID - Legend
75	1695-D-62499	P&ID – Symbols & Abbreviations
76	1695-D-62500	P&ID – Symbols & Abbreviations
77	1695-D-62501	P&ID – Tank Yard
Information Drawings:		
78	1695-D-61852	San Juan Lateral – Block 2 - 3 – Shumway Arroyo – Plan and Profile (Plastic)
78A	***1695-D-62329***	***San Juan Lateral – Block 2 - 3 – Reach 1 – Additional Contractor Use Area – Weathers Parcel***
78B	***1695-D-62330***	***San Juan Lateral – Block 2 - 3 – Reach 1 – Additional Contractor Use Area – Shaw Parcel***
79	1695-D-62450	San Juan Lateral – Block 2 - 3 – Shumway Arroyo – Plan and Profile (Metallic)
80	1695-D-62452	San Juan Lateral – Block 2 - 3 – San Juan River – Plan and Profile
81	1695-D-62454	San Juan Lateral – Block 2 - 3 – Nenahnezad Bluff – Plan and Profile
82	1695-D-62456	San Juan Lateral – Block 2 - 3 – Chaco River – Plan and Profile
83	1695-D-61865	San Juan Lateral – Pumping Plant No. 1 – Manifold Piping – Plan and Profile
84	085-N-1100	SJLWTP Regulating Tank NIP Layout

Table 52 00 00A – List of Drawings		
Sheet No.	Drawing No.	Title
85	085-D-1101	SJLWTP Regulating Tank NIP Power Distribution
Standard Drawings:		
86	40-D-60001	Electrical Equipment Support, Type 1 – Sections and Detail
87	40-D-60002	Typical Guard Posts – Non Security Application
88	40-D-60003	General Notes for Concrete Outline and Reinforcement
89	40-D-60004	Minimum Requirements for Detailing Reinforcement
90	40-D-6137	Manholes – Class 150 LB. and 300 LB.
91	40-D-6234	Standard Nameplates
92	40-D-7016	Chain Link Fencing Requirements Soil Installation
93	40-D-7102	Government Drawing Format - Drawing Border, Sample Title Block, and Signature Lines
94	40-D-4334	Electrical Standards – Typical Grounding Details
95	40-D-4335	Electrical Standards – Typical Grounding Details
96	40-D-4753	Electrical Installation - Typical Grounding Details - For Switchyards and Substations
97	40-D-6463	PVC Waterstops - 12-Inch Type, 9-Inch Type, and 6-Inch Type - Cross-Sections

Table 52 00 00B – Drawings in Numerical Order	
Drawing No.	Sheet No.
1695-D-	
085-D-1101	85
085-N-1100	84
1695-D-60249	1
1695-D-60776	2
1695-D-60777	3
1695-D-60778	4

Table 52 00 00B – Drawings in Numerical Order	
Drawing No.	Sheet No.
1695-D-60779	5
1695-D-60780	6
1695-D-60782	7
1695-D-60783	8
1695-D-60784	9
1695-D-60785	10
1695-D-60786	11
1695-D-60787	12
1695-D-60788	13
1695-D-60789	14
1695-D-60792	15
1695-D-60794	16
1695-D-60795	17
1695-D-60796	18
1695-D-60797	19
1695-D-60798	20
1695-D-60799	21
1695-D-60800	22
1695-D-60801	23
1695-D-60802	24
1695-D-60803	25
1695-D-60804	26
1695-D-60805	27
1695-D-60806	28
1695-D-60807	29
1695-D-60808	30
1695-D-60809	31
1695-D-60810	32

Table 52 00 00B – Drawings in Numerical Order	
Drawing No.	Sheet No.
1695-D-60811	33
1695-D-60812	34
1695-D-60813	35
1695-D-60814	36
1695-D-61852	78
1695-D-61865	83
1695-D-62329	***78A***
1695-D-62330	***78B***
1695-D-62450	79
1695-D-62452	80
1695-D-62454	81
1695-D-62456	82
1695-D-62461	37
1695-D-62462	***1A***
1695-D-62463	38
1695-D-62464	39
1695-D-62465	40
1695-D-62466	41
1695-D-62468	43
1695-D-62469	44
1695-D-62472	***48***
1695-D-62473	49
1695-D-62474	50
1695-D-62475	***51***
1695-D-62476	***52***
1695-D-62477	53
1695-D-62478	54
1695-D-62479	***55***

Table 52 00 00B – Drawings in Numerical Order	
Drawing No.	Sheet No.
1695-D-62480	***56***
1695-D-62481	***57***
1695-D-62482	***58***
1695-D-62483	***59***
1695-D-62484	60
1695-D-62485	61
1695-D-62486	62
1695-D-62487	63
1695-D-62488	64
1695-D-62489	65
1695-D-62490	66
1695-D-62491	67
1695-D-62492	68
1695-D-62493	69
1695-D-62494	70
1695-D-62495	71
1695-D-62496	72
1695-D-62497	73
1695-D-62498	74
1695-D-62499	75
1695-D-62500	76
1695-D-62501	77
1695-D-62503	47
1695-D-62505	***1B***
40-D	
40-D-4334	94
40-D-4335	95
40-D-4753	96

Table 52 00 00B – Drawings in Numerical Order	
Drawing No.	Sheet No.
40-D-60001	86
40-D-60002	87
40-D-60003	88
40-D-60004	89
40-D-6137	90
40-D-6234	91
40-D-6463	97
40-D-7016	92
40-D-7102	93
Deleted	42
Deleted	45
Deleted	46

END OF SECTION

This page intentionally left blank.

SECTION 53 15 00

GEOTECHNICAL RECOMMENDATIONS

PART 1 GENERAL

GEOTECHNICAL REPORT WILL BE MADE AVAILABLE FROM THE CONTRACTING OFFICER'S OFFICE UPON REQUEST

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

This page intentionally left blank.