SECTION 33 05 16.13
PRECAST ONCRETE UTILITY STRUCTURES

PART 1 - GENERAL

1.1 DESCRIPTION

1.1.1 Section Includes: Requirements for providing precast concrete structures, manholes, wet wells, vaults, and other miscellaneous structures or members.

1.2 REFERENCE STANDARDS

1.2.1 All work hereinafter shall comply with current and applicable portions of the following:

1.2.1.1 American Concrete Institute (ACI) Publications.

1.2.1.2 American Society for Testing and Materials (ASTM) Publications.

1.2.1.3 American Welding Society (AWS) Publications.

1.2.1.4 ACI 318, Building Code Requirements for Reinforced Concrete.

1.2.1.5 Precast/Prestressed Concrete Institute (PCI).

1.3 RELATED SPECIFICATIONS

1.3.1 SECTION 09 06 91 - SUBGRADE SERVICE CONCRETE COATING

1.4 QUALITY ASSURANCE

1.4.1 Acceptable Manufacturers and Erectors shall have had a minimum of 5 years experience in precast structural concrete work of the quality and scope required on this project. The producer shall have an established written quality assurance program in effective operation at their plant attested to be a current enrollment of the plant in the PCI "Certification Program for Quality Control" or a Quality Control Program acceptable to the Engineer. The written Quality Control Program will be furnished to the Engineer upon request.

1.4.2 Design

1.4.2.1 Structural members have been indicated on the drawings by general size and depth. The structural analysis and design of these items as well as lifting devices for all precast concrete members

shall be performed by the manufacturer of the precast materials and subject to review of Engineer.

1.4.2.2 Design shall be in accordance with ACI 318, latest edition, and under the supervision of a Professional Engineer registered in the state where the project is located.

1.4.2.3 Design loads shall consist of dead load, live load, impact load, and loads due to water table and any other loads which may be imposed upon the structure. Unless noted otherwise, live loads shall be for HS-20 per AASHTO standard specifications for highway bridges and design wheel loads shall be 16 kips. The live load shall be that which produces the maximum shear and bending moments on the structure.

1.4.2.4 Before shipment, all concrete members shall be inspected to determine that materials and workmanship conform to the requirements of these specifications and the manufacturer/vendor quality control program.

1.4.3 Allowable Tolerances

1.4.3.1 Dimensions and cambers shall be within the tolerances as described in PCI MNL-116, Division V, Section 5.

1.4.3.2 Deflection: Deflection under design live load shall not exceed calculated deflection by more than 10 percent.

1.4.4 Sampling and Testing

1.4.4.1 General

1.4.4.1.1 Samples and tests required below and other tests are to be made by and at the Contractor's expense. The tests shall be performed by an independent commercial testing laboratory or by the manufacturer's lab subject to review by the Engineer. Compressive strength tests for initial prestress may be performed in the manufacturer's plant laboratory. Certified copies of test reports shall be furnished as required in this Specification, and shall include all test data and results.

1.4.4.2 Concrete Testing

1.4.4.2.1 During the progress of the work, plastic concrete, as delivered to the casting site, shall be sampled and tested for slump, air content and compressive strength in accordance with ACI 381, Part 2, Chapter 3, and Part 3,

Chapter 4. No fewer than 6 cylinders shall be made during each concreting cycle. Not more than 1 test in 10 shall fall below the specified strength.

1.4.4.3 Slump Tests

1.4.4.3.1 Slump tests shall be in accordance with ASTM C 143.

1.4.4.4 Failure to Meet Strength Requirements

1.4.4.4.1 If compressive strength tests fail to meet the above requirements, the Engineer may require load tests to be made in accordance with ACI 318. Units failing to meet requirements of the load tests shall not be used. Load tests shall be performed at the expense of the Contractor.

1.5 SUBMITTALS

1.5.1 Shop Drawings

1.5.1.1 Furnish complete details of design, manufacture, fabrication, installation and erection in accordance with the contract conditions. Location of all inserts and openings shall be shown.

1.5.2 Design computations shall be submitted with shop drawings for review prior to manufacture of any units and shall bear the seal of the Professional Engineer who performed or approved the design and is registered in the state where the project is located. All design loads shall be clearly shown.

1.5.3 Each precast concrete unit shall be properly identified by a specific mark, to appear both on the shop drawings and on the manufactured unit. These identifying marks are to be clearly visible to facilitate proper erection and installation.

1.5.4 All connections, bearings, and anchorage details shall be shown on the shop drawings. The precast concrete manufacturer, subject to review of Engineer, will be permitted to modify any details shown on the drawings provided such modifications will be equally or more efficient and more consistent with the latest recommended practices of the Precast/Prestressed Concrete Institute, and at no additional cost to the Owner. All cast-in connection components shall be designed with positive anchorage which shall be accomplished by having the anchors attached to or around reinforcing steel wherever possible.

1.5.5 Design loads, used in design of the precast concrete section, shall be indicated on the shop drawings.

1.5.6 Certificates of Conformance

1.5.6.1 Before delivery of materials and equipment, 4 notarized certificates attesting that materials and equipment meet the requirements specified shall be submitted to the Engineer for review.

1.6 DELIVERY, STORAGE AND HANDLING

1.6.1 Delivery

1.6.1.1 Precast structures and members shall be inspected upon delivery to the erection site and stored in a manner that will prevent staining and damage.

1.6.1.2 Substantially damaged, cracked, or broken units which are deemed unsuitable for the intended use shall be rejected and removed from the site at no cost to the Owner.

1.6.1.3 The Engineer's decision will be final in determining unsuitable units.

1.6.2 Handling

1.6.2.1 Precast concrete members shall be lifted and supported during transportation only at the lifting and/or support points shown on the Shop Drawings. Only lifting devices embedded in these sections by the manufacturer shall be used, unless specific authorization to use other lifting points is received in writing from the manufacturer.

1.6.2.2 Proper equipment shall be used to transport the precast concrete sections to the job site. Trucks and trailers with sufficient capacity to handle the heaviest sections specified, without overloading the access routes, must be used. Units damaged due to racking or twisting will be rejected whether damaged on site and route or at the plant.

1.6.2.3 Proper access on the job site shall be provided by the contractor to permit transportation units to proceed under their own power to a location accessible to erection units.

1.6.3 Storage

1.6.3.1 Store precast structures or members off the ground on wooden blocking, pallets, or other appropriate means away from brush, and in areas accessible for inspection.

1.6.4 Repair or Replacement

1.6.4.1 Repair damage or defects if Engineer deems repairable and at his direction.

1.6.4.2 Remove and replace at no cost to the Owner if Engineer deems damage or defects are not repairable by Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Reinforced Concrete Materials: As modified herein, except that slump requirement shall not apply to manholes.

2.1.2 Precast Concrete Manholes: ASTM C478 except:

2.1.2.1 Compressive Design Strength of Concrete

2.1.2.1.1 Minimum 5,000 psi using Type II cement.

2.1.2.1.2 Minimum compression cylinder test of 4,000 psi at time of shipment.

2.1.2.2 Configurations: Follow Drawings and Standard Details.

2.1.2.3 Joints: ASTM C443.

2.1.2.4 Appurtenances.

2.1.2.4.1 Steps: Manufacture standard details.

2.1.2.4.2 Bolt inserts: Follow Standard Details.

2.1.2.4.2.1 Embed one of following a minimum of 3 inches, to accommodate ¾-inch diameter bolts.

2.1.2.4.2.1.1 Heckman Building Products Corporation, No. 444 Star Threaded Inserts.

2.1.2.4.2.1.2 Pennsylvania Insert Corporation, the Liberator.

2.1.2.4.2.1.3 Atlantic Concrete Products Co., Bolt Slot Insert System.

2.1.2.4.2.1.4 Strut Service Company inserts.

2.1.2.5 Manhole Identification: Clearly marked on inside near top where applicable.

2.1.2.5.1 ASTM Specification designation.

2.1.2.5.2 Manhole setting number (bases only) and Owner project number.

2.1.2.5.3 Date of manufacture.

2.1.2.5.4 Production control number for tracking manufacture phases of item and name or trademark of manufacturer.

2.1.2.5.5 Manhole sections with flexible connectors:

2.1.2.5.5.1 Marked above connector openings with type and size, and type of pipe for which connector is designed.

2.1.2.5.5.2 Engraved or stenciled markings with waterproof paint or ink in minimum 1-inch high letters.

2.1.2.5.6 Lined manholes: Stenciled with waterproof paint or ink markings as noted herein that cannot be easily removed from lining or epoxy coated surfaces.

2.1.2.6 Precast Manhole Sections

2.1.2.6.1 Approved Manufacturers:

2.1.2.6.1.1 Tindall

2.1.2.6.1.2 Old Castle

2.1.2.6.1.3 Or approved equal

2.1.2.7 Precast Concrete Grade Rings: ASTM C478, except:

2.1.2.7.1 Compressive Design Strength of Concrete: Minimum 5,000 psi using Type II cement.

2.1.2.7.2 Configurations: Follow Standard Details.

2.1.2.7.3 Rings: Drilled with holes 1½- to 2-inch diameter to accommodate frame anchor bolts.

2.1.2.7.3.1 Grade rings with cracks or fractures passing through height of ring and any continuous

crack extending for length of 3 inches or more will be rejected.

2.1.2.7.3.2 Rings with damaged edges which will prevent making satisfactory joint in the opinion of the Engineer will be rejected.

2.1.2.7.3.3 Planes of ring surfaces: Within limits of plus or minus ¼ inch of horizontal and vertical, except for sloped adjusting grade ring to be within ¼ inch of Standard Detail.

2.1.2.7.3.4 Protection

2.1.2.7.3.4.1 On lined manholes: Follow manufacturer's recommendations.

2.1.2.7.4 Approved manufacturers:

2.1.2.7.4.1 Atlantic Concrete Products Company

2.1.2.7.4.2 Americast

2.1.2.7.4.3 Contractors Precast Corporation

2.1.2.7.4.4 Hanson Concrete Products

2.1.2.7.4.5 Dal-Col Products, Inc.

2.1.2.7.4.6 Prism Precast Products, Inc.

2.1.2.7.4.7 Frederick Precast Concrete, Inc.

2.1.2.7.4.8 Or approved equal

2.1.2.8 Precast Concrete Vaults and Wet Well: ASTM C858

2.1.2.8.1 Configurations: Follow drawings.

2.1.2.8.2 Identification: Clearly mark inside of each precast concrete vault section.

2.1.2.8.2.1 ASTM Designation.

2.1.2.8.2.2 Structure size.

2.1.2.8.2.3 Date of manufacture.

2.1.2.8.2.4 Project station location and Owner project number.

2.1.2.8.2.5 Name or trademark of manufacturer.

2.1.2.8.2.6 Mark slabs on top and bottom surfaces.

2.1.2.8.3 Design Mixes

2.1.2.8.3.1 5,000 psi at 28 days using Type II cement.

2.1.2.8.3.2 Mix proportion: ACI 318.

2.1.2.8.4 Approved Manufacturers

2.1.2.8.4.1 Tindall

2.1.2.8.4.2 Old Castle

2.1.2.8.4.3 Or approved equal

2.1.2.8.5 Vault Access Doors

2.1.2.8.5.1 Vault access doors shall be fabricated aluminum, 4 feet wide by 4 feet long, unless otherwise specified by the Engineer. Access doors shall mount flush with the surrounding area.

2.1.2.8.5.2 Access doors shall be equipped with heavy brass hinges, stainless steel pins, compression spring operators, an automatic hold-open arm with release handle and a locking device, to receive a padlock.

2.1.2.8.5.3 All vault access doors shall be H-20 rated traffic doors.

2.1.2.8.5.4 Access doors shall be Type JD-AL as manufactured by the Bilco Company, New Haven, Connecticut, or approved equal.

2.1.2.8.6 Ladders

2.1.2.8.6.1 Ladders shall be of aluminum construction. Rung diameter shall be 1-inch minimum, with 12 inches between rungs, and 18 inches between side bars. Ladders shall exceed the requirements of CAL/OSHA and ANSI standards.

2.1.2.8.6.2 Material for ladders shall be high strength 6061-T6 aluminum alloy.

2.1.2.8.6.3 Appropriate Bilco, or approved equal, ladder-up safety post for each ladder installation shall be provided.

2.1.2.8.7 Sump

2.1.2.8.7.1 Vault floor shall contain an 18-inch-diameter hole for installation of a 24-inch-deep sealed sump with a removable expanded metal safety grate. The vault floor shall be constructed such that there is a positive slope to the sump. A minimum 6-inch drain shall be provided where applicable or as directed by the Engineer.

2.1.2.8.7.2 Sump pump shall be Zoeller Model #M53, or approved equal.

2.1.2.9 Miscellaneous Materials

2.1.2.9.1 Granular Bedding: ASTM C33 coarse aggregate size number 4.

2.1.2.9.2 Weep holes: Service weight cast iron covered with non-erodible filter on earth side.

2.1.2.10 Manhole Ring and Cover

2.1.2.10.1 Manhole rings shall be made from gray or ductile iron and manhole cover shall be ductile iron. Castings shall be made in the USA and shall be ERGO® Access Assembly with EJ product number 41600533L01 or approved equal. Approved equal must meet the requirements of this specification.

2.1.2.10.2 Material: Manufacturer shall certify that the ductile iron conforms to ASTM A536 grade 70-50-05 or 80-

55-06. Castings must contain a minimum of 85% recycled content.

2.1.2.10.3 Markings: The top of manhole covers shall have the country of origin and manufacturers identification. The cover shall have "WATER" permanently cast into the cover in 2" Gothic lettering. The bottom of the casting shall have the product name or series number, part number, production date (example: mm/dd/yy) for tracking purposes, and material quality (such as ASTM A536) to verify the materials used. Castings without proper markings shall be rejected.

2.1.2.10.4 Product Specifics:

Cover: Covers and grates shall be provided with a continuous vulcanized one piece EPDM gasket with a shore durometer of 70 ±5 permanently attached to the cover. An integrated Slip Resistant surface shall be cast into the cover surface. The hinge shall have a drain to allow for proper debris and foreign object removal. The cover or grate shall positively lock at 90° to prevent accidental closure and open fully to 120°. For ergonomic purposes the cover or grate must be removable at 120°. The cover shall also include a single multi-tool lifting slot adjacent to the edge of the cover and opposite to the hinge to facilitate opening/lifting/prying once unlocked. The lifting slot must be open to the edge of the cover to allow for prying. The cover shall have no less than 24 each, one inch diameter vent holes. Nominal cover diameter shall be 38" with a 36" clear opening.

Frame: Frame shall have a 36" clear opening. Frames shall have a minimum of four 1" holes/slots for anchoring purposes. Frames shall be 6" in height. Slots for embedment/lightening are not allowed in frame flange.

2.1.2.10.5 These castings are manufactured to withstand highway traffic loads, exceeding AASHTO H-20/HS-20 specifications (wheel loads of 16,000 pounds with a tire contact area of 8" x 20").

2.2 SOURCE QUALITY CONTROL

2.2.1 Test Equipment: Instruments, gages, and other testing and measuring equipment of proper range, type, and accuracy to verify conformance with specification requirements.

2.2.1.1 Ensure equipment is calibrated and certified at annual intervals.

2.2.1.2 Calibrate against measurement standards with known relationship to existing national standards.

2.2.1.3 Calibrate and certify gages on equipment to which they belong, and keep them on equipment following certification.

2.2.1.4 Do not use instruments, gages, testing, and measuring equipment found to be out of calibration or adjustment until applicable requirements have been met.

2.2.1.5 Calibration by agency regularly engaged in this type of activity.

2.2.2 Precast Manhole Testing

2.2.2.1 Joint and Barrel Testing: ASTM C443.

2.2.2.1.1 Plant vacuum testing: ASTM C1244.

2.2.3 Acceptance Procedure for Concrete Strength of Precast Manhole Sections: Procedure applies to acceptance and approval of precast manhole bases, riser, and cone sections, flat top slabs, and grade rings.

2.2.3.1 Concrete Design Mix Approval: Based on submittal specified above herein.

2.2.3.1.1 The Owner will issue approval for up to 3 years, provided design mix materials and sources are not changed and in-plant concrete testing of manhole sections continues to be accepted without rejection of more than 2 days' production in a row.

2.2.3.1.1.1 Every 3 years thereafter, and under failure conditions stated above resubmit concrete design mix for approval.

2.2.3.1.1.2 Production from mixes other than those approved will be rejected.

2.2.3.1.2 Compressive strength test: ACI 301 and ACI 318.

2.2.4 Vaults and Other Precast Concrete Structures

2.2.4.1 Determination of concrete compressive strength: from compressive tests made on concrete cylinders.

2.2.4.2 Unless otherwise specified, retain independent testing facility approved by Engineer for molding, capping, and testing concrete cylinders following appropriate ASTM requirements or, at Engineer's option, make cylinders and use own equipment to test.

2.2.4.2.1 Furnish test results to Engineer.

2.2.4.2.2 Engineer may require core samples of finished products.

2.2.4.2.3 When requested by Engineer, furnish compressive test specimens for testing in addition to requirements above, and continue to monitor quality of concrete.

2.2.4.3 Notify Engineer at least 10 working days prior to pouring any structure.

2.2.4.4 The Owner may perform random or full inspections of manufacture of boxes, vaults, and precast structures to inspect:

2.2.4.4.1 Steel placement and size.

2.2.4.4.2 Overall fabrication.

2.2.4.4.3 Workmanship.

2.2.4.4.4 Other general or specific aspects of production and specification compliance.

PART 3 - EXECUTION

3.1 EARTHWORK

3.1.1 The Contractor shall prepare an excavation large enough to accommodate the structure and permit grouting of openings and backfilling operations.

3.1.2 The bottom of the structure shall be placed on 6 inches of compacted, crushed rock subbase, and graded level to the elevation as shown on the plans.

3.1.3 Vault excavations shall be backfilled with imported granular material to a minimum relative density of 95 percent standard proctor method as determined by ASTM D-698.

3.2 INSTALLATION

3.2.1 Openings or "knockouts" in precast concrete vaults shall be located as shown on the drawings and shall be sized sufficiently to permit passage of the largest dimension of pipe and/or flange.

3.2.2 Upon completion of installation, all voids or openings in the vault walls around pipes shall be filled with 3,000 psi non-shrink grout.

3.2.3 After the structure and all appurtenances are in place and approved, backfill shall be placed to the original ground line or to the limits designated on the plans.

3.2.4 All joints between precast concrete vault sections shall be made watertight. The plastic joint sealing compound shall be installed according to the manufacturer's recommendations to provide a watertight joint which remains impermeable throughout the design life of the structure. The outside of the entire structure shall be coated with an approved waterproofing material.

3.2.5 Access doors shall be built up such that the hatch is flush with the surrounding surface unless otherwise specified on the drawings or by the Engineer. The Contractor is responsible for placing the cover at the proper elevation where paving is to be installed and shall make all necessary adjustments so that the cover meets these requirements.

3.2.6 Ladders shall be installed using Type 316 stainless steel capsule anchors.

3.2.7 Ladders shall be attached a minimum of 3 places to the vault wall.

3.2.8 Ladder shall be centered under access door opening.

3.3 FIELD QUALITY ASSURANCE

3.3.1 Perform field testing of precast concrete structures required under other sections of these specifications.

*** END OF SECTION ***

SECTION 33 11 13
WATER MAIN CONSTRUCTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

The work includes furnishing all material, labor, tools, equipment, skills, and incidentals necessary to construct expansions of the Cobb County-Marietta Water Authority's supply system in Cobb County, Georgia.

1.2 ORDER OF WORK

The Engineer will designate the starting point, or points, for construction and the order in which the work shall be constructed, completed, and placed into operation.

1.3 SINGLE SOURCE OF PIPE AND FITTINGS

A single pipe manufacturer will be responsible for providing all 36" and larger pipe, proprietary restraint joint pipe, and proprietary restraint joint fittings on this project. This pipe manufacturer will be responsible for the quality of all materials and shall provide a one year warranty for all materials supplied for this project.

1.4 SUBMITTALS

The Contractor shall submit for review a pipe laying schedule for the project. The schedule shall be provided by the pipe manufacturer. Both the schedule shall include all pipe, fittings, and valves to be installed for this project.

PART 2 - PRODUCTS

2.1 GENERAL

The Contractor shall furnish all materials and incidental items (whether or not they are specifically described herein) necessary to complete all work called for under the contract, except for any items that are specifically listed in these contract documents as being furnished by the Owner.

2.2 PIPE FOR WATER MAINS

2.2.1 Pipe - Pipe for water mains shall be ductile iron (D.I.P.) designed and manufactured in accordance with the latest revision of ANSI/AWWA C151/A21.51. Each pipe shall be subjected to a hydrostatic test pressure of at least 500 psi at the time and

place of manufacture. Pipe wall thickness shall be sufficient to meet the above conditions, and in accordance with the Pressure Class listed in the Bid Proposal or shown on the contract drawings.

The Pressure Class or nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the manufacture's mark, country where cast, year in which the pipe was produced and the letters "DI" or "Ductile" shall be cast or stamped on each length of pipe.

Ductile Iron Pipe shall have an outside asphaltic coating in accordance with the latest revision of ANSI A21.51-81. The Ductile Iron Pipe shall also have an inside cement lining and asphaltic seal coat in accordance with the latest revision of ANSI/AWWA C104/A21.4.

The manufacturer of pipe shall be capable of producing the full range of pipe sizes used by the CCMWA, 6" through 54".

CCMWA has found that pipe manufactured by American Cast Iron Pipe Company, and US Pipe meet the requirements of this specification. Therefore, pipe shall be as manufactured by the above named manufacturers. No substitution is permitted.

2.2.2 Pipe Joints - Pipe joints shall be as the type specified on the project plans. Restrained Joint Pipe shall be:

1. For 6" through 20" DIP water main, restrained by Fast-Grip gaskets inserted in Push-On Joints or approved equal.
2. For 24" through 48" DIP water main, restrained by Flex-Ring joints or approved equal.
3. For 54" through 64" DIP water main, restrained by Lok-Ring joints or approved equal.
4. For all mechanical joints, restrained by Megalug Glands by EBAA Iron, Inc. or approved equal.

Standard "Push-On" type joints shall be in accordance with the latest revision of ANSI/AWWA C111/A21.11 and furnished complete with gaskets.

2.2.3 Inspection and written certification that the pipe meets all applicable specifications will be required in accordance with section 51-4 of ANSI A21.51-81. A written transcript of foundry acceptance tests must be furnished in accordance with section 51-14 of ANSI A21.51-81. These documents must be forwarded to the engineer prior to shipping of pipe.

2.2.4 Fittings shall be ductile iron. Fittings shall conform to the latest revision of either ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53. Fittings shall have a standard asphaltic coating on the exterior. Fittings shall also have a cement-mortar lining on the interior in accordance with ANSI/AWWA C104/A21.4, of latest

revision.

Fittings and accessories shall be furnished with Mechanical Type Joints in accordance with ANSI/AWWA C111/A21.11, or latest revision. Fittings may be furnished with a proprietary joint provided by an approved pipe manufacturer subject to approval by the Engineer.

Fittings with Mechanical Type Joints will be restrained by Megalug Glands by EBAA Iron, Inc. or approved equal.

CCMWA has found that fittings with Mechanical Type Joints manufactured by American Cast Iron Pipe Company, US Pipe, Sigma Corporation, or Star Pipe Products meet the requirements of this specification. Therefore, pipe shall be as manufactured by the above named manufacturers. No substitution is permitted.

2.2.5 Outlets shall be of the type shown on plans and shall be furnished by the pipe manufacturer.

2.2.6 Gaskets for use with flanged surfaces, either on a fitting, valve, or outlet shall be full face bulb gasket, American Toruseal Flange Gasket or approved equal.

2.3 ENCASEMENT

2.3.1 POLYETHYLENE

Polyethylene encasement for corrosion protection shall consist of three layers of co-extruded linear low density polyethylene (LLDPE) that are fused into one. The inside surface shall infused with a anti-microbial biocide and a volatile corrosion inhibitor. The encasement shall meet all requirements of ANSI/AWWA C105/A21.5. Tape for polyethylene tubing shall be as provided by the manufacturer for this specific purpose.

2.3.2 STOPAQ

See SECTION 15250, CORROSION WRAP COATING.

2.4 BUTTERFLY VALVES

2.4.1 Class 250B Butterfly Valve

Valves shall be designed, manufactured, and tested in accordance with AWWA C504, latest revision, and include design features for additional working pressure. Valves shall be rated and tested for absolute zero leakage shut-off. The closed seat shall be tested to 250 psi and the valve body shall be tested to 500 psi. Certification of test may be required by Owner.

Valve body shall be cast iron per ASTM A126 Class B or ductile iron per ASTM A536 Grade 65-45-12. Flanged end valves shall be faced and drilled per ANSI B16.1, Class 250, or as specified by Owner. Mechanical joint ends shall be per ANSI A21.11 and include MJ accessories. If the manufacturer includes a stainless steel seat ring retained in the valve body, it must do so without the use of clamping devices, adjustment segments, or other hardware being in the waterway.

Valve disc shall be cast iron per ASTM A126 Class B or ductile iron per ASTM A536 Grade 65-45-12. The resilient seat shall be located either on the valve disc or in the valve body. Replacement or repair of valve resilient seat in the field shall be possible without valve disassembly.

The disc shall be connected to the offset stainless steel shaft by locked taper wedge keys and stainless steel retaining nuts on the back side of the disc, or by a similar method. Taper keys shall be heat treated 416 Stainless Steel for added strength. Valve shaft shall be per ASTM A564 type 630/1100-1150. Minimum diameter shall conform to Table 3 of AWWA C504, latest revision. Shaft shall be equipped with adjustable thruster for centering the disc on 30" and larger valves if required, or shall be permanently centered at the factory.

Shaft shall have nylon sleeve or woven teflon fiberglass backed sleeve for bearing surfaces. Bearings shall be self lubricating.

Manual actuators shall be manufactured and assembled to the valve by the valve manufacture. They shall be direct mounted to the valve or be located on top of an extended bonnet as required. Actuator shall be designed with field adjustable stops and be capable of holding disc stationary in any position under full rated pressure. Stop-limiting devices must withstand 450 ft./lbs. of input torque without failure. Actuators shall be sized based on 250 psi pressure differential and 16 ft./sec. flow velocity unless stipulated otherwise. Manufacturer shall provide certification of having produced valves in this pressure class for minimum of 5 years. Valves shall open-left.

Exterior coating shall be asphaltic varnish per Federal Specification TT-V-51, or equal. All interior ferrous surfaces of valves shall have a fusion bonded epoxy coating meeting the requirements of AWWA C550, latest revision, for potable water service and NSF Standard 61.

Field service is critical to Owner. Therefore, all pre-approved manufacturers shall show a history of supplying field service within 24 hours of being notified of a problem.

CCMWA has found that butterfly valves manufactured by Val-Matic, Mueller Co., Henry Pratt Co., and M&H Valve Company meet the requirements of this specification. Therefore, butterfly valves shall be as manufactured by the above

named manufacturers. No substitution is permitted.

2.4.2 Class 150B Butterfly Valve

Valves shall be designed, manufactured, and tested in accordance with AWWA C504, latest revision, and include the following design features. Valves shall be rated and tested for absolute zero leakage shut-off. The closed seat shall be tested to 150 psi and the valve body shall be tested to 300 psi per AWWA C504. Certification of test may be required by owner.

Valve body shall be cast iron per ASTM A126 Class B or ductile iron per ASTM A536 Grade 65-45-12. Flanged end valves shall be faced and drilled per ANSI B16.1, Class 125, or as specified by Owner. All castings must be manufactured in the U.S. Mechanical joint ends shall be per ANSI A21.11 and include MJ accessories (USA manufacture only). If the manufacture includes a stainless steel seat ring retained in the valve body, it must do so without the use of clamping devices, adjustment segments, or other hardware being in the waterway.

Valve discs shall be cast iron per ASTM A126 Class B or ductile iron per ASTM A536 Grade 65-45-12. All castings must be manufactured in the U.S. The resilient seat shall be located either on the valve disc or in the valve body. Replacement or repairing of valve resilient seat in the field shall be possible without valve disassembly.

The disc shall be connected to the offset stainless steel shaft by locked taper wedge keys and stainless retaining nuts on the back side of the disc, or by a similar method. All trim material shall be 304 Stainless Steel, ASTM A276. Shafts shall be either one piece or stub type for all valves 14" in diameter and larger. Shaft shall have nylon sleeve or woven teflon lined-fiberglass backed sleeve for bearing surfaces. Bearings shall be self lubricating.

Manual actuators shall be manufactured and assembled to the valve by the valve manufacturer. They shall be direct mounted to the valve or be located on top of an extended bonnet as required. Actuator shall be designed with field adjustable stops and be capable of holding disc stationary in any position under full rated pressure. Stop-limiting devices must withstand 300 ft/lbs of input torque without failure. The disc travel stop cannot be made against the actuator housing. Actuators shall be fully enclosed and designed for buried service. Valve shall open-left.

Exterior coating shall be asphaltic varnish per Federal Specification TT-V-51, or equal. All interior ferrous surfaces of valves shall have a fusion bonded epoxy coating meeting the requirements of AWWA C550, latest revision, for potable water service and NSF Standard 61.

Field service is critical to Owner. Therefore, all preapproved manufacturers shall

show a history of supplying field service within 24 hours of being notified of a problem.

CCMWA has found that butterfly valves manufactured by Val-Matic, Mueller Co., Henry Pratt Co., and M&H Valve Company meet the requirements of this specification. Therefore, butterfly valves shall be as manufactured by the above named manufacturers. No substitution is permitted.

2.5 GATE VALVES

Valves 14"–16" shall be resilient wedge gate valves, of a non-rising stem design and rated for 250 psig cold water working pressure. All cast ferrous components shall be ductile iron, ASTM A536. Valves shall meet or exceed all applicable requirements of AWWA C515.

The wedge shall be ductile iron fully encapsulated with EPDM rubber. The wedge shall be symmetrical and seal equally well with flow in either direction. The wedge nut shall be independent of the wedge and held in place on three sides by the wedge to prevent possible misalignment.

Bolting materials shall be 304 stainless steel unless otherwise specified. Bolts may have either regular square or hexagonal shaped heads with dimensions conforming to ANSI B18.2.1. Metric size socket head cap screws are not allowed. The operating nut shall be constructed of ductile iron. All gaskets shall be pressure-energized O-Ring type seals. Stem shall be sealed by three O-Rings. O-Rings set in a cartridge shall not be allowed. The valve shall have thrust washers located with (1) above and (1) below the thrust collar to assist operation of the valve.

All internal and external surfaces of the valve body and bonnet shall have an epoxy coating, complying with ANSI/AWWA C550.

Valves shall be Certified to NSF 61-G.

The valves shown as flanged shall have a flange connection conforming to ANSI B 16.1 when flanges are shown on the plans. Valves with mechanical joints shall be fitted with Megalug restraining glands.

Gate valves shall be Series 2500 Ductile Iron Resilient Wedge Gate Valve, American Darling as manufactured by American Flow Control or as approved equal.

2.6 VALVE BOXES

Valve boxes shall be provided for all buried valves. Valve boxes for valves shall be approved standard cast iron, adjustable-shaft boxes having a minimum shaft diameter of 5-1/4 inches. The casting shall be coated with two coats of coal tar pitch varnish. The lids of all boxes shall bear the word "Water" or the letter "W". Boxes shall be equal to Vulcan Pattern VVB-

4. Valve boxes shall be flush with the final grade after grading and / or paving.

Valve extension stems shall be constructed with standard valve operating nut, 4-½" diameter x ¼" steel guide plate, 1-1/4" square solid steel stem, and standard operating wrench coupling with four 3/8" set screws. The material shall be galvanized. The extension stem must be capable of surviving a torque test to 1000 ft-lb without failure.

The valve box top and lid shall be constructed of ductile iron.

2.7 VALVE MARKER

One concrete valve marker shall be furnished and set at each line valve. The marker shall be made of 3000 psi concrete and shall be four (4) feet long and 4" on each side, with #4 reinforcing bars as shown on the detail.

The markers shall be set an even number of feet between the center line of the valve and the center line of the aluminum disc in the top of the marker, and the distance in feet between the valve and marker shall be stamped in the marker at the time of setting.

2.8 FIRE HYDRANT

All hydrants shall meet or exceed AWWA C-502, latest revision for dry-top fire hydrants. Hydrants must meet UL-FM standards on allowable configurations. The hydrant shall be of traffic-model type, rated at 250 psi and hydrostatically tested at 500 psi. The hydrant main valve shall be of compression type opening against pressure and closing with pressure and shall not be less than 5¼" valve opening.

All operating parts shall be bronze in full compliance with AWWA C-502, section 2.2.5-01. The seat and drain ring must be bronze. Bronze to cast iron seating will not be accepted. The hydrant shall be a three way design, with two-2½" hose nozzles and one-4½" pumper nozzle. The nozzle threads, operating nut dimensions and opening direction must meet county specifications. Hydrant must have a breakaway traffic feature and designed for 360 degree rotation of nozzle section. Friction loss through the pumper nozzle shall not exceed 3.0 psi per 1000 gpm at 60 psi working pressure.

The hydrant base and lower barrel shall be made of ductile iron material. Hydrant shall allow for easy installation of extensions and repair at the ground line. All interior parts shall be accessible through the top of the hydrant without excavation. Lubrication chamber must be self-lubricating and can be either grease or oil. Allen head screws may be used in location of inserting lubrication, otherwise no Allen head screws or metric bolting will be allowed. The bolts shall meet ASTM A-307 grade B, in accordance with the requirements of specification of ASTM B-633. The hydrant valve assembly shall be a three piece design consisting of a valve top, valve bottom and the hydrant valve rubber. A one piece valve assembly will not be accepted.

Upon request, all hydrant manufacturers shall furnish a list of ten owners that have used the submitted hydrant for at least ten years. All hydrants must have a ten year warranty, identified from the cast date on the upper barrel of the hydrant.

Hydrants shall be American Darling B-62-B, American AVK 2700 & 2780, Mueller Centurion & Improved, U.S. M-94, Kennedy K81-A, M&H 129 & 929, and Clow Medallion.

Leads from the main line to the fire hydrant shall use 6" ductile iron pipe and shall have a 6" gate valve between the main line and fire hydrant. The valve shall be connected to the main line by using a locked hydrant tee, equal to American Pipe model A-10180. Retainer glands or steel rods must be used to insure adequate connection of fire hydrant to valve. When the hydrant is close enough to the valve to allow its use, the hydrant shall be connected to the valve by using a locked hydrant adapter, equal to American Pipe model A-10895.

2.9 AIR AND VACUUM RELEASE VALVES

Air release and vacuum break valve shall be of the compact single chamber design with solid cylindrical HDPE control floats housed in a tubular stainless steel body with epoxy powder coated cast iron or steel ends secured by stainless steel tie rods. The valve shall have an integral orifice mechanism, which shall operate automatically to limit transient pressure rise induced by closure to twice valve rated working pressure. The intake orifice shall be equal to the nominal size of the valve. The flat face or the control float seating against a nitrate rubber o-ring housed in a dovetail groove circumferentially surrounding the orifice shall affect large orifice sealing. The seating and unseating of a small orifice nozzle on a natural rubber seal affixed into a control float shall control discharge of the pressurized air. The nozzle shall have a flat seating land surrounding the orifice so that damage to the rubber seat is prevented. All components shall be easily replaced. Connection to valve inlet shall be NPT.

The valve shall be Vent-O-Mat series RBX. No substitution permitted.

2.10 MEGALUGS

Restraint devices for nominal pipe sizes 3 inch through 48 inch shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10. The devices shall have a working pressure rating of 350 psi for 3-16 inch and 250 psi for 18-48 inch. Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes. Gland body, wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536. Ductile iron gripping wedges shall be heat treated within a range of 370 to 470 BHN. Three (3) test bars shall be incrementally poured per production shift as per Underwriter's Laboratory (U.L.) specifications and ASTM A536. Testing for tensile, yield and elongation shall be done in accordance with ASTM E8. Chemical and nodularity tests shall be performed as recommended by the Ductile Iron Society, on a per ladle basis.

Restraint devices shall be Listed by Underwriters Laboratories (3" through 24" inch size) and Approved by Factory Mutual (3" through 12" inch size).

CCMWA has found that restraint devices manufactured by EBBA Iron Sales, Inc., Sigma Corporation, and Star Pipe Products meet the requirements of this specification. Therefore, restraint devices shall be as manufactured by the above named manufacturers. No substitution is permitted.

2.11 STEEL CASING

Casing pipe, for boring and jacking and open cut installation shall be steel pipe conforming to ASTM Designation A-139, Grade B, electric fusion longitudinally welded steel pipe. The pipe shall have a minimum tensile strength of 35,000 psi. The exterior and interior of the pipe shall have a coal tar epoxy coating. Wall thickness shall be as shown on plans.

2.12 CASING SPACERS

Application: For casings 48" in diameter or less and for lengths 500' and less
Casing spacer shall be made from T-304 stainless steel of a minimum 14 gauge thickness. Each shell section shall be a minimum of 8" wide and shall be a two piece design. Each shell shall be lined with a 0.090" thick, ribbed PVC extrusion with a retaining section that overlaps the edges of the shell and prevents slippage. Risers shall be made of T-304 stainless steel of 10 gauge thickness. Risers shall be MIG welded to shell. Bottom risers 6" and over in height shall be reinforced. Bearing surfaces (runners) shall be ultra high molecular weight polyethylene (UHMW) to provide abrasion resistance and a low coefficient of friction (0.12). Runners shall be attached to support structures (risers) at appropriate positions to support carrier pipe within casing pipe. The runners shall be mechanically bolted to riser. Bolt heads shall be welded to the inside of risers. Casing spacers shall position the carrier pipe centered and restrained within the carrier pipe with a top clearance of ¾" minimum. Casing spacers shall be as manufactured by Cascade Waterworks Manufacturing Company or approved equal. Spacers for D.I.P. carrier pipe shall be Model CCS. Insulators shall be located within 2' of each end of the casing and spaced no more than 10' apart within the casing. .

Application: For casings greater than 48" in diameter and for lengths greater than 500'
Casing spacer shall be made from T-304 stainless steel of a minimum 14 gauge thickness. Each shell section shall be a minimum of 12" wide and shall be a two piece design. Each shell shall be lined with a 0.090" thick, ribbed PVC extrusion with a retaining section that overlaps the edges of the shell and prevents slippage. Risers shall be made of T-304 stainless steel of 10 gauge thickness. Risers shall be MIG welded to shell. Bottom risers 6" and over in height shall be reinforced. Bearing surfaces (runners) shall be ultra high molecular weight polyethylene (UHMW) to provide abrasion resistance and a low coefficient of friction (0.12). Runners shall be attached to support structures (risers) at appropriate positions to support carrier pipe within casing pipe. The runners shall be mechanically bolted to riser. Bolt heads shall be welded to the inside of risers. Each shell section shall have a stud bard and receiver bar TIG welded to the shell. Studs shall be T-304 and threaded as 5/8-11x7" long. Each stud

bar shall include up to three studs. Casing spacers shall position the carrier pipe centered and restrained within the carrier pipe with a top clearance of ¾" minimum. Casing spacers shall be as manufactured by Cascade Waterworks Manufacturing Company or approved equal. Spacers for D.I.P. carrier pipe shall be Model CCS-ER. Insulators shall be located within 2' of each end of the casing and spaced no more than 8' apart within the casing.

2.13 TUNNEL LINER

Tunnel shall be of the diameter and gage as shown on the construction plans, and shall be of 2 or 4-flange type. Liner plate design shall be in accordance with the design criteria for joint strength, stiffness, buckling, and deflection as defined in the AASHTO Standard specifications for Highway Bridges, latest edition.

Liner plate shall be fabricated from structural quality, hot-dipped galvanized, bituminous coated steel sheets or plates conforming to ASTM Specification A 569. Plates shall have the following mechanical properties before cold forming: tensile strength = 42,000 psi, yield strength = 28,000 psi, elongation, 2 inches @ 30%. Plates shall be accurately curved to suit the tunnel cross section and shall be of uniform fabrication to allow plates of similar curvature to be interchanged.

All plates shall be punched for bolting on both longitudinal and circumferential seams and shall be fabricated as to permit complete erection from the inside of the tunnel. The longitudinal seam shall be of the lap type, with an offset equal to gage of metal for the full width of plate to allow the cross section of the plate to be continuous through the seam. Circumferential hole spacing will be a multiple of plate length to allow staggering of the longitudinal seam.

Grout holes shall be two inches (2") in diameter and shall be provided in the top plates at intervals not to exceed ten feet (10') to permit grouting as the assembly of the liner plate proceeds. All grout holes shall be tapped or welded with coupling. Tapped holes shall be provided with a pipe plug or screwed in place.

Material shall be galvanized, zinc coated in accordance with ASTM Specification A123, except that the zinc shall be applied at the rate of two (2) ounces per square foot total for both sides.

Bolts and nuts shall be of the diameter and length as recommended by the manufacturer and shall be galvanized to conform to ASTM Specification A153. The materials to be used for the construction of the tunnels shall be new and unused and suitable for the purpose intended.

2.14 SUBGRADE STABILIZER

Subgrade stabilizer shall consist of crushed stone meeting size and gradation requirements for GDOT #67 designation and complying with the requirements of GDOT section 800 – Coarse Aggregate.

2.15 CONCRETE

Concrete for blocking, replacing curb and gutter, replacing sidewalks and miscellaneous concrete shall have a minimum compressive strength of 3000 pounds at 28 days. Concrete shall be Type A as defined in GDOT Section 500 – Concrete Structures, latest revision. Provide mix design, showing amounts of each ingredient for each type mix, for review by Engineer.

2.16 CONCRETE GROUT

Concrete grout shall be Type A as defined in GDOT Section 500 – Concrete Structures, latest revision minus coarse aggregate. Provide mix design, showing amounts of each ingredient for each type mix, for review by Engineer.

2.17 SAND FOR BACKFILL

Sand for backfilling over water mains, when required, shall be coarse, well-graded sand relatively free from dirt and other foreign matter. Sand shall be approved by the Engineers.

2.18 BRICK

All brick shall be best grade. All hard burned common, acceptable to the Engineers and giving a ringing sound when struck and presenting a regular and smooth face, shall be used. When submerged in water for 24 hours, they will not absorb more than 10% of their weight in water.

Bricks shall be culled when delivered on the site and all imperfect brick are to be immediately removed from the work. All salmon, soft or arch brick or brick made of alluvial soil will be rejected. All brick used in the work shall be of uniform size.

2.19 BITUMINOUS PAVEMENT REPLACED

Pavement shall be replaced in accordance with the details shown on the drawings and as set out under "Removing and Replaced Pavement - Bituminous Paving" under section for construction methods. All bituminous materials and workmanship shall conform to the latest standard specifications of the Georgia Department of Transportation; referenced in Section 32 12 16 - Asphalt Paving.

2.20 TRAFFIC STRIPE

Materials used in painting traffic stripes shall comply with Georgia DOT Specification 652, latest revision; referenced in Section 32 12 16 - Asphalt Paving.

2.21 FLOWABLE FILL

Controlled low strength flowable fill (100 psi maximum) shall comply with GDOT Specification Section 600. A concrete mix design shall be submitted to the Engineer for approval prior to use. The flowable fill shall consist of Portland cement, fine aggregate, air-entraining admixtures, and water proportioned to provide low strength, self-leveling backfill material.

2.22 LOCATOR BALLS

Locator balls shall be 3M Series EMS iD Ball Markers. The model number shall be 1423-XR/iD.

2.23 BORROW MATERIAL

Borrow material shall be material hauled from borrow areas outside the project area.

The Contractor shall identify the source of borrow material, have performed the geotechnical testing of the material to determine its suitability as a backfill material, transport the material to the project, and place the material to specified soil density. Final determination of the suitability of the material is the responsibility of the Engineer.

The material shall be Class IIB3 or better in accordance with GDOT Standard Specifications, latest revision.

2.24 GEOGRID SOIL REINFORCEMENT

Geogrid soil reinforcement shall be Tensar TriAx TX 170 Geogrid soil reinforcement or approved equal.

2.25 TEST STATION APPURTENANCES

Flushing Hydrant shall be of automatic freeze-proof design with weep hole installed within a 2" ball valve. Valve will be 600 lb. WOG bronze body with chrome plated brass ball and Teflon seals. Ball Valve to be ISO 9001 Certified. Hydrant barrel must be of black iron pipe. Exterior shall receive 4 mil thickness of electrostatically applied Sherwin-Williams Fast Dry Acrylic Enamel, catalyzed with Polane for durability. All standpipes to be painted red and all buried pipes will be painted black. Overall length of hydrant will vary, according to the depths of water systems. Barrel and standpipe shall be joined with a breakable malleable union. A brass hose connection, 2 1/2" NSFT with attached cap & chain, shall be provided for convenience in flushing. Operating device shall be of key type design, with permanent attachment to the valve stem. Valve stem must be full length of the hydrant barrel with permanent attachment to the valve. Hydrant must have provision for lock up to prevent tampering. Flushing Hydrant to be AQUARIOUS GP "POST HYDRANT" as manufactured by GIL Industries, Inc., Pensacola, Florida, or approved equal.

2.26 FLEXIBLE (TRANSITION) COUPLINGS

Flexible couplings shall be Catalog No. 441 as manufactured by Smith-Blair, JCM 215 Long DI Coupling by JCM Industries, or approved equal.

2.27 PIPE CONNECTION COUPLINGS

Pipe connections between new pipe and existing pipe shall be made with Dresser Style 90 long steel couplings for pipe sizes 2" and below; for pipe sizes above 2", M.J. solid sleeves (long style) shall be used. Spacer rings must be used at all solid sleeve locations. A spacer ring is defined as a short section of pipe cut to fit into the gap between the two plain ends of pipe at the sleeve location.

2.28 COPPER TUBING FOR SERVICES

House water service pipe shall be copper service pipe, type K, soft temper, seamless copper tubing, conforming to ASTM B-88 and AWWA 7S-CR and may be used in 20-foot straight lengths or 60/100-foot coils. Flair joints shall be used.

2.29 CURB STOPS

All metal parts of curb stops shall be made of bronze. The stops shall be approved by Owner. The cock shall be operated with a combined cap and tee and shall open when turned counter-clockwise. Curb Stops shall be Hayes 5060, or approved equal.

2.30 CORPORATION COCKS

All metal parts of the cock assembly shall be made of all bronze or bronze suitable for 200 psi operating pressure. The cock shall be operated with a tee head and shall open when turned counter-clockwise. The cock shall be Mueller Co. H-15000, Hayes Model 5200, or approved equal.

2.31 METER BOXES

Not Applicable.

2.32 SERVICE SADDLES

Service saddles shall be equal to Smith-Blair 313 double strap clamps or Superior Style 32 suitable for use with ductile iron or PVC pipe. Service saddles are required for taps 1" in diameter and larger.

2.33 METERS

See Section 15900.

2.34 BACKFLOW PREVENTERS

Not Applicable.

2.35 PVC PIPING

As-built/Locator pipe shall be Polyvinyl Chloride (PVC) designed and manufactured in accordance with SDR-35.

Service casing pipe shall be Polyvinyl Chloride (PVC), schedule 80.

Water pipe shall be Polyvinyl Chloride (PVC), schedule 80, compliant with ASTM D1785.

2.36 NA

2.37 PIPE FOR GRAVITY SEWER

2.37.1 Pipe - Pipe for gravity sewer shall be ductile iron (D.I.P.) designed and manufactured in accordance with the latest revision of AWWA/ANSI C150/A21.50. Pipe wall thickness shall be in accordance requirements of the Pressure Class 350.

Ductile Iron Pipe shall have an outside asphaltic coating in accordance with the latest revision of ANSI A21.51.

Pipe interior shall be polybond, polyline, polyurethane, or protecto 401 ceramic epoxy lined with a minimum thickness of 40 mils and sealed with an approved exterior bituminous seal coat in accordance with ANSI A21.51.

2.37.2 Pipe Joints - Pipe joints shall be as the type specified on the project plans. Restrained Joint Pipe shall be Standard "Push-On" type joints shall be in accordance with the latest revision of ANSI/AWWA C111/A21.11 and furnished complete with restraining gaskets.

2.38 MECHANICAL JOINT TAPPING SLEEVE

A. Tapping sleeves shall be of split mechanical joint design with separate end and joint gaskets.

B. For tapping sleeves 24-inch and smaller, tapping sleeves shall be ductile iron construction meeting ASTM A536. Side flange seals shall be of the O-Ring type of either round, oval or rectangular cross-sectional shape. All sleeves are to include the end joint accessories and split glands necessary to assemble sleeve to pipe. No special tools are required other than a standard socket

wrench. Sleeve shall be coated with asphaltic varnish in compliance with NSF-61.

American Flow Control Series 2800 or approved equal.

C. For tapping sleeves 30-inch and larger, tapping sleeves shall be stainless steel 304. Glands shall be 304 stainless steel and bolts shall be stainless steel 18-8 Type 304. Gasket shall be Nitrile Buna-N. Side flange seals shall be of the O-Ring type of either round, oval or rectangular cross-sectional shape. All sleeves are to include the end joint accessories and split glands necessary to assemble sleeve to pipe. No special tools are required other than a standard socket wrench. Sleeve shall be in compliance with NSF-61.

JCM 414 Series or approved equal.

2.39 TAPPING VALVE

A. Tapping valves shall be resilient wedge type with bodies and bonnets made of ductile iron for 250 psig working pressure. Tapping valves shall accept full-size shell cutters.

B. The alignment ring dimensions of the tapping valve flange shall conform to MSS SP 60. The outlet end of the valve shall have the desired joint connection for the intended pipe.

C. All tapping valves shall include a minimum 3/8-inch NPT pipe plug on the bonnet of the valve body for field testing of the valve.

D. All wedges shall be full encapsulated with EPDM rubber. All wedges shall be provided with guide covers.

D. All interior and exterior ferrous surfaces shall be protected by fusion-bonded epoxy coating. The coating shall be applied prior assembly to assure coverage of all exposed surfaces including bolt holes.

American 4-inch – 48-inch Series 2500 Ductile Iron or approved equal.

PART 3 - EXECUTION

3.1 SURVEY AND STAKING

Establish line and grade for the project and establish construction staking for installation of the water main. Provide such services in accordance with SECTION 01 32 23 - FIELD ENGINEERING.

3.2 CLEARING AND GRUBBING

Where necessary, the construction zone will be cleared to allow trenching and pipe laying operations. Clearing will be restricted to easement limits shown on plans, plus areas within the highway right-of-way. The cleared area shall be left free of stumps, limbs, rocks and other debris. Cleared areas in forested zones will be left in a

condition suitable for bush-hog cutting; areas adjacent to lawns shall be left suitable for lawn mower cutting and at least in as good a condition as the adjoining property. Trees, brush, stumps and other debris from clearing and grubbing shall be disposed of in accordance with local ordinances (which place restrictions on burning); burial within the right-of-way or easement will not be permitted.

The Contractor is responsible for restoring any property (shrubs, signs, sidewalks, paving, trees, structures, etc.) that is damaged by his operations. It is understood that any item which is not specifically listed as a pay item but which exists at the time the project is bid is included in the overall bid price.

3.3 FENCES

The Contractor shall take down fences on or crossing right-of-way for such periods of time only as are necessary to prosecute the work of clearing, grubbing, trenching, pipe laying and backfilling. Gaps made in fences shall be closed in substantial manner at night and during any suspension of work, and, upon completion of the pipe line, fences shall be restored to as good condition as before disturbed. No charges shall be made by the Contractor for any expense incurred in taking down or restoring fences, except where listed in the bid proposal.

3.4 PROTECTION OF TREES

The Contractor shall remove only such trees on or along the work as necessary, and shall carefully protect all other trees adjacent to the work. He shall not permit excavating machinery or trucks to scrape the bark or tear the limbs from the trees, nor connect ropes or guy cables to them.

3.5 INTERFERENCE WITH EXISTING STRUCTURES

All existing pipes, drains, or other structures on, above, or below ground shall be carefully supported and protected from injury, and if injured, they shall be restored in a satisfactory manner by and at the expense of the Contractor.

3.6 INFORMATION CONCERNING CONDITIONS

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

3.7 CLEAN UP

The Contractor shall remove all unused material, excess rock and earth, and all other debris from the construction site as closely behind the work as practical. All trenches shall be backfilled and tamped before the end of each day's work.

If at any time during the course of the work, the clean up, grassing and/or pavement replacement falls too far behind the pipe laying (at the discretion of the Engineer) the Contractor shall be required to close down pipe laying operations until the clean up, grassing and/or pavement replacement is caught up to the work in progress.

3.8 TRENCH EXCAVATION

Pipe trenches shall be straight and true to grade and in the location shown on the plans. The bottom of trenches shall be dressed to facilitate laying conditions called for on construction plans. The excavation shall permit the placement of compacted stabilizer stone with a minimum of 8" under pipe. Suitable materials shall be clean and free of rock larger than 2-inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials; Unsuitable soils for backfill are MH, CH, OL, and Pt. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. The bottom of the trenches shall be dressed so that the pipe has an even bearing on bedding material throughout the entire length of the pipe barrel.

All trenches shall be of sufficient width to provide ample working space on each side of the pipe for maintaining a straight line of pipe, and bell or coupling holes of sufficient size to allow making perfect joints shall be provided at all joints.

Water lines shall have a minimum cover of 120 inches unless otherwise specified or shown on the drawings. The depth of cover shall be a minimum of 120" below grade, 120" below the edge of pavement, or 120" below the drainage ditch paralleling the road, whichever is deepest. All changes in grade shall be made gradually.

In laying pipe across water courses, railroad crossings, or depressions of any kind, the minimum depth herein specified shall be maintained at the bottom of the depression.

Where necessary, the line shall be lowered at valves so that the top of the valve stem is approximately one foot below the finished grade. The trench shall be deepened to provide a gradual approach to all low points of the line, and no additional payment shall be allowed for extra excavation involved.

The Engineer shall have the right to limit the amount of trench open at any one time.

All excavation material shall be so placed so as not to interfere with public travel on the streets and highways along which the lines are laid. All excess excavated

material shall be disposed of without extra cost to the Owner.

3.9 LAYING PIPE

All pipes, before being placed in trench, shall be examined, and any pipe showing defects shall be rejected. The inside of the pipe shall be clean and free of trash and dirt, and if necessary a swab or brush shall be used to clean the pipe before lowering it into the trench.

All pipes shall be laid straight, true to line and grade. For all laying conditions, bell and coupling holes shall be dug to allow the pipe to have continuous bearing with bedding throughout the entire length of the barrel between bell or coupling holes. No shimming or blocking up of the pipe will be allowed.

Trench dewatering methods (gravel bedding with pumps, etc.) must be used where necessary to maintain a dry ditch during pipe laying operations. Dewatering will be done in accordance with SECTION 31 23 19 - CONSTRUCTION DEWATERING.

All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods.

In making ductile iron joints, the outside of the spigot end of the pipe and the inside of the bell shall be thoroughly cleaned and the gasket inspected to see that it is properly placed. Lubricant shall be applied to the spigot end of the pipe and it shall be inserted into the bell of the adjoining pipe to the "Stop Mark" shown on the pipe. Joint deflection shall be checked by Contractor for compliance with the pipe manufacturer's recommended limits. Restrained pipe joints will be full engaged.

Contractor shall bear all costs for his failure to maintain a clean pipe. These costs include but are not limited to flushing water, temporary fittings, piping, and connections, labor, equipment, materials, and other items necessary to clean the line.

3.10 BACKFILLING

After the pipe has been laid and all joints have been made, the trench shall be backfilled as described on the detail sheet of the construction plans for the Type 5 condition that shall be used throughout this project.

3.10.1 Type 5:

Backfill shall be granular or select material free from rocks and foreign material compacted to one foot above the top of the pipe. It shall be tamped in layers not over 6 inches thick to at least 95% standard proctor, AASHTO T-99. Remainder of backfill to top of trench shall be tamped in layers not over 12 inches thick (6 inches under roads) to 95% standard proctor,

AASHTO T-99. Under road ways, the top 12 inches of backfill shall be compacted to 100% standard proctor, AASHTO T-99.

Tamping shall be done with mechanical tamps in such a manner as to meet compaction requirements without moving or injuring pipes. Compaction shall be done with either pneumatic hand tamps, hydro-tamps or other approved methods. Compaction tests will be run as directed by Engineer to insure that the above specifications are being met.

In rock excavation, the backfill from the bottom of the trench to two feet above the top of the pipe shall be granular or select material, free from rocks and stones. The rest of the backfill shall not contain over 50% broken stone, and the maximum sized stone placed in the trench shall not have a weight exceeding 25 pounds. Excess rock and fragments of rock weighing more than 25 pounds shall be loaded and hauled to disposal as directed by the Engineer. If it is necessary, in order to comply with the above specifications, selected backfill shall be borrowed and hauled to the trenches in rock excavation, at no additional cost to the Owner. Under no circumstances shall bottom of pipe rest against rock or unyielding material. Minimum bedding of 12" carefully compacted backfill shall separate bottom of pipe from rock or unyielding material.

3.11 ENCASEMENT

3.11.1 POLYETHYLENE:

Polyethylene encasement shall be installed in accordance with AWWA C105 (ANSI A21.5-82) "Method A" as follows:

Cut polyethylene tubes to a length approximately 2 ft. longer than that of the pipe section. Slip the tubes around the pipe, centering it to provide a 1-ft. overlap on each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears the pipe ends.

Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at joints to facilitate installation of the polyethylene tubes.

After assembling the pipe joint, make the overlap of the polyethylene tubes. Pull the bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe, and secure it in place. Then slip the end of the polyethylene from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Secure the overlap in place. Take up the slack width to make a snug, but not tight fit along the barrel of the pipe, securing the downward fold at quarter points.

Repair any rips, punctures, or other damage to the polyethylene with manufacturer's

adhesive tape or with a short length of polyethylene tube cut open, wrapped around the pipe, and secured in place. Proceed with installation of the next section of pipe in the same manner. The second layer of polyethylene encasement shall be installed in the same manner as the first.

Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in the same manner as the pipe.

When valves, tees, crosses, and other odd-shaped pieces cannot be wrapped practically in a tube, wrap with a flat sheet or split length of polyethylene tube by passing the sheet under the appurtenance and bringing it up and around the body. Make seams by bringing the edges together, folding over twice, and taping down. Handle width and overlaps at joints as described above. Tape polyethylene securely in place at valve stem and other penetrations.

Provide openings for branches, service taps, blow-offs, air valves, and similar appurtenances by making an X-shaped cut in the polyethylene and temporarily folding back the film. After the appurtenance is installed, tape the slack securely to the appurtenance and repair the cut, as well as any other damaged areas in the polyethylene, with tape.

3.11.2 STOPAQ:

Install Stopaq Corrosion Wrap in accordance with SECTION 15250 - CORROSION WRAP COATING.

3.12 ROCK EXCAVATION

All material shall be considered as trench rock if the material has a original volume of at least on-half cubic yard and the material cannot be excavated with a hydraulic excavator having a minimum flywheel power rating of 123 kw (165 hp); such as a Caterpillar 322 C L, John Deere 230 C LC or a Komatsu PC220L-C-7; equipped with a short tip radius bucket not wider than 42 inches.

The Contractor shall notify the Engineer when rock is encountered. Measurement of rock will normally be made from rock profile on the trench wall after excavation. Rock will be removed to a depth of twelve inches below normal bottom and this area below the pipe will be backfilled with select material.

All material shall be considered as casing rock which cannot be excavated by normal boring operations including a rock head and requires blasting. Measurement of rock volume will normally be made based upon area of casing times actual length of casing installed in rock. Contractor shall notify engineer when casing rock is encountered.

Rock excavation by blasting shall be at least 75 feet in advance of pipe laying.

Before blasting, the Contractor shall cover the excavation with heavy timbers and mats in

such manner as to protect the adjacent property Owners from damage. The Contractor will be held responsible for all damage done.

3.13 THRUST RESTRAINT

3.13.1 GENERAL

At changes in direction of the main and at other points shown on the plans or directed by the Engineer, thrust forces in the line shall be absorbed by restrained joints, concrete blocking, or reinforced concrete collars, or a combination thereof.

3.13.2 RESTRAINED JOINTS

Where restrained joint are called for on the construction plans, they shall be of the type specified in these specifications, and assembly shall be in accordance with manufacturer recommendations. Torque wrenches shall be used to verify that all bolts and nuts have tightened to manufacturer's recommendations.

3.13.3 CONCRETE BLOCKING

The Engineer shall be notified by the Contractor before blocking is placed. Blocking will be of the dimensions called for on the construction plans and will be placed against a vertical surface of undisturbed soil that has been cleared of all loose material.

3.13.4 REINFORCED CONCRETE COLLARS

Reinforced concrete collars shall be cast in place as shown on detailed plans and as specified in ACI 318-83.

3.13 LEAKAGE TEST

3.13.1 PRESSURIZATION

After the pipe has been laid, all newly laid pipes or any valved section thereof shall be subjected to a hydrostatic pressure of 1.5 times the working pressure at the point of testing. Each valved section of pipe shall be slowly filled with water, and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the owner. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. It is good practice to allow the system to stabilize at the test pressure before conducting the leakage test.

If the Contractor intends to perform hydrostatic testing against existing valves which are in service, the Contractor must obtain permission from the Owner. Prior to testing, the Contractor shall disinfect the pipeline in accordance with the requirements of Paragraph 3.14. If, after repairs are made to the pipeline to correct leakage test deficiencies, the Engineer deems that the sanitation of the pipeline has been compromised, the Contractor shall disinfect the pipeline at the Contractor's expense.

3.13.2 AIR REMOVAL

Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place at the discretion of the owner.

3.13.3 LEAKAGE DEFINED

Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipes or any valved section thereof to maintain the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop in pressure in a test section.

3.13.4 ALLOWABLE LEAKAGE

No pipe installation will be accepted if the leakage is greater than 15 gallons per day per inch diameter per mile of pipeline. This rate is shown in the following table:

ALLOWABLE LEAKAGE PER 1,000 FEET OF PIPELINE
(Based on 15gpd/in/mile)

Pipe Diameter (inches)	Allowed Leakage Per Day (Gallons)	Allowed Leakage Per Hour (Gallons)
6	17.0	0.71
8	22.7	0.95
10	28.4	1.18
12	34.1	1.42
14	39.8	1.66
16	45.5	1.89

20	56.8	2.37
24	68.2	2.84
30	85.2	3.55
36	102.3	4.26
42	119.3	4.97
48	136.4	5.68
54	153.4	6.39
60	170.5	7.10

3.13.5 TEST RESTRICTIONS

The hydrostatic test shall be of at least 2-hour duration. Test Pressure shall not vary by more than ±5 psi for the duration of the test; this may require periodic pumping.

Valves shall not be operated in either direction at differential pressure exceeding the rated valve working pressure. Use of a test pressure greater than the rated valve pressure can result in trapped test pressure between the gate of a double-disc gate valve. For tests at these pressures, the test setup should include provision, independent of the valve, to reduce the line pressure to the rated valve pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or fully opened is desired.

Test pressure shall not exceed the rated pressure of the valves when the pressure boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.

3.14 DISINFECTION

After leakage testing and all necessary repairs have been made, the lines shall be flushed clean and then disinfected in strict accordance with AWWA Standard For Disinfecting Water Mains, C651- latest edition, subject to the following special conditions:

3.14.1 The method of disinfection shall be either the Continuous-Feed Method or the Slug Method. The Tablet Method is not acceptable.

3.14.2 The form of chlorine may be either: (1) a 1 percent solution made from either sodium hypochlorite or calcium hypochlorite and pumped and metered into the pipeline; or (2) liquid chlorine fed from a pressurized cylinder through a gas-flow chlorinator and metered into the pipeline. With either form, water must be flowing during the feeding operation and the injection point must be located so that the flow of water will disperse the chlorine throughout the pipeline.

3.14.3 Unless otherwise approved by the Owner, Contractor shall dechlorinate the highly-chlorinated water being flushed from the pipeline.

3.14.4 The Owner shall be responsible for bacteriological sampling and testing water from the disinfected pipeline.

3.14.5 Before any flushing or disinfection work is begun, the Contractor shall outline his planned procedures for these tasks and obtain approval of the Owner.

The Contractor is responsible for the installation and removal of sample points as required by AWWA C651 on the water main.

3.15 DECHLORINATION

After the disinfection process has been completed, the heavily chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system or is acceptable for domestic use. The area where the chlorinated water is to be discharged shall be inspected. If there is any possibility that the chlorinated discharge will cause damage to the environment, then a neutralizing chemical shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water.

The chlorine residual of the water being disposed may be neutralized by treating the water with ascorbic acid or sodium ascorbate. Minimum dosage requirements are listed in the table below. Additional dosage for the complete neutralization of chlorine residual is the responsibility of the Contractor.

Chlorine	Ascorbic Acid	Sodium Ascorbate
1 Kg	2.5 Kg	2.8 Kg
1 Lb	2.5 Lb	2.8 Lb

3.16 CONNECTION TO EXISTING WATER MAINS

At beginning of construction, the Contractor shall make exploratory excavation at each location where connections to existing pipes are shown for the purpose of determining the exact location, elevation and type of fittings required to make the connections. Where it is necessary to disrupt service on existing lines, the Contractor shall first obtain permission from the Owner and schedule his work accordingly.

Where existing pipe is to be abandoned, the Contractor shall plug the opening by pouring concrete in an around the opening as needed to completely seal the opening.

3.17 SETTING VALVES

Valves shall be placed where shown on the plans or directed by the Engineer. Valves shall be set plumb, and shall have cast iron valve boxes and/or manholes as called for on the

plans. The valve boxes shall be placed directly over the valve and set plumb, the top of the box being brought to the surface of the ground. After the boxes are in place, earth shall be filled in the trench and thoroughly tamped around the box, and after all settlement has taken place, each valve box shall have a concrete collar as shown on the plans.

3.18 VALVE STEM EXTENSION

Valve stem extensions shall be installed all buried valves except for those for which a manhole is being provided.

3.19 AIR AND VACUUM ASSEMBLIES

Air and vacuum relief valve assemblies shall be constructed strictly in accordance with the details shown on the plans.

3.20 INSTALLATION OF SOLID SLEEVES

Spacer rings must be used with all solid sleeves and no exceptions will be allowed. When connecting to existing water lines, one full length joint of pipe must be installed between solid sleeves and adapter pieces.

3.21 FLANGED OUTLETS

Where flanged outlets are shown on the plans, they shall be installed as recommended by the manufacturer. When attaching a valve to the outlet, the valve and tapping machine, when used, shall be supported to relieve stress on the outlet fixture. The hole in the ductile iron pipe may be cut by either a mechanical tapping machine or by use of a cutting torch.

3.22 MEGALUG

When installing the Megalug gland, clean the inside of the pipe bell and lubricate both the Megalug gasket and the spigot end of the pipe. Place the gland on the plain end with the lip extension toward the plain end, followed by the gasket. Insert the pipe into the pipe bell and press the gasket firmly and evenly into place. Keep the joint straight during assembly. Push the gland toward the pipe bell and center it around the pipe with the gland lip against the gasket. Install bolts and hand tighten nuts. Make any required deflection after joint assembly and before the bolts are tightened. Tighten the bolts to the manufactures recommendation for the gland size. Tighten the twist-off bolts per manufacture's recommendation. Should removal of this application be necessary, this should be done in accordance with manufactures recommendation.

3.23 SPECIALS AND FITTINGS

Specials and fittings shall be properly braced to insure that they will not be blown off or

broken loose under the greatest possible working pressure, where it is necessary to use concrete to block vertical bends, etc., the concrete will be paid for extra, at the unit price bid per cubic yard for miscellaneous concrete.

3.24 HIGHWAY AND RAILROAD CROSSINGS

Where the lines cross railroads and/or highways under the jurisdiction of the State Highway Department, or railroad, the Owner will obtain written permission from the controlling authority before any work can be done within the right-of-way. After the Owner notifies the Contractor that the permit or permits have been obtained, the Contractor shall coordinate his activities and construction procedure with the proper authority of the Railroad or the Highway Department and shall conform with the requirements thereof. The Contractor will be required to furnish a release from the said controlling authority before final acceptance of the work. The Contractor will be responsible for all damage and injuries to persons and property inflicted or caused by said work.

3.25 PLACING OF STEEL CASING PIPE

Steel Casing pipe shall be installed by the "Jack and Bore" procedure or the "Open-Cut" method. Steel casing pipe shall be installed at the specific locations called for on the plan sheets and the installation method shall be by the "Jack and Bore" procedure unless specifically stated to be installed by the "Open-Cut" method.

The "Jack and Bore" installation procedure shall be by the dry-bore method. The hole is to be mechanically bored and cased through the soil by a cutting head on a continuous auger mounted inside the casing pipe. The cutting head shall suitable for all soils that may be encountered; varying from loose soil to rock. The cutting head shall be steerable to maintain the line and grade. The cutting head must be steered continuously, either from the bore pit or from an operator's console within the machine's shield. Steering shall be accomplished via a laser is set up in the back of the bore pit and projected onto a target inside the machine. The operator can then control the machine using stabilizer pads and hydraulic articulation cylinders that pivot the machine on an articulation joint.

The installation of the casing and boring of the hole shall be done simultaneously by jacking. Lengths of pipe are to be continuously welded the full circumference of the pipe diameter to the preceding section installed. Excavation material will be removed and placed at the top of the working pit. Backfill materials and methods of backfilling and tamping shall be as required under BACKFILLING. For this method of installation, rock is defined as material defined in Paragraph 3.12 ROCK EXCAVATION.

The "Open-Cut" method consists simply of excavating the trench along the pipeline route and placing the steel casing in the trench. Special care shall be taken not to damage any existing utilities as the sections of casing are maneuvered into the open trench. Lengths of

pipe are to be continuously welded the full circumference of the pipe diameter to the adjacent sections. Backfill materials and methods of backfilling and tamping shall be as required under BACKFILLING. For this method of installation, rock is defined as material defined in Paragraph 3.11 ROCK EXCAVATION.

Casing insulators shall be used while installing the water main inside the casing. Insulators shall be located within 2' of each end of the casing and spaced no more than 10' apart within the casing. After the water main is installed in the casing, a check shall be made to ensure that the carrier pipe is not touching the casing at any point. The ends of the casing pipe shall be sealed with a three course mortared brick wall, one course of which shall be erected inside the casing.

Construction techniques required to provide access for casing shall be such as to ensure the safety of the work. Final dimensions of access pits selected by Contractor shall conform as with minimum dimensions required to permit the installation of the work. The contractor shall be required to properly support all excavations and to prevent all movement of the soil, pavement, utilities or structures outside of the excavation. All pits shall conform to applicable Local Safety Standards, OSHA Standards, trenching and shoring standards. Provide surface drainage during the period of construction to protect the work.

Casing will be installed in accordance with the line and grade shown on contract drawings. The casing shall be installed within one half of a foot (6-inches) of the line and of the elevations shown. The failure to maintain line and grade main may require the installation of a new casing and removal and backfilling of the unacceptable casing at the expense of the Contractor or additional fittings and pipe at the expense of the Contractor. The acceptability of the casing installation shall solely be made by the Engineer. The required remedial work shall be solely determined by the Engineer.

The Contractor is totally responsible for the performance of the equipment and methods selected for this phase. Each pipe section shall be jack forward as the excavation progresses in such a way to provide complete and adequate ground support at all times. Lubrication shall be applied to the external surface of the pipe to reduce skin friction. A jacking frame shall be positioned to develop a uniform distribution of ramming forces around the periphery of the pipe. The Contractor is responsible for monitoring ground movements associated with the work and making suitable changes in the construction methods to control ground movements and prevent damage or detrimental movement to the work and adjacent structures and pavements. A lubrication system shall be provided that injects an approved lubricant on the inside and outside of the pipe to lower the friction developed on the sides of the pipe during jacking. The overcut on the pipe shall not exceed 1 inch. The annular space created by the overcut shall be filled with a lubricant that has been proved suitable for the particular soil conditions.

Welds shall be complete around the casing joints and smooth to permit the passage of carrier spacers. The line and grade shall not vary within the overall casing. The installation shall

permit the continuous installation of the carrier pipe with spacers.

The Contractor shall be paid for this work under unit price bid per linear foot of steel casing pipe used and for miscellaneous concrete used.

3.26 BORE PITS

Bore pits for cased bores and uncased bores shall be constructed as to avoid conflicts with the existing utilities and remain in the limits of the construction area. The contractor shall take necessary precautions in order to insure the pit meets the latest requirements under the Cobb County Trench Safety Ordinance and O.S.H.A. requirements imposed on such work.

3.27 REMOVE & DISPOSE OF EXISTING APPURTENANCES

Where called for on the plans, all existing above ground appurtenances shall be removed and disposed of by the contractor after prior approval and refusal from the owner. The area where these appurtenances are removed shall be regraded and grassed to match the existing landscaping.

3.28 REMOVE & DISPOSE OF EXISTING WATER MAIN

Where called for on the plans, existing water main shall be removed and disposed of by the Contractor after prior approval and refusal from the owner. The Contractor will be responsible for proper disposal of the existing water main off site.

3.29 REMOVING AND REPLACING PAVEMENT

3.29.1 GENERAL

Removing and replacing pavement bituminous or concrete shall consist of removing the type of pavement and base encountered and replacing same as shown on the detailed drawings. Pavement shall be removed only as necessary to install water main.

3.29.2 REMOVAL

Saw cut all pavements prior to removal. Cut pavement vertically and through the entire depth of pavement so that pavement can be removed without disturbing remaining pavement. Replace disturbed pavement beyond limits necessary for water main water installation at no cost to the Owner.

3.29.3 SUBGRADE

The trench shall be backfilled in layers not more than 6" thick and shall be

thoroughly compacted with mechanical tamps. No base course shall be placed on loose earth or dusty material. Compact subgrade to 95% Standard Proctor soil density except for top 12". Compact top 12" of subgrade to 100% Standard Proctor soil density.

3.29.4 SUBBASE

Place 12" of graded aggregate and compact to 100% Standard Proctor soil density. Comply with requirements of SECTION 32 12 16 - ASPHALT CONCRETE PAVING

3.29.5 BITUMINOUS PAVEMENT

Bituminous pavement shall be replaced with base and binder pavement as shown on drawings. Provide required depth of pavements as shown included additional depth required during construction.

Resurface roadway within the limits shown. Mill roadway to depth shown and within limits shown. Place surface course to depth shown and within limits shown.

Edges of cut pavement shall be neatly squared off. Then the base and edges shall be primed with a tack coat of AC-15 or equal, applied at the rate of 0.25 gallons per square yard prior to placement of asphalt topping. Extreme care shall be executed to assure that the squared edges of existing pavement will not be broken or disturbed during rolling of 1-1/2" asphalt topping.

Comply with requirements of SECTION 32 12 16 - ASPHALT CONCRETE PAVING

3.29.6 TEMPORARY BITUMINOUS PAVEMENT

At the completion of work daily and for all paved areas subject to traffic, install 12.5 mm Superpave Cold Patch to a depth of 3 inches. Maintain the temporary surface until replacement by permanent bituminous pavement.

Comply with requirements of SECTION 32 12 16 - ASPHALT CONCRETE PAVING

Where the length of temporary pavement exceeds 500 feet, remove temporary pavement and install permanent bituminous pavement.

3.30 REMOVE & REPLACE CONCRETE CURB AND GUTTER

3.30.1 The Contractor shall remove only that curbing which would otherwise be damaged in

the prosecution of his work within the limits of the pavement removal.

3.30.2 After the Contractor has completed his pipe laying and backfilling operations, the concrete curb and gutter shall be constructed monolithically on a prepared compacted subgrade, in conformity with the lines, grades and cross-section of the existing curbing and in accordance with these specifications.

Concrete materials, placement and protection shall be in accordance with ACI 318 specifications.

The forms, except the divider plates or templates between each ten (10) foot section, may be of wood or metal. The divider plates or templates shall be of metal. Forms shall be of approved sections and shall have a flat surface on top. Forms shall present a smooth surface, sufficiently thick and braced to withstand the weight of the concrete without bulging or becoming displaced. Special care shall be exercised to keep metal forms free from rust, grease or other foreign matter which would discolor the concrete. Metal templates or dividing plates shall be of sufficient thickness and of such design as to hold the forms rigidly in place and to produce a smooth vertical joint after the plates are removed. They shall be of the full dimensions shown on the plans for curb, gutter or combinations of curb and gutter.

Concrete curb and gutter shall be constructed in sections having uniform lengths of ten (10) feet. The length of these sections may be reduced where necessary for closures, but no section less than six (6) feet will be permitted. These sections shall be separated by sheet steel templates set perpendicular to the face and top of the curbing. These templates shall be one-eight (1/8) of an inch in thickness of the widths of the gutter and not less than two (2) inches longer than the depth of each respective type. The templates shall be set carefully during the placing of concrete and allowed to remain in place wherever possible until the concrete has set sufficiently to hold its shape, but shall be removed while the forms are still in place. The vertical face and top of the curb shall be floated smooth and the edge of the face shall be rounded to a radius of three- quarters (3/4) of an inch while the concrete is still soft. The forms on the face of the gutter and curb shall be removed as soon as possible and at the surface of the curb floated with a wooden float to a smooth and even surface finish.

Immediately after the removal of the forms, the ends of the transverse joints at the edge shall be carefully opened for the entire depth of the cross section. Expansion joints shall be formed of premolded joint filler of the specified thickness, and shall be placed in line with the expansion joints in the adjoining pavement or gutter and at other locations designated on the plans. All joint filler shall be cut to full depth, width and length of construction. Any expansion joint material protruding after the concrete is finished shall be trimmed as directed. Where curb and gutter is constructed upon a street without paving, the distance between expansion joints shall

not exceed forty (40) feet.

After the concrete has set sufficiently, the space behind the curb shall be refilled to the required elevation with material which shall be compacted by tamping until firm and solid.

Where concrete curb and gutter is to be located along the edge of existing pavement, the following procedure shall apply. A uniform alignment shall be established by string line. A cut line will be marked along the pavement to give a uniform cut width of 24 inches, and the pavement will be sawed and then removed to a depth of six inches. The cut edge will be used for the front form of the curb and gutter except in locations where the edge of pavement deviates from face of curb by six inches or more in which case a front form will be used. The space will later be filled with concrete to a depth of two inches below the surface and finished with a two-inch thick layer of asphalt.

In cases where new replaced curb is joined to old curb, the old curb shall be squared off to provide a straight construction joint.

3.31 REMOVE & REPLACE CONCRETE SIDEWALK

Debris from sidewalks removed shall be collected and hauled away and disposed of by the Contractor in an approved disposal area. Sidewalks shall be replaced with Portland Cement Concrete of not less than 3,000 p.s.i. compressive strength at 28 days of age. Sidewalks shall be replaced to the original width and thickness or a minimum of 4" thick. The sidewalks shall have a broom finish. All instructions in Placing of Concrete in these specifications shall be adhered to.

3.32 REMOVE & REPLACE CULVERTS (ALL SIZES & TYPES)

When culverts are encountered during the construction of the pipeline, the said culvert shall be removed and then replaced upon installation of the pipeline. If the culvert, in the opinion of the engineer, is damaged beyond use the contractor shall be responsible for replacing new culvert pipe to match the existing pipe.

3.33 REPLACING GRAVEL DRIVEWAYS

Gravel driveways will be replaced at locations shown on the plans. Gravel shall be graded aggregate base and shall be placed 6" layers, 12"deep

3.34 REPAIR OF SEPTIC TANK DRAIN FIELDS

If the contractor encounters an existing septic tank drain field during installation of the proposed water main, he shall immediately notify the Cobb County Health Department and

acquire a permit to repair the drain line in accordance with Health Department regulations. A new drain field line will be installed as necessary a minimum of ten feet away from the proposed water main.

3.35 CONNECTION TO EXISTING WATER MAINS, 12" AND SMALLER

At beginning of construction, the Contractor shall make exploratory excavation at each location where connections to existing pipes are shown for the purpose of determining the exact location, elevation and type of fittings required to make the connections. Where it is necessary to disrupt service on existing lines, the Contractor shall first obtain permission from the Owner and schedule his work accordingly.

3.36 PIPE LOCATION

The Contractor shall install 6" PVC pipe from the top of the water main to above grade at specific locations and maintain the pipe for the duration of the construction. The pipe shall be maintained clear of debris. Upon the survey for recording location of the pipe, the pipe shall be cut and capped to a point below grade, backfilled with a locator ball installed as shown on plans.

3.37 RECORD INFORMATION

The Contractor shall record on the manufacturer's pipe laying drawings the top of bell elevation for the each joint of pipe installed in the format shown as follows. Such drawings shall be submitted to the Engineer at the same time as the Contractor's monthly pay request is submitted.

Point #	STATION #	TOP OF PIPE ELEV.	DESCRIPTION

END OF SECTION