

## Section 33 1113

## PUBLIC WATER UTILITY DISTRIBUTION PIPING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes water-distribution piping and related components outside the building for water service and fire service mains.
- B. Utility-furnished products include fire hydrants that will be furnished to the site, ready for installation.

## 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Detail hydrant assemblies and indicate dimensions, method of field assembly, and components.
- C. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

## 1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. Comply with requirements of utility company supplying water, Aqua, NJ. Include tapping of water mains and backflow prevention.
  - 2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
  - 3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

- C. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
  - 1. Ensure that valves are dry and internally protected against rust and corrosion.
  - 2. Protect valves against damage to threaded ends and flange faces.
  - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
  - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
  - 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.

#### 1.6 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of service.

2. Do not proceed with interruption of water-distribution service without Owner's written permission.

#### 1.7 COORDINATION

- A. Coordinate connection to water main with utility company.

### PART 2 - PRODUCTS

#### 2.1 PIPING

- A. All water pipe 4-inches or larger to be polyvinyl chloride (PVC) pressure water pipe.
- B. Pipe and Fittings: All PVC water pipe and fittings shall be manufactured in accordance with one of the following standard specifications:
  1. AWWA C900, "Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-inch through 12-inch (100 MM through 300 MM) for Water Distribution".
  2. AWWA C909, "Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4-inch through 24-inch (100 MM through 300 MM), for Water Distribution".
  3. ASTM D2241, "Poly(vinyl chloride) (PVC) Pressure-Rated Pipe (SDR PR Series)".

#### 2.2 JOINTS AND FITTINGS

- A. Pipe joints shall be gasket, push-on type. Gaskets shall be part of a complete pipe section and purchased as such. Lubricant shall be as recommended by the pipe or fitting manufacturer and shall not adversely affect the potable qualities of the water to be transported. The gasketed joint shall meet the laboratory performance requirements specified in ASTM D3139. (This is a qualification test to verify a leak-free design of the specified joint). Certifications: PVC water pipe shall be certified to NSF International Standard No.

#### 2.3 ACCESSORIES

- A. Accessories such as gaskets, glands, bolts, nuts, etc., shall be furnished as required to make all piping systems complete.

#### 2.4 VALVES

- A. Gate valves shall be of the resilient seat wedge gate valve design, meeting or exceeding all requirements of the latest revision of AWWA C 509 & C-550. The wedge shall consist of a ductile iron casting encased in a bonded-in-place nitrile elastomer covering which forms the resilient sealing surfaces. The valves shall be of the non-rising stem design with sealing accomplished by double "O" rings and shall open left for Southern Division. All gate valves shall be designed for a minimum of 150-psi working pressure. Valves shall have mechanical joints and shall be epoxy or bituminous coated. Valves shall be Mueller Model A2360-20 or approved equal.

- B. Butterfly valves shall conform to AWWA C504, except as modified herein. Valves shall be designed for tight shutoff against a differential pressure equal to a minimum 150 psi for the service indicated. The valve body shall be constructed of cast iron, ASTM A126, Class B. Two trunnions for shaft bearing shall be integral with the valve body. Discs shall be cast iron, ductile iron or type 304 or 316 stainless steel. Seats bonded on the discs are not acceptable. Seats shall be Buna-N for liquids. Stuffing boxes shall be constructed of cast iron, ASTM A126. Gland assemblies shall be of cast bronze, ASTM B132. The packing gland shall be housed in a solid walled cast iron, ASTM A48, Class 40 one piece structure, or approved equal. Valves shall be open left. Shaft seals shall be O-ring type. Valve body & vane shall be epoxy coated in accordance with AWWA Standard C-550.

2.5 VALVE BOXES

- A. Each exterior valve shall be provided with a valve box. Valve boxes shall be cast iron and of the adjustable, telescoping type. The heavy pattern type must be used in areas where vehicular traffic can be expected. They shall be so designed and constructed as to prevent the direct transmission of traffic loads to the pipe or valve and shall be made by Pioneer, Quality Water Products, or Company approved equal.
- B. The box shall be adjustable at least 6" vertically without reduction of lap between sections to less than 4 in. The length shall be as necessary to suit the ground elevation. The inside diameter of the box shall be at least 5-1/4 in.
- C. Covers shall be close fitting and substantially dirt-tight. The top of the cover shall be flush with the top of the box rim.

2.6 FLANGED ADAPTOR

- A. Flanged adapter shall be Uni-flange, manufactured by EBAA Iron Sales, Inc. of Eastland, Texas or similar type couplings as approved by the Company. Interior couplings shall have retainer rods according to the following schedule:

<u>Pipe Dia.</u>	<u>No. of Rods</u>	<u>Rod Dia.</u>
3	2	5/8"
4	2	5/8"
6	4	3/4"
8	4	3/4"
12	4	7/8"

2.7 HYDRANTS

- A. All material used in the production of fire hydrants for ordinary service shall conform to the specifications designated for each material listed in AWWA Standard C 502.
- B. All hydrants will be provided by the Contractor.

2.8 BRASS GOODS

- A. Corporation Stops: Stops shall be manufactured and designed in accordance with AWWA C800-89. Design working pressure shall be 150 psi. Outlet threads shall be tapered iron pipe threads as described in Table 7 AWWA C800-89. Inlet threads shall be the standard corporation stop thread as described in Table 8, AWWA C800-89. Corporation stops to be Ford F-600, F-1000 or equal. Stops shall be of domestic manufacture.
- B. Ball Valve Curb Stops: Curb stops shall be manufactured and designed in accordance with AWWA C800-8. Design working pressure shall be 150 psi. Compression fitting equal or exceeding Ford pack joint with gasket material molded of synthetic rubber meeting ASTM D-2000. Body shall be three piece design with solid brass ball. Stem shall be locked on with brass ring. Curb stops to be Ford B44-333, B77-333, B44-444, B77-444 or equal. Valves shall be of domestic manufacture.
- C. Couplings: Couplings shall be manufactured and designed in accordance with AWWA C800-89. Design working pressure shall be 150 psi. Compression fitting equal or exceeding Ford pack joint with gasket material molded of synthetic rubber meeting ASTM D-2000. Couplings to be Ford C44-33, C44-34, C44-44 or equal. Couplings shall be of domestic manufacture.
- D. Alternate for all Brass Goods: Brass goods meeting and manufactured in accordance with AWWA C800-89 specifications and of the same or equal design as material as it appears in Ford's catalog 70 may be bid on a list price less percentage discount basis. Discount percentages may vary in accordance with different product lines.

2.9 TAPPING SLEEVES AND TAPPING VALVES

- A. Tapping Sleeves: Mechanical joint or caulked type tapping sleeve with Class 125 outlet flange shall be used. Sleeve working pressure shall be 150 psi. Neoprene gaskets to be included with each sleeve. Sleeve to be cast iron construction and furnished with COR 10 bolts and nuts.

<u>Pipe Type</u>	<u>Sleeve Type</u>	<u>U.S. Pipe Type</u>
Class 150 Asbestos Cement	Caulked	Type 5
Ductile Iron	Mechanical Joint	M.J.
Class 150 Asbestos Cement	Mechanical Joint	M.J.
PVC Plastic pipe - AWWA C-900	Mechanical Joint	M.J.

U.S. pipe type or approved equal

Tapping sleeves are to be used to make "Wet" taps.

- B. Tapping Valves: Tapping valves shall be in accordance with AWWA C500. Affidavit from manufacturer required that the valves furnished comply with all applicable provisions of AWWA C-500 Standard. Flanged valve ends - Inlet flanges to be Class 125. Outlet Flange to be mechanical joint. Companion flanges shall be made from a corrosion-resistant material and all mechanical joint bolts and nuts shall be COR-10. Stem seal to be "O" Ring type. Double disc bronze gates shall have parallel seats. Valve to be Mueller type H-667, H-642, H-541 or approved equal. Prices also accepted on Metropolitan Design valves. All valves shall be of domestic manufacture.

### PART 3 – EXECUTION

#### 3.1 MATERIALS

- A. All materials shall be stored and handled in accordance with the manufacturer's recommendations. The Contractor is responsible for replacing at his cost any pipe and/or material damaged during the course of unloading or construction.
- B. Pipe Unloading: It is the responsibility of the Contractor to unload and string pipe. Pipe shall be lifted off the truck and placed on the ground with care to prevent damage to the pipe and the cement lined interior of the pipe. Rolling the pipe off the truck or dropping the pipe is prohibited. Pipe may be stacked, but no more than three layers high and only with proper blocking in between layers.
- C. Pipe Jointing: For exterior piping, all joints shall be made in a dry trench and in accordance with the manufacturer's recommendations and the best practices for class of pipe laid. The ends of the pipe shall be wiped clean with a dry cloth before making the joint.
- D. Pipe Laying:
  - 1. Installation of ductile iron and PVC pipe shall be in accordance with the requirements of AWWA C 600 and AWWA C 605, respectively. The pipe shall be accurately laid to the line and grades to the satisfaction of the Engineer or Owner's representative. The line and grade may be adjusted by the Engineer or Owner's representative from that shown on the drawings to meet field conditions and no extra compensation shall be claimed therefore.
  - 2. All pipes shall be laid with a minimum of four feet and maximum of six feet of cover over the top of the pipe.
  - 3. All pipes laid within 3 feet of a culvert or with less than 4.0 feet of cover shall be insulated with 2-inch 40-pound density Styrofoam material. The insulation shall extend the width of the trench, a minimum of 4 feet, above the pipe envelope and on the vertical sides of the trench bottom from the bottom to above the pipe envelope. No pipe shall be laid with less than 4.0 feet of cover without prior approval of the Engineer.

4. The deflection of alignment at a joint shall not exceed the appropriate permissible deflection, as specified in the tabulation titled PIPE DEFLECTION ALLOWANCES.

PIPE DEFLECTION ALLOWANCES  
DUCTILE IRON PIPE

Maximum Permissible Deflection, In.*			
Size of Pipe, "	Push-on Joint	Mechanical Joint	Maximum Offset (") Per 18' Length Due to Pipe Curve
16	10	11	--
12	16	18	8
8	16	18	12
6	16	18	16

\* Maximum permissible deflection for 18-ft. length, maximum permissible deflections for other lengths shall be in proportion of such lengths to 18 ft.

5. When mechanical joint, push-on joint or similar pipe is laid, the bell of the pipe shall be cleaned of excess tar or other obstruction and wiped out before the cleaned and prepared spigot of the next pipe is inserted into it. The gasket, bell, and spigot shall be lubricated with gasket lubricating compound compatible with potable water. The new pipe shall be shoved firmly into place until properly seated and held securely until the joint has been completed. All pipes shall be pushed home by a method that protects the driving end of the pipe.
6. No pipe laying will be allowed to begin at any point other than a stub end or other appurtenance without the expressed consent of the Owner's representative. If the Owner's representative requires it, the interior of each length of pipe will be swabbed and wiped clean before laying the next length. Whenever the work is stopped temporarily, or for any reason whatsoever, the end of the pipe shall be carefully protected against dirt, water, or other extraneous material. Bedding shall be as shown on the plans.
7. In areas where the Contractor's trenching operation exceeds the typical section, the Contractor may be required to use a higher strength class pipe in lieu of the designated class at no additional cost to the Owner.

E. Valve Installation:

1. All valves shall be installed in accordance with the specifications for the pipe to which they are to be connected. Valve joints shall be made up in accordance with the Contract Drawings. The valves shall bear no stresses due to loads from the adjacent pipe. Valve shall be placed on solid concrete block with operating stem plumb. Wedges shall be used to prevent movement during backfill operation. The valve shall be operated completely before placement in the trench, and all factory-installed bolts shall be checked for tightness. All valves

shall be inspected before installation and they shall be cleaned and well lubricated before installed in the line.

2. Valves shall be installed a maximum of 1000 feet between valves.
3. The number of valves located at a “Tee or Cross” fitting shall equal the number of branches minus one (N - 1). This does not pertain to fire hydrant tees unless otherwise noted on the plans.

F. Pipe Cutting:

1. Where required, sections of pipe may be cut to provide shorter sections of pipe necessary for the construction. The cutting of the pipe shall be done in accordance with the pipe manufacturer's recommendations and subject to the approval of the Company Inspector.
2. In general, the pipe material shall be cut by using a saw or milling process, approved by the pipe manufacturer. The pipe shall be cut, not broken. The cut end of the pipe shall be square to the axis of the pipe; any rough edges ground smooth, and beveled where being used for push-on joints.

G. Repair Clamps:

1. Repair clamps are not considered as permanent repairs. If a section of main is found to be defective, it shall be cut out and a new section of ductile iron pipe shall be installed using solid cast couplings.

H. Hydrant Installation:

1. The hydrant valve shall be installed using a hydrant tee with a ductile iron rotatable MJ gland. The other MJ gland shall be installed with a Meg-A-Lug or equivalent retaining gland.
2. The hydrant shall be secured to the hydrant valve-connecting piece with a ductile iron rotatable MJ gland on one end.
3. The MJ bolts shall be Cor-ten.
4. If a long hydrant lateral is required, all bell joint shall be mechanical joint with retaining glands or push-on joint with “Field Lok” gaskets.
5. The hydrant shall be set in true vertical alignment and shall be braced against undisturbed trench walls with hardwood or solid concrete blocks. Hydrants shall not be encased in poured cement in such a way that the bolts can not be removed.
6. No service connection shall be made between the distribution main and the hydrant along the hydrant lateral.

7. All hydrant installations shall be inspected by a Company representative prior to backfilling.
8. Upon completion of the installation, the hydrant shall be painted with rust inhibiting paint, OSHA industrial yellow color for the barrel, and yellow for the bonnet and caps.
9. In unfavorable soil conditions and at any time when so designated by the Engineer, a concrete collar shall be placed below the surface around the hydrant barrel, as shown in AWWA Manual M17, to provide better resistance for traffic model hydrants.

### 3.2 SPECIAL REQUIREMENTS

- A. Pressure Pipe: Valves shall bear no stresses due to loads from the adjacent pipe.
- B. Vertical Separation from Sanitary and Storm Sewer: Utility separation must be in accordance with NJAC 7:10-11.7. Whenever water mains must cross sewers, the main shall be laid at such an elevation that the top of sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be buried to meet the above requirements, protection shall be provided as follows:
  1. A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main. (Water main below sewer).
  2. Adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking the water main.
  3. That one full length of water pipe be centered at the point of crossing so that the joints will be equal distance and as far as possible from the sewer.
  4. Concrete encasement of the lower pipe for a distance of 10 feet on either side of the crossing.
- C. Parallel Separation from Sanitary and Storm Sewer: Water mains shall be laid at least 10 feet horizontally, edge to edge, from sewers or sewer manholes. When conditions do not permit a horizontal separation of 10 feet, a water main may be laid closer to a sewer provided that:
  1. The bottom of the water main is at least 18-inches above the top of the sewer and a minimum of 5 feet edge to edge horizontally. Separate trenches are required.
  2. Where this 18-inch vertical separation can not be obtained, the sewer shall be constructed of materials and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure water tightness prior to backfilling.

- D. **Assembling Mechanical Joints:** Mechanical joints shall be assembled in accordance with manufacturer specifications, pipes shall be parallel in line with each other as joint is assembled. Surfaces against which the gasket will come in contact shall be thoroughly brushed with a wire brush prior to assembly of the joint. The gasket shall be cleaned. The gasket, bell, and spigot shall be lubricated by using gasket lubricating compound compatible with potable water. The spigot shall be inserted into the bell until it is correctly seated. The gasket shall then be seated evenly in the bell at all points, centering the spigot, and the gland shall be pressed firmly against the gasket. After all bolts have been inserted and the nuts have been made up finger-tight, diametrically opposite nuts shall be progressively and uniformly tightened all around the joint to the proper tension by means of a torque wrench. Mechanical joints shall be assembled with mechanical joint restraint glands, megalugs or approved equal.

The correct range of torque as indicated by a torque wrench and the length of wrench, shall not exceed the values specified in the tabulation titled TORQUE RANGE VALUES.

**TORQUE RANGE VALUES**  
Range of torque 75-90 ft. - lb.

Mechanical joint bolts shall be retorqued to a range of 75 to 90 ft.-lb. after waiting a period of two hours.

If effective sealing of the joint is not attained at the maximum torque indicated above, the joint should be disassembled and thoroughly cleaned, then reassembled. Bolts shall not be overstressed to tighten a leaking joint

- E. **THRUST BLOCKS:** Thrust blocks of concrete of adequate size and weight shall be used on all pressure piping for all fittings and bends including and in excess of 11-1/4 degrees.

Minimum thrust blocking size shall be as shown on the standard details or shall be determined by the soil characteristics and bearing capacities as shown on the following table, whichever is larger:

**Horizontal Bearing Strengths**

<u>Soil</u>	<u>*Bearing Strength S<sub>b</sub>(lb/ft<sup>2</sup>)</u>
Muck	0
Soft Clay	1,000
Silt	1,500
Sandy Silt	3,000
Sand	4,000
Sandy Clay	6,000
Hard Clay	9,000

- \* Although the above bearing strength values have been used successfully in the design of thrust blocks and are considered to be conservative, their accuracy is totally dependent on accurate soil identification and evaluation. The ultimate responsibility for selecting the proper bearing strength of a particular soil type must rest with the design engineer.

3.3 FIELD TESTING OF PRESSURE PIPE:

- A. The Contractor shall perform pressure and leakage tests under Company supervision, according to the requirements set forth below.
- B. The duration of the pressure test shall be at least two hours duration.
- C. The allowable leakage for ductile iron pipe may be determined by the formula:

$$L = \frac{SD p^{1/2}}{133,200}$$

Where L is the allowable leakage in gallons per hour, S is the length of pipe in feet, D is the nominal diameter in inches, and P is the average test pressure in psi.

For convenience, the following table (Page 02600-10) may be used to estimate allowable leakage for ductile iron pipeline installations:

DIPRA RECOMMENDED ALLOWABLE LEAKAGE PER 1000' OF PIPELINE\*  
(GALLONS PER HOUR)

Avg. Test Pressure PSI	NOMINAL PIPE DIAMETER - INCHES					
	4	6	8	10	12	16
450	0.64	0.95	1.27	1.59	1.91	2.55
400	0.60	0.90	1.20	1.50	1.80	2.40
350	0.56	0.84	1.12	1.40	1.69	2.25
300	0.52	0.78	1.04	1.30	1.56	2.08
275	0.50	0.75	1.00	1.24	1.49	1.99
250	0.47	0.71	0.95	1.19	1.42	1.90
225	0.45	0.68	0.90	1.13	1.35	1.80
200	0.43	0.64	0.85	1.06	1.28	1.70
175	0.40	0.59	0.80	0.99	1.19	1.59
150	0.37	0.55	0.74	0.92	1.10	1.47
125	0.34	0.50	0.67	0.84	1.01	1.34
100	0.30	0.45	0.60	0.75	0.90	1.20

\* For mechanical or push-on joint pipe with 18-ft. nominal lengths. To obtain the recommended allowable leakage for pipe with 20-ft. nominal lengths, multiply the leakage calculated from the above table by 0.9.

If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

3.4 DISINFECTION OF WATER MAINS (Refer to ANSI AWWA Standard C651 to C654)

- A. Disinfection: The disinfection and hydrostatic testing operation can be combined provided that suitable amounts of dry hypochlorite are deposited near each pipe joint as it is laid to make up the required solution strength (25/mg/l) following filling of the pipeline for testing purposes. This test procedure shall not be used if trench water or foreign materials has entered the main or if the water is below 40°F.

A quantity of calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-foot intervals. The quantity of granules used shall be as shown in Table 1.

**WARNING: THIS PROCEDURE MUST NOT BE USED WITH  
SOLVENT-WELDED PLASTIC OR SCREWED-JOINT STEEL PIPE.**

Table 1

<u>Dia. of Pipe (")</u>	<u>Calcium Hypochlorite Granules (oz.)</u>
4	0.5
6	1.0
8	2.0
12	4.0
16 and Larger	8.0

Dry HTH (calcium hypochlorite) tablets are to be placed in each section of pipe and also one such tablet shall be placed in each hydrant, hydrant branch, and other appurtenance. Number of HTH tablets required per length of pipe is as noted in Table 2 below. The tablets shall be attached by an approved adhesive. There shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe. Attach all tablets inside and at the top of the main, with approximately equal numbers of tablets at each end of a given pipe length. If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the section so it can be readily determined that the pipe is installed with the tablets at the top.

Table 2

<u>Length of Section (feet)</u>	<u>Diameter of Pipe (inches)</u>						
	2	4	6	8	10	12	16
13 or less	1	1	1	1	2	3	4
18	1	1	1	2	3	4	6
20	1	1	1	2	3	4	7

After a satisfactory hydrostatic test and allowing the chlorinated water to remain in the pipe for at least 24 hours, the line shall be flushed as described below. If the water temperature is less than 41 F (5 C), the water shall remain in the pipe for at least 48 hours. During this test period, all newly installed valves and hydrants shall be operated to thoroughly disinfect all moving internal parts.

- B. Flushing Procedures: After the chlorinated water has been retained for the required time, the treated water shall then be thoroughly flushed from the newly laid pipeline at its extremities until the replacement water throughout its length shall, upon test show a residual chlorine content of not more than 1 PPM as tested by the Water Company.

Water samples taken from the test section following completion of the disinfection procedure described above shall show no coliform count in 2 consecutive 100-ml samples. Should the initial treatment fail to result in the conditions specified in the above paragraphs, an alternate disinfection procedure shall be used as directed by the Water Company Chemist.

The environment to which the chlorinated water is to be discharged shall be inspected. If there is any question that the chlorinated water discharge will cause damage to the environment, the Owner will direct the Contractor as to how to dispose of water and will pay the cost of removal.

All expenses and costs incurred in carrying out the specified disinfection work, with the exception of furnishing the calcium hypochlorite granules and tablets, shall be borne by the Contractor at no extra cost to the Water Company.

- C. Alternate Test Procedure: An alternate test procedure, as approved by the Aqua New Jersey, Inc., may be used if the above-described procedure is not used.

Such alternate is described in Section 5.2 of AWWA C 651-86.

### 3.5 ACCEPTANCE

- A. The Owner reserves the right to accept the mains in section after the satisfactory tests have been made and approved, and to make full use of any part or parts of the system after acceptance of those parts.
- B. Until such time as the entire contract has been accepted by the Engineers and the Owners, the Contractor shall be held responsible to rectify any leaks, errors, or other poor workmanship which may be discovered and shall make an necessary repairs, alterations, or adjustments as may be required to properly complete the work, as directed by the Engineers at his own expense.

END OF SECTION 33 1113



## Section 33 3100

## SANITARY UTILITY SEWERAGE PIPING

## PART 1 - GENERAL

## 1.1 STANDARDS

## A. Related Work Specified Elsewhere

1. Earthwork, Section 31 200, EARTH MOVING.
2. Manholes, Section 33 3913, SANITARY UTILITY SEWERAGE MANHOLES, FRAMES AND COVERS.
3. Concrete, Section 32 1313, CONCRETE PAVING.
4. Contract Drawings

2.1 POLYVINYL CHLORIDE GRAVITY SEWER PIPE (PVC)A. General

1. Polyvinyl Chloride Sewer Pipe and fittings shall meet the requirements of ASTM Specification D-3034 (SDR 35), Type PSM Polyvinyl Chloride Sewer Pipe and Fittings. Where the height of cover over the pipe exceeds 10 feet, then SDR 26, heavy wall pipe shall be installed. (Johns-Manville or equal).
2. Gaskets shall meet the requirements of ASTM F477, latest revision.
3. Couplings shall be Fluid-Tite by Certainteed, Ring Tite by Johns-Manville, or approved equal. Joints shall be tested in accordance with ASTM D-3212.
4. Pipe shall have integral wall bell and spigot type joints.
5. Minimum "pipe stiffness" at 5% deflection shall be 46 psi when tested in accordance with ASTM D2412.
6. Pipe shall be drop impact tested in accordance with ASTM D2444.
7. Gravity sewer mains shall be tested for exfiltration and alignment in accordance with the Inspection and Testing Procedures for GTMUA.
8. The Contractor shall notify the Owner at least 48 hours prior to testing so that the Owner may arrange for observation of the test.
9. Sewers not meeting these requirements shall be repaired or rebuilt as directed by the Owner at the Contractor's expense.

10. When required by the Owner, the Contractor shall after completion, thoroughly flush sewers designated by the Owner to remove all foreign materials which may have entered during construction. The expense of flushing shall be borne by the Contractor and shall be included in the price bid for the sewer.

## 2.2 POLYVINYL CHLORIDE PRESSURE SEWER PIPE (PVC)

### A. General

1. Polyvinyl Chloride Pressure Sewer Pipe shall meet the requirements of AWWA Specification C909, Integral Bell and Spigot, conforming to ASTM D1784, D2241 and D3139. (CertainTeed or equal).

## 2.3 PIPING APPURTENANCES

### A. Pipe Couplings for Steel or Ductile Iron Pipe

1. Pipe couplings shall be provided in sizes and at locations shown on the drawings. Couplings shall be of gasketed, sleeve type, with diameter to properly fit the pipe, and shall consist of one (1) steel middle ring; two (2) steel follower rings; two (2) rubber compound wedge section gaskets and sufficient steel track-head bolts to properly compress the gaskets. Provide galvanized steel bolts and nuts for outdoor and underground couplings. All underground couplings shall be coated with bitumastic. Aboveground couplings shall be painted. Couplings shall be assembled to provide permanently tight joints, and shall be as manufactured by Dresser Mfg. Div., Bradford, PA, Smith Blair, or equal.

### B. Pipe Restraints

1. Mechanical joint retainer glands designed to provide a method for restraining mechanical joint pipe and fittings shall meet the specifications of AWWA C-111 (ANSI A21.11), Rubber Gasket Joints for Ductile Iron Pipe and Fittings, Table 11.1 "Mechanical Joint Dimensions". Glands shall be constructed of ductile iron with set screws of heat-treated AISI 4140 steel. Retainer glands shall be as manufactured by the Standard Waterworks Equipment Co., American Cast Iron Pipe Co. or equal.
2. Pipe harness, when required, shall be in accordance with the requirements specified and conform to details shown on the drawings.

### C. Pipe Sleeves and Hangers

#### 1. General

- a. Furnish all wall thimbles and boxes for openings throughout the entire job which are to be partially or wholly embedded in the concrete. At no place in the structures shall a pipe be put through concrete without the use of a wall casting or pipe sleeve.

#### 2. Pipe Sleeves, Hangers and Supports

- a. All sleeves and hangers for piping in this section shall be furnished and set by the Contractor who shall be responsible for their proper and permanent location.
- b. Pipe Sleeves:
  1. Cast iron or steel pipe sleeves shall be provided for all pipe passing through concrete walls except pipe passing through footings. All wall sleeves shall be provided with a waterstop.
  2. All steel pipe sleeves shall be of standard schedule pipe with caulking groove entering the pipe sleeve at both ends. A minimum of 1/4-inch space shall be provided between the ID of the sleeve and the OD of the pipe passing the wall sleeve.
  3. Cast iron pipe sleeves shall comply with the specifications covering cast iron pipe and shall be made of good quality cast iron, smooth and free from defects of every nature. Each end of the cast iron pipe sleeve shall be provided with caulking grooves. The size of the sleeve shall be the size as recommended for the pipe, an oversize pipe sleeve will not be permitted.
  4. Pipes will not be permitted to pass through floorings, beams, or ribs unless otherwise noted on the Drawings.
  5. All pipe sleeves shall be caulked watertight.
- c. Pipe Hangers
  1. Horizontal overhead runs of pipe shall be hung with approved heavy adjustable malleable iron pipe hangers. Vertical runs of pipe shall have heavy wrought iron clamps or collars for support. All hangers and collars shall be of a size proportionate to the weight of pipe supported. Commercial malleable iron, clevis, chain, strap, perforated bar or wire hangers may be used. Trapeze hangers may be used where directed, in lieu of a separate hanger for each pipe.
- d. Pipe Supports
  1. The Contractor shall also provide all concrete, grout and pipe supports ("kickers") required to support pipes, valves and other items. All supports for mechanical piping consisting of pipe shall be filled with concrete.

D. Miscellaneous Items

1. Non-Shrink Grout

- a. Non-shrink grout for closing masonry and concrete openings at pipe and sleeve locations, shall be “EMBECO 636 GROUT” by Master Builders, Philadelphia, PA, or equal.

2. Pipe Tie Rods

- a. Pipe tie rods shall be made of steel, with steel tie-rod plates as detailed on the Drawings.

3. Valve Boxes

- a. Valve boxes are required on all buried valves, unless otherwise noted on Drawings. Valve boxes shall be of cast-iron. Provide extension stems complete with operating nut not more than 12-inches below top of valve box. Provide spacers every 5 feet for extension stem. The minimum thickness of the metal of the valve box at any point shall be not less than 3/16 of an inch. The cover shall have cast thereon the words “SEWER” or “WATER” and “OPEN” and a direction arrow. In areas other than paved, the Contractor shall construct a Class “B” concrete pad 2 ft. x 2 ft. x 6 in. under the valve box. The valve box shall be sufficient in size to enclose any exposed working part of the valve, such as the valve stem. Provide one “T” wrench for buried valves.

4. Modular Mechanical Type Seal

- a. Modular mechanical type seals shall consist of interlocking synthetic rubber links, two pressure plates and stainless steel nuts and bolts.
- b. The modular mechanical type seals shall be “Link-Seal” as manufactured by Thunderline Corporation, Belleville, Michigan, or equal.

2.4 BEDDING MATERIAL FOR UTILITIES

- A. Class A: Concrete, NJDOT Class C or coarse aggregate #56.
- B. Class B: Coarse Aggregate No. 67 per NJDOT Specifications.

## PART 3 – EXECUTION

3.1 PIPING INSTALLATION

- A. All pipes shall be carefully inspected before installation. Pipe and fittings, which show defects, shall be rejected. Any injuries to the protective coatings of the pipe or fittings shall be carefully repaired by the Contractor. Pipe shall be cleaned inside before it is erected.
- B. All pipe shall be installed true to alignment and rigidly supported. Care shall be taken to install the pipe so that excess stresses are not imposed on the pipe during installation.
- C. The buried pipes and fittings must be so installed that after the line is completed; the interior surface thereof shall conform accurately to the grade and alignment shown on the drawings.
- D. In order to insure the accurate installation of the gravity sewer pipe as herein specified, the Contractor shall utilize the "laser" equipment method for the establishment of line and grade. The intent of this requirement is such that the Contractor bidding may lease, borrow, or own the equipment. It is not to be construed that only owners of such equipment may bid. The Contractor shall have present at all times during the working day when gravity sewer is being installed at least one (1) person qualified to set up and use the equipment.
- E. Where straight pipes are being laid between manholes or other permanent openings, light from the remote end of the section shall remain constantly in plain view throughout the entire length.
- F. The Contractor shall do all necessary pipe cutting and shall locate fittings, etc. in the exact positions indicated on the drawings
- G. Screwed joints shall be made up with Teflon tape applied to the male thread only. After having been set up, a joint must not be backed off unless the joint is completely broken, the threads cleaned and new tape applied.
- H. Poured joints for caulked sleeves shall be made by use of braided jute or asbestos rope and soft virgin lead, poured and caulked.
- I. Flanged joints shall be made up square with even pressure upon the gaskets. Gaskets of material suitable for the intended service shall fit the inside dimension of the pipe accurately so that no surplus material projects into the flow area. The completed joint shall be smooth and properly aligned.

3.2 INITIAL BACKFILL

- A. Clean earth fill composed of sand, sand and silt, sand and rock, crushed rock or approved combination containing not more than 15% by weight finer than a #200 sieve. Under no circumstances shall any muck, stumps, roots, brush, trash, rubbish or organic material be used in the backfill. Material may be selected from the excavation, or obtained, if necessary, from an approved borrow pit area. The fragment size listed below shall not be exceeded for the following pipe materials:

<u>Pipe Material</u>	<u>Fragment Size (Greatest Dimension – Inches)</u>
Concrete	3
Ductile Iron	3
Corrugated Metal	3
Vitrified Clay	1-1/2
Plastic PVC	1
High Density Polyethylene	1

3.3 TRENCH BACKFILL

- A. Site soils may be used provided they comply with the above. As specified for “Initial Backfill”, except that maximum dimension for any stone or pavement fragment shall be 3-inches.

3.4 TRENCHES AND PITS

- A. Width: The minimum width of the trench shall be equal to the outside pipe diameter plus one (1) foot. Trench walls shall be maintained as vertical as possible to the top of the pipes; the maximum width of trench measured at the top of the pipe shall not exceed the outside pipe diameter of the pipe at the bell plus 4’.
- B. Unstable Bottom: Where muck or other deleterious material are encountered at or below trench grade, they shall be removed and replaced with Bedding Material in layers not to exceed 10" in thickness, compacted to at least 95% of maximum ASTM D-1557 (AASHTO T-180) density. The Owner may elect, depending upon the severity of the unstable soil, to require special foundations.
- C. Over-Excavation: Should the trench be inadvertently over-excavated below a point 6" below the bottom of the pipe, fill that area of over-excavation with Bedding material and compact to 95% of maximum (AASHTO T-180) density. The contractor shall fill any area of over-excavation beyond a point 10" below the bottom of pipe with Class A material. Compaction shall be not less than 95% of maximum ASTM D-1557 (AASHTO T-180) density for Class A bedding.
- D. Fill or backfill material at utility structures, culverts and pipes shall be deposited in horizontal layers not exceeding 10 inches in thickness prior to compaction. A minimum of 95 percent of Modified Proctor Maximum Density will be required. When placing fill or backfill around culverts and pipes, layers shall be deposited to progressively bury the

pipe or culvert to equal depths on both sides. When filling behind abutments and similar structures, all material shall be placed and compacted in front of the walls prior to placing fill behind the walls to a higher elevation.

- E. Fill or backfill for conduit or cable placed in a trench shall be carefully placed in horizontal layer to a depth of six inches over the top of the conduit or cable. The layer of material shall be not compacted, however, the remaining portion of the trench shall be backfilled in accordance with the preceding paragraph. Where cables or conduits are placed and backfilled by a machine in one operation, the above requirements for backfilling do not apply.

### 3.5 PIPE TESTING

- A. All pipe testing shall be performed by Contractor at his expense in presence of Owner or the Owner's Representative as follows:
  - 1. Gravity Piping Exfiltration tests shall be performed before backfilling to measure joint tightness. Basic minimum internal head of 2 feet over top of pipe shall be applied. Water shall be held in pipe for 24 hours. (Leakage shall not exceed 100 gallons per 1 inch diameter of pipe per mile in 24 hours).
  - 2. Force Mains shall be tested for leakage at pressure of 50 lbs. above normal working pressure. (No leakage will be permitted inside buildings).
    - a. Prior to connecting the new force main to the existing pipe, the Contractor shall provide at no additional cost to the Owner a temporary restrained test plug to be placed at the end of the new force main just prior to the connection with the existing force main.
    - b. After the new force main has been tested for leakage and is acceptable, and the new pumping station is ready to go on line, the Contractor may proceed with the final connection to the existing force main. The final connection shall be visibly inspected by the Owner, while the new pumping station is being exercised. The final connection with the existing force main can be backfilled after the Owner has approved the visual inspection for leakage.
  - 3. Duration of each pressure test shall be one (1) hour.
  - 4. Allowable leakage, for force mains outside buildings, shall conform to limits indicated in applicable table in AWWA Std. C600-87. A copy of the AWWA C 600-87, Section 4, is attached for reference.
  - 5. All other pipes not listed shall be tested to 50 percent above normal operating pressure. No leakage is permitted.
  - 6. The Contractor shall provide a certification of all pipe tests.
  - 7. Test Failures

- a. If the installation fails to meet the stated test requirements, the Contractor at his own expense shall determine the source of leakage, repair or replace all defective materials and/or workmanship failing to meeting tests and shall retest same until proven acceptable to the Owner.
- b. In the event the result(s) of the test(s) does not fall within the allowable range of acceptance, the Contractor shall take whatever corrective action is necessary including replacement of the said pipe, etc., to bring the result(s) of the test(s) to within the allowable range of acceptance.

END OF SECTION 33 3100

## Section 33 3913

## SANITARY UTILITY SEWERAGE MANHOLES, FRAMES AND COVERS

## PART 1 – GENERAL

## 1.1 STANDARDS

- A. Related Work Specified Elsewhere
  - 1. Excavation, Section 31 2000, EARTH MOVING.
  - 2. Concrete, Section 32 1313, CONCRETE PAVING.
  - 3. Piping, Section 33 3100, SANITARY UTILITY SEWERAGE PIPING.
  - 4. Contract Drawings.

## 1.2 MANHOLE TYPES

- A. Manhole shall be made up of precast concrete sections.

## PART 2 PRODUCTS

## 2.1 CONCRETE AND GROUT

- A. Concrete shall be in accordance with Section 32 1313, CONCRETE PAVING.
- B. Grout shall be "Masterflow 713 Grout" manufactured by Master Builders, "Non Shrink 5 Star Grout" manufactured by U.S. Grout Corporation or equal. Grout shall be capable of meeting test requirements of ASTM C827.

## 2.2 CRUSHED STONE

- A. Crushed stone shall be in accordance with the crushed stone specified in Section 02215 EARTHWORK, of these Specifications.

## 2.3 MANHOLE STEPS

- A. Manhole steps shall be extruded 6061-T6 aluminum and shall be equal to the following ALCOA Part Number:
  - 1. 16027B (with plastic inserts) or 15785

- B. Portions of manhole steps which are to be embedded in concrete shall be protected by coating those portions with a mastic or other suitable protective coating, which will prevent corrosion due to galvanic action. Direct contact between the aluminum alloy step and any steel reinforcing bars, other dissimilar metal or concrete will not be permitted.

## 2.4 MANHOLE FRAMES, COVERS AND FLOOR DOORS

### A. General

1. Castings shall be heavy duty gray cast iron, meeting ASTM A-48 Specifications, designed for H-20 loading as designated by AASHTO.
2. Castings shall be free from cracks, holes, swells and cod shuts. All manhole castings shall be made accurately to the pattern and to the dimensions shown on the Drawings, and shall be planned where marked, or where otherwise necessary to secure perfectly flat and true surfaces. All lids which "rock" and do not lie solid after construction is finished will be condemned and must be replaced by perfect lids.
3. No plugging, burning in or filling will be allowed. Covers must fit the frames in any position. All castings shall be carefully coated, both inside and out, with coal-tar pitch varnish. The varnish shall be made from a good quality of coal-tar, with sufficient oil added to make a smooth coating, tough and tenacious when cold, and not brittle nor with any tendency to scale off.

### B. Manhole Covers

1. Manholes indicated on the Drawings shall each be equipped with a cast iron cover with lifting handles. Each of these manholes shall be of standard construction, equipped with Frame and Cover conforming to details of the Drawings. Frame and Cover shall be Bridgestate 1012-B or approved equal.

### C. Anchor Bolts

1. Anchor bolts for bolting manhole frame to the precast manholes shall be made of 3/4 inch diameter all-thread steel rods with a minimum 2-inch projection through the frame. The all-thread steel rod, washer and nuts shall be galvanized.
2. The concrete inserts for use in pre-cast manholes shall be in accordance with Federal Spec. WW-H-171C (Type 18). Cinch anchoring will not be permitted.

### D. Mastic

1. Mastic for use between manhole frame and manhole top shall be equal to that as specified for "Joint Material" in Paragraph 2.5,D of this section of the Specifications.

## 2.5 PRECAST CONCRETE MANHOLES AND COMPONENTS

## A. Sections

1. The sections for the manholes shall be of the size indicated on the Drawings.
2. The Sections shall conform to the requirements of "Specifications For Precast Reinforced Concrete Manhole Sections" (ASTM C478), except that the joints shall be sealed with a preformed flexible plastic gasket.

## B. Risers and Top Sections

1. The top of base walls, the ends of reinforced concrete risers and the bottom ends of precast tops shall be so formed that when risers and tops are assembled with the base, they will make a continuous manhole. Joints shall be of such design as will permit effective joining and placement without irregularities in the interior wall surface of the manhole.
2. Precast barrels shall consist of riser sections. No more than two (2) lift holes shall be cast in each riser or top section. Holes shall be tapered and plugged with rubber stoppers and mortar after installation.
3. Precast riser sections shall be designed, manufactured, tested, finished and marked in accordance with this specification and "Specifications for Precast Reinforced Concrete Manhole sections" (ASTM C478 Latest Revision).
4. The precast sections shall be constructed by the wet process method and shall have a slump of 3-1/2 inches to 4-1/2 inches. A letter of certification shall be submitted to the engineer stating that these requirements have been attained.

## C. Precast Slap Tops

1. Precast slab tops for manholes shall be fabricated as detailed on the Drawings.

## D. Joint Material

1. The joint material shall be a preformed flexible gasket. It shall consist of hydrocarbon plastic and vulcanized rubber and shall be capable of meeting the following conditions:

<u>Test</u>	<u>Reference</u>
Hydrocarbon plastic content 50-70% by weight	ASTM D297
Volatile matter 2.0% max. by weight	ASTM D6
Specific gravity, 77 deg. F-1.20 to 1.35	ASTM D71
Ductility, 77 deg. F 5.0 cm min.	ASTM D113
Softening Point, ring and ball, 320 deg. F min.	ASTM D36
Penetration, cone 77 deg. F, 150 gm 5 sec., in 0.1 mm. -50-120	ASTM D217
Flash point, C.O.C. 600 deg. F min.	ASTM D92
Fire point, C.O.C. 625 deg. F min	ASTM D92
	<u>Requirement</u>
Inert miner filler % by weight	30-50
Adhesion and Hydrostatic Pressure	Material, when in place, shall not leak at joints while being subjected to 10 psi test for 24-hr. period.
Sag or Flow Resistance (vertical and overhead, 1" wide joints)	No sagging shall be detected while being subjected to temperature of 135 deg. F for period of 5 days.
Chemical Resistance	No visible deterioration of compound when immersed separately in solution of acid, alkalis and saturated hydrogen sulfide, for period of 30 days.
<p>2. Sealing compound shall be supplied in extruded rope-form of suitable cross-section and of such sizes as to seal the joint space when the sections are set in place. The sealing compound shall be protected by a suitable removable two-piece wrapper. The two-piece wrapper shall be so designed that one-half may be removed longitudinally without disturbing the other half to facilitate application of the sealing compound.</p>	
<p>E. Hold-Down Anchors</p>	
<p>1. Provide hold-down anchors cast into the bottom section as detailed on the Drawings.</p>	

## F. Curing Concrete Manhole Sections

1. When forms are stripped from a section, a cement slurry shall be brushed on to outside of section to fill in voids which appear on face of the section.
2. Within 2 hours after the section has been cast, it shall be enclosed within a suitable steam-curing chamber of enclosure that will protect the pipe from outside drafts. Enclosure shall allow full circulation of saturated vapor around the inside and outside of the section, and the curing shall keep all concrete surfaces continuously moist throughout the curing process. The ambient temperature rise about the pipe at any time shall not exceed 30 Deg. F. per hour. The ambient temperature within the enclosure shall not be raised above 100 Deg. F. by the use of steam within 2 hours after completion of concrete placement; thereafter, the temperature shall be maintained between 90 deg. and 150 deg. F. for the remainder of the steam-curing, except as provided for interruption of cure to remove the headers and pallets to prepare the section ends.
3. The curing cycle shall be maintained for a period of 12 hours.
4. The top and bottom rings used to form the tongue and groove ends shall remain on the section for the entire curing cycle.
5. Each manhole section shall be aged seven (7) days before coating is applied in the field.

## PART 3 - EXECUTION

## 3.1 GENERAL

## A. Line and Grade

1. Care shall be taken to have all pipes laid to correct lines and grades as established.

## 3.2 PRECAST MANHOLES

## A. Handling

1. All precast manhole components shall be lifted and moved by use of suitable lifting slings and plugs that will not damage the precast manhole lip.
2. All damage to precast sections shall be thoroughly repaired in the presence of the Professional. Repair and patching of minor breaks shall be done by chipping and scarifying the defective area before application of grout. Sufficient time shall be allowed for curing before the precast sections are put together. Concrete cast-in-place bases shall be specially formed and keyed in accommodate the bottom precast section.

B. Site Inspection of Precast Sections

1. Precast sections shall be subject to rejection on account of failure to conform to any of the specification requirements. In addition, individual sections of manhole sections may be rejected because of any of the following:
  - a. Fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint
  - b. Defects that indicate imperfect proportioning, mixing, and molding.
  - c. Surface defects indicating honey-combed or open texture.
  - d. Damaged or cracked end, where such damage would prevent making a satisfactory joint.
  - e. Any continuous crack having a surface width of 0.01 inch (0.25 mm) or more and extending for a length of 12 inches (305 mm) or more, regardless of position in the section wall.

C. Bituminous Coating

1. Prior to setting the precast sections in place each section shall have the exterior concrete surface blown free of all dirt and debris and brushed clean and then coated with bitumastic.
2. The coating shall be Bitumastic Super Service Black as manufactured by Koppers Co., equivalent of Mobil Chemical Co., or equal.
3. At least three (3) coats shall be applied giving a total dry film thickness of a minimum of 32.0 mils. Coats shall be allowed to cure between coats in accordance with manufacturer's recommendations.
4. After installation, damaged surfaces shall be recoated in accordance with the coating manufacturer's recommendation to give the required 32.0 mils dry film thickness.
5. The Contractor shall provide a certification stating that he has installed the exterior manhole coating in accordance with the manufacturer's recommendations and that this is a minimum of 32.0 mils of material on all manholes.

D. Placement of Precast Bases

1. The bases shall be constructed of precast reinforced concrete, and shall consist of the manhole bottom including the shape invert and a wall which shall extend a minimum of 6 inches above the top of the highest inflowing line or as detailed on the Drawings.

2. The concrete to be used shall be Class "A", unless otherwise noted.
3. The bases shall rest upon a base of sound, level, crushed stone.

E. Placement

1. Manhole sections shall not be set by wedging or placing shims to secure proper level.

F. Pipe Installation

1. The pipes shall be placed in the manhole section and grouted in place with a watertight rubber gasket, unless otherwise noted on the Drawings.

### 3.4 MANHOLE FRAMES AND COVERS

- A. Manholes frames and covers shall be brought to proper grade as previously noted, set in a 1/2 inch bed of mastic that shall completely fill the space between the manhole frame and top of manhole. Frame shall be anchored in place with the four (4) 3/4 inch diameter anchor bolts which shall be securely embedded in the top of the manhole.

### 3.5 TESTS

A. General

1. After the manholes have been installed and backfilled, the manholes shall be tested for leakage.

B. Test Procedure

1. All lines entering and leaving each manhole shall be plugged. Those manholes which are constructed in a high groundwater table location will be allowed to remain plugged for a period of not less than four (4) hours, after which the quantity of inward leakage accumulation will be measured by bailing and measuring and/or computation against depth of water and diameter of the manhole. Those manholes constructed above the groundwater table will be filled with water to the top of the cast iron frame and allowed to stand until the walls are well soaked. The manhole shall then be refilled to the full or overflow point and remain undisturbed for a period of not less than four (4) hours. The loss of water shall be measured by refilling to the top with a premeasured quantity of water and/or computation against depth of water loss and diameter of the manhole.
2. Gain or loss by the respective methods shall not exceed the following:
  - a. 0.02 gal. per hour, per vertical ft. of depth in top section.
  - b. 0.03 gal. per hour, per vertical ft. of depth in a cone section.

- c. 0.04 gal. per hour, per vertical ft. of depth in a 4 foot diameter barrel section.
- d. 0.05 gal. per hour, per vertical ft. of depth in a 5 foot diameter barrel section.
- e. 0.06 gal. per hour, per vertical ft. of depth in a 6 foot diameter barrel section.
- f. 0.07 gal. per hour, per vertical ft. of depth in a 7 foot diameter barrel section.
- g. 0.08 gal. per hour, per vertical ft. of depth in a 8 foot diameter barrel section.
- h. 0.10 gal. per hour, per vertical ft. of depth in a 10 foot diameter barrel section.
- i. 0.12 gal. per hour, per vertical ft. of depth in a 12 foot diameter barrel section.

END OF SECTION 33 3913

## Section 33 4100

## PUBLIC STORM UTILITY DRAINAGE PIPING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Pipe and fittings.
  - 2. Cleanouts.
  - 3. Encasement for piping.
  - 4. Manholes.
  - 5. Catch basins.
  - 6. Stormwater inlets.
  - 7. Stormwater disposal systems.

## 1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A 760 - Standard Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drains.
  - 2. ASTM C 76 - Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
  - 3. ASTM C 443 - Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
  - 4. ASTM D 3034 - Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
  - 5. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

## 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  - 1. Manholes: Include plans, elevations, sections, details, frames, and covers.
  - 2. Catch basins and stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.

## 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.
- D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

#### 1.4 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of service without Owner's written permission.

### PART 2 - PRODUCTS

#### 2.1 PIPE MATERIALS

- A. Reinforced Concrete Pipe:
  - 1. Pipe: ASTM C 76, Class III unless indicated otherwise on Drawings.
  - 2. Gaskets: ASTM C 443; rubber compression gaskets installed in accordance with manufacturer's published instructions.
- B. Polyvinyl Chloride (PVC) Pipe:
  - 1. Pipe: ASTM D 3034, SDR 35 Rated.
    - a. Continuously mark pipe with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification.
  - 2. Joints: ASTM D 3034, Table 2; integrally molded bell ends with factory supplied elastomeric gaskets and lubricant.
  - 3. Pipe: ASTM D1785-91, PVC Schedule 40, continuously marked with classification and rating.

#### 2.2 INLETS, CATCH BASINS, CLEANOUTS, AND MANHOLES

- A. Lid and Frame: Cast iron as indicated on Drawings.
- B. Structure: As indicated on Drawings.
- C. Concrete: Specified in Section 033000.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
  - 1. Verify that survey benchmark and intended elevations for the Work are as indicated on Drawings.
  - 2. Verify that trench cut and excavation is ready to receive Work and excavations, dimensions, and elevations are as indicated on Drawings.
- B. Report in writing to Owner prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

### 3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.
- B. Remove large stones or other hard matter that could damage piping or impede consistent backfilling or compaction.

### 3.3 BEDDING

- A. Excavate pipe trench as specified in Section 310000. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place bedding material at trench bottom, level materials in continuous layers not exceeding 6-inches compacted depth, each layer. Place compacted bedding material to elevation of paving subgrade as indicated on Drawings.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.
- D. Remove excess backfill and excavated material from site.

### 3.4 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with ASTM C 12, ASTM D 2321 or manufacturer's published instructions, and state or local requirements. Seal joints watertight.
- B. Install pipe on minimum 4 inch bedding as specified in Section 022150.
- C. Lay pipe to slope gradients indicated on Drawings.
- D. Install aggregate at sides and over top of pipe. Provide top cover to minimum compacted thickness equal to paving subgrade indicated on Drawings.

- E. Refer to Section 310000 for trenching requirements. Do not displace or damage pipe when compacting.

### 3.5 INSTALLATION - CATCH BASINS, INLETS, MANHOLES AND CLEANOUTS

- A. Form bottom of excavation clean and smooth to elevation indicated on Drawings.
- B. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe to be placed at required elevations.
- C. Form and place cast-in-place concrete walls, sleeved at required elevation, to receive storm sewer pipe as indicated on Drawings.
- D. Form and place cast-in-place top of structure as indicated on Drawings.
- E. Mount grate and frame level, in grout, secured to top section at elevation indicated.

### 3.6 CONSTRUCTION

- A. Interface with Other work: Coordinate the Work with termination of storm sewer connection outside building including connection to municipal storm sewer system.

### 3.7 FIELD QUALITY CONTROL

- B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
  - 1. Submit separate reports for each system inspection.
  - 2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    - c. Infiltration: Water leakage into piping.
    - d. Exfiltration: Water leakage from or around piping.
  - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  - 4. Reinspect and repeat procedure until results are satisfactory.
- C. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  - 1. Do not enclose, cover, or put into service before inspection and approval.
  - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
  - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
  - a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
  - b. Option: Test plastic piping according to ASTM F 1417.
  - c. Option: Test concrete piping according to ASTM C 924
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 33 4100

