



**WARMINSTER MUNICIPAL
AUTHORITY**

Water & Sewer Services

WATER AND SANITARY SEWER FACILITIES

CONSTRUCTION SPECIFICATIONS

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SECTION I - GENERAL REQUIREMENTS

1.01 SCOPE.

The following paragraphs outline minimum acceptable standards to be followed for all additions and extensions to the Water Distribution and Sanitary Sewage Collection Systems of the Warminster Municipal Authority hereinafter referred to as the Authority. These Specifications shall apply to the construction, repair, replacement or alteration of Tract Water and Sewer Facilities as defined herein. Work shall be done in accordance with the requirements of the Authority and these Specifications. The work shall be executed in the most workmanlike manner by qualified, careful and experienced workmen.

To the extent that these Specifications are contradictory or inconsistent in any respect with the provisions shown on any Construction Drawings, or other contract documents, these Specifications shall govern and take precedence over any such inconsistencies. The Authority reserves the right to make any decisions and determine the answers to any and all questions of fact. All such decisions and answers shall be final and binding upon the Contractor.

1.02 INSPECTION.

During construction, the Engineer will provide inspection and will observe all required tests. The primary responsibility for compliance with design drawings and specifications rests with the Contractor installing the system.

The inspection of work performed by the Contractor does not relieve the Contractor of his responsibilities for repairs of defects due to improper installation, carelessness, poor workmanship, etc. The Authority's representative, hereinafter referred to as the Inspector, does not have the authorization to revoke, alter, relax, release, or waive, etc., any requirement of the Specifications. The Inspector is not a foreman. Any advice from him to the Contractor shall not be binding to the Authority and Engineer, and shall not relieve the Contractor of his obligation.

All work within township and borough streets or roads, State highways and rights-of-ways is subject to inspection by representatives of the municipality and the Pennsylvania Department of Transportation, respectively. All costs of PennDOT inspection are the responsibility of the Contractor. Any additional or corrective work required by municipality or PennDOT, as a result of their inspection, shall be performed by the Contractor, before continuing with the work.

The Contractor must notify the Engineer a minimum of 48 hours prior to the start of work. Where work is to be performed in a State highway, the Contractor must also notify the Pennsylvania Department of Transportation Press Office (610-964-6673) a minimum of 96 hours and County Permit Inspector (215-345-0429) a minimum of 72 hours prior to the start of work.

Where work is to be performed in a township or borough road, the Contractor must notify the police department, the manager's office, licenses and inspections and public works (road) department of the municipality in which the work is located.

All Tract Water and Sewer Facilities, including underground building sewers and water service pipes to inside the basement or foundation walls shall be inspected by personnel of the Authority or the Engineer.

1.03 EROSION CONTROL MEASURES.

The Contractor shall plan all phases of the construction work so as to minimize erosion. Temporary erosion and sediment control measures, structures and procedures shall be conducted, completed and maintained in strict accordance with the recommendations and regulations of the Pennsylvania Department of Environmental Protection, the Bucks County Conservation District, the Drawings and these Specifications. All required erosion and sedimentation control measures shall be performed by the Contractor.

1.04 STANDARD SPECIFICATION, ABBREVIATIONS.

All standard specifications referred to herein, such as ACI, ASTM, AWWA, and the like, shall have the meaning set forth opposite each below and shall be the latest revision thereof at the time of construction.

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing Materials
AWWA	American Water Works Association
AASHO	American Association of State Highway Offs.
API	American Petroleum Institute
AWS	American Welding Society
CISPI	Cast Iron Soil Pipe Institute
CRSI	Concrete Reinforcing Steel Institute
DIPRA	Ductile Iron Pipe Research Association
NCSA	National Crushed Stone Association
NSF	NSF International (formerly National Sanitation Foundation)
OSHA	Occupational Safety and Health Administration

1.05 LINES AND GRADES

The Contractor shall supply the Engineer with construction stake out and cut sheets. The offset stakes will be used by the Contractor for the installation of the sanitary sewers, water mains and appurtenances. The trench centerline elevations are to be used for computing actual depth of excavation. The Contractor, when required, shall supply the Engineer with competent laborers to assist in verifying the construction stake out. The Contractor shall provide all equipment and competent personnel required to establish the line and grade for the construction.

1.06 FEDERAL, STATE, AND LOCAL REQUIREMENTS

The Contractor shall, at all times, observe and comply with all Federal and State laws and regulations, and Local bylaws, ordinances, and regulations in any manner affecting the conduct or work or applying to employees on the project, as well as all safety precautions and orders or decrees which have been promulgated or enacted by any legal bodies or tribunals having authority or jurisdiction over the work, materials, equipment, employees or the contract; such observance and compliance shall be solely and without qualification the responsibility of the Contractor without reliance or superintendence or direction by the Authority or Engineer. The duty of enforcement of all said laws, ordinances, regulations, order or decrees lies with the body or agency promulgating them, not with the Authority or Engineer.

The Contractor must keep a copy of Publication 408 (Form 408) of the Commonwealth of Pennsylvania Department of Transportation (PennDOT) in the field office for the duration of the project.

1.07 SAFETY

The Contractor's attention is directed to the regulations of the PA Dept. Of Labor and Industry relating to trenches and excavations, confined spaces, tunnel construction, equipment, materials, labor, safety, sanitation, and other regulations on which the Contractor shall be fully informed and with which he shall fully comply. Attention is also directed to the U.S. Department of Labor, Occupational Safety and Health Administration, Construction Safety and Health Standards - Excavation, 29 CFR Part 1926, and all other applicable requirements of the Occupational Safety and Health Act of 1970 (P.L. 91-596).

Observance of and compliance with, the above regulations shall be solely, and without qualification, the responsibility of the Contractor, without reliance or superintendence of the Authority or the Engineer. The duty of enforcing such laws and regulations lies with the federal and state agencies, not with the Authority or Engineer. The Contractor shall hold the Authority and the Engineer harmless from any civil or criminal penalties imposed as a result of the Contractor's non-compliance with regulations.

1.08 SHOP DRAWINGS

All materials to be incorporated in the work shall be subject to approval by the Engineer. The Contractor shall obtain manufacturer's certified shop drawings and other pertinent data and shall submit them to the Engineer for review. All shop drawings must be reviewed and approved by the Contractor prior to submittal to the Engineer. All shop drawings not stamped with the Contractor's approval will be returned to the Contractor. Electronic copies of the submittals are acceptable and preferred. These can be submitted directly to the Engineer for review and approval. If paper copies are provided, a minimum of four (4) copies of each shop drawing must be submitted. The Engineer will retain two (2) copies for his dispersal and return all remaining copies to the Contractor after review. Shop drawings shall be submitted for all materials.

Detailed shop drawings shall be submitted to the Engineer for approval prior to installation of any equipment/material. The Contractor shall not install any material until the shop drawings have been approved and the Contractor has received written notification from the Engineer. The Contractor shall schedule his work so as to allow sufficient time for review of all shop drawing submittals by the Engineer. The Engineer's acceptance of shop drawings before approval of any material or device shall not relieve the Contractor from the responsibility of furnishing the same of proper dimension, size, quantity, quality and all performance characteristics to properly meet the requirements and intent of the Drawings and Specifications. Such acceptance shall not relieve the Contractor from responsibility for errors of any sort on the shop drawings. If the shop drawings deviate from the Drawings and Specifications, the Contractor shall advise the Engineer of the deviations, in writing, accompanying the shop drawings, including the reasons for deviations and shall request a deviation from the Drawings and Specifications as hereinafter described.

1.09 MAINTENANCE

The Contractor shall promptly complete all such repairs ascribed to him. When in the interest of the public service or safety, by reason of failure of the Contractor to act with sufficient promptness, sufficient number of skilled workmen, or proper equipment, in completing said repairs affecting the public or Authority's service or safety, the Engineer may deem it advisable to repair or complete such repairs, by the services of another Contractor or by the Authority's personnel. If such measures are employed, the Contractor shall be responsible for the expenses involved for another Contractor, or Authority's personnel, and shall reimburse the Authority for the cost of performing this work.

1.10 CONSTRUCTION SCHEDULE

The Contractor must submit, to the Engineer a written construction schedule seven (7) days prior to the start of any work. This schedule shall consist of, but not be limited to, the starting and completion dates of all construction, the delivery dates of long term delivery items, construction phases with detailed sequence of construction, the number of crews to be utilized, submittal of shop drawings, etc. If the schedule changes during the contract period, the Contractor must submit a revised schedule to the Engineer.

1.11 CONSTRUCTION PROGRESS MEETINGS

Construction progress meetings will be scheduled, as required, the day and time of which to be selected by the Engineer. The meetings shall be held at the job site during the construction period. Those in attendance shall include the Engineer and a Contractor's representative, who shall have authority greater than, or equal to, an overall job superintendent.

1.12 CLEAN UP

The Contractor shall maintain, and keep clean all areas in which he is working, storing equipment or materials, testing, etc. Equipment machinery, materials, tools, etc. must be stored so as not to interfere with the public, create hazardous conditions, damage property, etc. The Contractor is

responsible to obtain permission from any private property owner affected by the Contractor's operations.

1.13 SUBSURFACE CONDITIONS

Contractors are advised to perform their own subsurface investigation at their own expense, prior to beginning construction. Prior to excavation, drilling, boring, etc., all Contractors must obtain approval from the proper regulatory agencies having jurisdiction, including, but not limited to, the Authority, Warminster Township and the Pennsylvania Department of Transportation. All utility companies must be notified prior to commencing the subsurface investigation. All utilities, structures, obstructions, etc. which may interfere with and/or hinder the Contractor's performance of the work are to be reported to the Authority. Any damage to public and/or private property resulting from subsurface investigation work performed by the Contractor must be repaired in a manner acceptable to the Authority, at the sole expense of the party causing such damage.

The determination of all subsurface conditions, including, but not limited to, the existence, location and quantities of rock, as well as any utilities, shall be the sole and exclusive responsibility of the Contractor, by and through those means of investigation as shall be selected solely by the Contractor. Any utilities, structures, obstructions or other conditions which may interfere with the Contractor's work or require a change of design from that shown on the Drawings, shall be reported to the Engineer before proceeding with the construction.

1.14 RIGHTS-OF-WAYS/EASEMENTS

All work to be performed in rights-of-way and/or easements must be performed and confined by the Contractor, to within the legal rights-of-way and/or easements and, if applicable, the temporary construction easements. Complete restoration of all areas must be made by the Contractor, in accordance with the Drawings and Specifications.

If areas outside the rights-of-way and/or easements are damaged by the Contractor, they must be repaired, to the original condition, at the Contractor's expense.

If all lands and rights-of-way are not obtained, as contemplated by the Drawings, before construction begins, Contractor shall begin the work upon such land and rights-of-way previously acquired.

1.15 SERVICES AND FACILITIES

The Contractor shall be responsible for providing all services and facilities, as required for the work specified and shown on the Drawings. The services and facilities are, but not limited to, workmen's quarters, drinking water, sanitary facilities, electric power, and parking for all equipment and vehicles. All temporary services and facilities shall be maintained by the Contractor, and shall be removed by the Contractor at the completion of the work.

1.16 WORKING CONDITIONS

No work shall be performed by the Contractor on Saturdays, Sundays, Holidays or at night, except with the written permission of the Engineer.

Work shall not be performed when, in the opinion of the Engineer, the weather is unsuitable for good and careful work to be performed. If the severity of the weather continues such that the work cannot be performed successfully, the Contractor, upon order of the Authority or Engineer shall cease all such work until directed to resume the same.

1.17 MOBILIZATION

This work includes, but is not limited to, the establishing of field office, shops, storage areas, sanitary facilities, moving all construction equipment, material, tools, etc. to and from the project sites and any other facility required to complete the project. This work shall also include obtaining all required permits, insurances, bonds, and all other items required for the start of the work.

1.18 MAINTENANCE AND PROTECTION OF TRAFFIC

The Contractor is responsible for the maintenance and protection of all traffic adjacent to, and within, the construction area. Traffic control on all State highways and Township roads shall be maintained and protected, as per PennDOT Publication 203, and Section 901 of PennDOT Publication 408.

The Contractor shall not close and/or detour any road or street without obtaining the written permission of the Authority, Warminster Township, and all applicable regulatory agencies. The Contractor shall obtain all required permits, and shall be responsible for all costs associated with the closing of roads and/or the detouring of traffic. Additionally, the Contractor must notify the news media, police department, emergency services, and affected school districts prior to setting up a detour.

The Contractor will not be permitted to start construction within any roadway until all signs, barriers, etc., as required, are in place.

1.19 CONTRACTOR'S QUALIFICATIONS

When required by the Authority, the Contractor shall furnish, prior to beginning construction, a completed Qualification Statement with other information deemed necessary by the Engineer to evaluate the experience and qualifications of the Contractor to perform the work contemplated by the Drawings. The Contractor shall provide written resumes of the principals and key personnel such as foremen, and at least ten (10) references including owners, engineers and/or other contractors for whom the Contractor has worked for in the past three (3) years.

The Authority reserves the right to determine in its sole judgment if a Contractor is inexperienced or unable for any reason to execute the work according to the best practice in the industry and to the complete satisfaction of the Authority and the Engineer.

1.20 SUBCONTRACTORS

The Contractor shall provide to the Authority the name, address and telephone number of each subcontractor to work on this project. Prior to beginning construction, the Contractor shall also provide, in writing, the name and telephone number of at least five references for each subcontractor. References shall include owners, engineers and/or other contractors for whom the subcontractor has worked for in the past three (3) years. Further, the Contractor shall provide any additional information deemed necessary by the Engineer for the evaluation of the qualifications of proposed subcontractors.

The Contractor shall not employ any subcontractor that the Authority or Engineer may, within a reasonable time, object to as incompetent or unfit. The Contractor acknowledges and agrees that he is as fully responsible for the acts and omissions of persons directly employed by him.

1.21 EMERGENCIES

The Contractor shall provide a minimum of two competent and reliable persons who are delegated to be readily available on a 24-hour basis, and have full authority to act on behalf of the Contractor, in case it is necessary to deal with any emergency situations which may arise in connection with the project during non-working hours, weekends, evenings, and holidays.

1.22 PENNDOT HIGHWAY OCCUPANCY PERMITS

The Warminster Municipal Authority will procure the Pennsylvania Department of Transportation Highway Occupancy Permit required for the work. The Contractor will be expected to observe all requirements of this permit. All work within State highways and rights-of-way is subject to inspection by representatives of the Pennsylvania Department of Transportation. All costs of PennDOT inspection are the responsibility of the Contractor. Any additional or corrective work required by PennDOT, as a result of their inspection, shall be performed by the Contractor. The Contractor must notify the Engineer, in writing, a minimum of 21 days prior to any paving work to be performed in a State Highway.

1.23 PRE-CONSTRUCTION MEETING

A pre-construction meeting, conducted by the Engineer, shall be held prior to the start of construction. The date, time, and place of the pre-construction meeting shall be selected by the Engineer. Attendance at the pre-construction meeting by the Contractor and all of his subcontractors (if applicable) is mandatory.

1.24 CONTRACTOR REGISTRATION

Prior to beginning construction, the Contractor and any subcontractor(s) must register with the municipality(ies) where the project site is located. For projects located in Warminster Township, the Contractor shall contact the following:

Warminster Department of Licenses & Inspection
910 West Bristol Road
Warminster, PA 18974
Phone 215-443-5423

1.25 DEFINITIONS

- A. “Authority” shall mean Warminster Municipal Authority, or the Warminster Township Municipal Authority.
- B. “Engineer” shall mean the Authority=s consulting engineer, Staff Engineer or such other engineer as the Authority may specify.
- C. “Contractor” shall mean any person, partnership, firm or corporation performing work within the service area of the Authority.
- D. “Drawings” shall mean the Final Site Plan(s) which show the nature and scope of the work to be performed, and the Standard Details or Detail Drawings.
- E. “Final Site Plans” shall mean the final stamped plans which have been approved by the Authority for development and improvement of the Tract.
- F. “Project” shall mean development and improvement of the Tract in accordance with the Final Site Plans.
- G. “Tract” shall mean the real estate parcel(s) to be developed and improved in accordance with the Final Site Plans.
- H. “Specifications” shall mean the technical standards which may be amended from time to time without notice that are required by the Authority for the performance of work on the Tract, known as the Project.
- I. “Standard Details” shall mean the detailed drawings attached to and which are part of the Specifications issued by the Authority.
- J. “Detail Drawings” shall mean any drawings, diagrams or illustrations which portray some portion(s) of the work and are either part of the Final Site Plans or issued by the Engineer to clarify, interpret or order minor changes in the work.
- K. “Work” shall mean and all obligations, duties and responsibilities necessary to the completion of the Project undertaken by a Contractor, including, but not limited to, the construction of additions and extensions to the water distribution and sanitary sewage collection systems of the Authority, and the construction, repair, replacement or alteration of Tract Water and Sewer Facilities.

- L. “Tract Water and Sewer Facilities” shall mean water and sanitary sewer pipelines and appurtenances including, but not limited to, distribution mains, service lines, gravity sewers, laterals, connections and all other facilities located under or on private property not dedicated or to be dedicated to Warminster Township, Ivyland Borough or to the Authority, and within roadbeds, rights-of-way or easements dedicated or to be dedicated to Warminster Township, Ivyland Borough or to the Authority.

SECTION II - MATERIALS

2.01 PIPE AND APPURTENANCE MATERIAL SPECIFICATION

A. GENERAL

1. This section lists and describes all piping, fittings valves, structures and other material required for construction of water distribution and sanitary sewer mains, laterals, service facilities and appurtenances. All materials shall be new, of an approved manufacturer, in accordance with these Specifications, unless specifically noted otherwise.
2. All piping, fittings, valves, structures and other materials, as indicated on the Drawings and described herein, shall be furnished by the Contractor.

B. RELATED WORK SPECIFIED ELSEWHERE INCLUDES:

Refer to: Section IV - Installation of Water and Sewer Pipe and Appurtenances.

C. REFERENCE STANDARDS

All reference standards shall be current editions, unless otherwise noted.

2.02 BURIED WATER MAINS

A. PIPE AND FITTINGS

All buried water mains shall be ductile iron pipe, in the required sizes, as indicated on the Drawings. Pipe barrel shall conform to ANSI A21.51/AWWA C151. All pipe shall be gasketed, push-on type and/or mechanical joints, but, in special circumstances, flanged pipe and fittings may be utilized, if approved by the Engineer. Mechanical joint/push-on joint pipe shall be thickness Class 52, with a 350 psi maximum working pressure, as per ANSI A21.51/AWWA C151. Flanged joint pipe shall be as specified below.

All buried pipe and fittings shall be bituminous coated, cement mortar lined (double thickness per ANSI A21.4/AWWA C-104).

Mechanical Joint/push-on joint ductile iron pipe and mechanical joint fittings shall conform to the following standards:

ANSI A21.51/AWWA C151 - Ductile Iron Pipe (Class 52)

ANSI A21.11/AWWA C111 - Gasket-Type Joints

ANSI A21.10/AWWA C110 - Gray Iron and Ductile Iron Mechanical Joint Fittings

Flanged ductile iron pipe shall be thickness Class 53 with a 250 psi maximum working pressure and shall conform to ANSI A21.15/AWWA C115. Flanges shall be flat faced, Class 125, ANSI B16.1 and shall also conform to ANSI A21.15/AWWA C115. All flanged fittings shall be either ductile iron or gray iron having a working pressure rating which equals or exceeds that of the flanged pipe and shall conform to ANSI A21.10/AWWA C110 standards. Flanges shall be flat faced, Class 125, drilled to ANSI B16.1 standards.

Flanged joints shall be flat faced (raised face flanges shall not be used), gasketed and bolted, with all joint materials conforming to the requirements of Appendix A to ANSI A21.15/AWWA C115.

B. BURIED WATER MAIN APPURTENANCES

1. Buried Gate Valves. Gate valves shall be manufactured in full compliance with the content of this Specification and, in addition, they shall comply with the American Water Works Association Gate Valve Specification No. C-509-87 for Resilient Seated Gate Valves, or latest revision thereof. The valves shall have iron body construction. The valve interior shall be free of ledges, pockets, or other areas which can collect debris or sediment. The valve body and bonnet shall be fusion bonded epoxy coated on all interior and exterior surfaces. The interior epoxy coating shall be AWWA approved for potable water applications. The waterway area shall be unobstructed, and valve shall be capable of passing a full-size shell cutter. The gate shall be solid cast iron, with rubber coating permanently vulcanized on all exterior surfaces. The gate shall be made with low friction, non-abrasive thermoplastic inserts, in order to minimize wear on said valve's internal epoxy coating. The valve shall be provided with "O" ring stem seals and a lubricant reservoir for the purpose of lubricating the "O" rings and stem thrust collar when valve is operated. Stem seal design shall allow replacement of "O" ring seals while valve is in any position of service. The valve shall be the non-rising stem type, square nut-wrench operated, and shall open when operated in the counterclockwise direction. The gate valve shall have a 200 psi working pressure and shall be certified to pass a 500 cycle test at 200 psi unbalanced pressure without wearing away the interior epoxy coating to bare metal. Valve shall also seal after cycle test without leakage at the gate or the "O" ring stem seals.

Gate valves shall be furnished with mechanical joint end connections for buried installation, as indicated on the Contract Drawings. Valve extensions shall be provided as required based on the depth of the water main and valve

Gate valves shall be U.S. Pipe and Foundry Company Metroseal AWWA C-509 Resilient Seated Gate Valves. This is the only acceptable manufacturer and model for gate valves.

2. Valve Boxes. Valve boxes shall be cast iron and shall be installed at each buried gate valve. Boxes shall be sufficient length to provide a cover of not less than four (4) feet over the pipe. The minimum thickness of the metal of the box, at any point, shall be not less than 3/16 of an inch. The cover shall have cast thereon the word "Water". The cast iron valve box and cover shall be given a heavy coat of bituminous paint. Valve boxes shall be adjustable two-piece sliding-type with internal shaft diameter of 5 1/4 inches. Bell diameter of bottom section shall properly fit over the valve bonnet and be compatible with the various gate valve sizes designated on the Drawings. Screw type and three-piece valve boxes are unacceptable. Valve boxes shall be Bingham and Taylor or Opelika Foundry Figure No. 4908, Tyler Pipe 6855 Series or approved equal.

3. Hydrants. Fire hydrants shall be manufactured in full compliance with the American Water Works Association Fire Hydrant Specification 502 latest revision thereof, and in addition shall comply with the following supplementary requirements:
 - a) Type: Compression - Dry Standpipe: Valve shall open against, and close with, the pressure. The design shall be such that all internal operating parts can be removed through the standpipe and the standpipe and main valve rod extended without excavating.
 - b) Size: Diameter of main valve opening shall be at least 5 1/4".
 - c) Inlet Size and Type: Six (6") inch mechanical joint inlet, with restraining lugs on the ductile iron base.
 - d) Hose Nozzles: Each hydrant shall be equipped with two 2 1/2 inch I.D. hose nozzles with National Standard thread connections. Nozzle caps shall be fitted with rubber gaskets and rustproof keeper chains to affix the cap to standpipe when the cap is unscrewed from nozzle.
 - e) Pumper Nozzle: Each hydrant shall be equipped with one 4 1/2 inch I.D. Pumper Nozzle National Standard Thread.
 - f) Direction to Open: Left, counter-clockwise.
 - g) Size and Shape of Operating Nut and Nozzle Cap Nuts: Pentagonal 1 1/2" point to flat.
 - h) Seal Plate: The hydrant "O" ring type seal plate shall be so constructed that a moisture-proof lubricant chamber is provided which encloses the operating threads, thereby automatically lubricating the threads and bearing surfaces each time the hydrant is operated. The seal plate assembly shall be fitted with at least three "O" rings. The two lower "O" rings shall serve as pressure seals; the third "O" ring as a combined dirt and moisture seal to

prevent foreign matter from entering the lubricant chamber. The “O” rings shall be Precision Rubber Products Corporation Compound No. 122-70 or approved equal. The lubricant shall be as approved by the hydrant manufacturer. Temperature rating minus 50 degrees to plus 250 degrees Fahrenheit.

- i) Standpipe Ground Line Safety Construction: The standpipe sections shall be connected at the ground line by two-part safety flange. The main valve rod sections shall be connected at the ground line by a frangible coupling. The standpipe and ground line safety construction shall be such that the hydrant nozzles can be rotated to any desired position without disassembling and removing the top operating components and the top section of the hydrant standpipe. The minimum inside diameter of the standpipe shall be seven (7) inches.
- j) Main Valve Rod Assembly: The steel rods shall be square in section, and all operating parts shall be removable through the standpipe, regardless of the depth of bury using removal wrench (weighing not more than 10 lbs.), which engages the square rod at the top flange of the hydrant standpipe. The main valve seat ring shall be of bronze, and its assembly in the hydrant shall involve bronze-to-bronze thread engagement (bronze-to-iron thread engagement not acceptable), and the valve assembly pressure seals shall be obtained without the employment of torque compressed gaskets. The design of the main valve rod shall be such that the operating thread at the top of the rod and the valve assembly thread at the bottom of the rod are isolated from contact with water in the standpipe or in the hydrant inlet shoe. In addition, the engagement between the bottom of the rod and the main valve top plate shall not involve dissimilar metal (bronze-to-iron engagement is not acceptable). In addition, there shall be no drilled holes, pins or bolts passing through the main valve rod at any elevation below the ground line elevation.
- k) Valve Travel: The design and location of the travel stop shall be such that the main valve rod cannot be placed in compression and deformed if an attempt is made to over open the hydrant valve. (Travel stops located at the bottom of the hydrant are no acceptable).
- l) Drain Valve: The operation of the drain mechanism shall be correlated with the operation of the main valve, and shall involve a momentary flushing of the drain ports each time the hydrant is opened. The drain ports shall be fully closed when the hydrant valve is more than 2 1/2 turns open, and the drainage channel in the bronze seat ring shall connect to two or more threaded outlet drain ports. No springs may be employed in the hydrant valve or drain valve operating mechanism.
- m) Depth of Bury: Hydrant shall be suitable for installation in trenches 5 feet 0 inches deep, unless otherwise specified.

- n) Location and Distance from Water Main: The typical location of fire hydrant installations is shown on the Standard Details, and the general or approximate location of each proposed hydrant is shown on the construction drawings. The Engineer shall approve the exact location of each hydrant prior to the Contractor installing the hydrant tee in the main.
 - o) Coating(s): All external and internal surfaces of the ductile iron base shall be fusion bonded epoxy coated by the manufacturer. Additionally, the lower barrel below grade and internal surfaces of upper barrel (nozzle section) shall be coated with black asphaltic paint. The manufacturer shall apply a rust inhibitive primer paint to the exterior of the upper barrel. Exterior surfaces of the upper barrel shall be finish painted by the Contractor after installation of the hydrant(s). Two coats of weather resistant oil base enamel shall be field applied; the barrel shall be white and the color of the bonnet and nozzle caps shall be selected by the Authority.
 - p) Pressure Rating: Test Pressure 500 psi, working pressure 250 psi.
 - q) Replacement Parts and Tools: Extension sections shall be available from the manufacturer in kits to raise the hydrant upper barrel section without excavation, interrupting service, or discarding parts of the existing hydrant.

One traffic repair kit consisting of a breakaway coupling for the barrel and rod with fasteners and gaskets, and one disassembly tool kit from the manufacturer, shall be supplied to the Authority by the Contractor.
 - r) Approved Models: Hydrants shall be only Metropolitan 250, Model 94, as manufactured by United States Pipe and Foundry Company.
 - s) Fire Hydrant Tees: Tees shall be valve and anchoring-type tee, as manufactured by United States Pipe and Foundry Company, Burlington, New Jersey.
4. Pipe Insulation. At locations shown on the construction drawings or where specified by the Engineer, the insulating material to be used in insulating the water main pipe shall consist of a hydrophobic mineral powder manufactured by Dri Therm, Inc. (1-800-343-4188) or Engineer approved equal. Installation shall be in accordance with manufacturer=s recommendations, the Detail Drawings and these Specifications.
 5. Transition Couplings. Transition couplings shall be provided in the locations indicated on the Drawings for the purpose of joining plain-end piping with dissimilar outside diameters by compression of a ring gasket at each end of the adjoining pipe sections.

The coupling shall consist of one center sleeve flared or beveled at each end to provide a gasket seat; two end rings; two resilient tapered rubber gaskets; and bolts and nuts to draw the end rings toward each other to compress the gaskets. The center sleeve and the end rings shall be true circular sections free from irregularities, flat spots, and surface defects; the design shall be such as to provide for confinement and compression of the gaskets. For ductile iron piping, the center sleeve and end rings shall be of ductile iron. Both center sleeves and end rings shall be coated with a factory applied epoxy. Ductile iron shall conform to ASTM A536-80. Gaskets shall be SBR rubber per ASTM D2000-80M 4 AA 809, and shall have size and end ring color code embossed for easy identification, and shall meet the applicable requirements specified for gaskets for mechanical joints in ANSI A21.AA/AWWA C111. Bolts and nuts shall be stainless steel. Bolt holes in end rings shall be of a shape to hold fast the necks of the bolts used. Coupling shall be manufactured in accordance with AWWA C219-91.

The Contractor must verify the outside diameter of the plain-end piping, which is to be joined by means of the transition coupling prior to procuring said coupling, to insure the proper coupling connection range is provided, which will result in a drip-tight joint.

Transition coupling shall be Ford Bolted Flex Transition Coupling, Style FC2A-ESH, or Engineer approved equivalent.

6. Transition Sleeves. Solid ductile iron sleeves shall be provided when two plain-end cast iron or ductile iron pipes of same or similar O.D.'s must be joined. The sleeves shall be mechanical joint ends, and be of the diameter required.
7. Corporation Stops. Brass corporation stops will be provided for service connections to the ductile iron water mains in the locations, as indicated on the Contract Drawings, or as directed by the Engineer. Corporation stops shall be designed and manufactured to conform with AWWA Standard C800-84. The corporation stops shall have a 100 psi working pressure, and shall be individually inspected and tested for leaks by air pressure underwater. Corporation stops shall have AWWA/cc taper thread inlet by flare copper outlet. Buried corporation stops for 1/2 inch and 1 inch diameter services shall be Ford F600 with No. L04 quarter bend having female copper thread inlet with pack joint (CTS) outlet, or Mueller equivalent.

For 1-1/2 inch and 2 inch services, a stainless steel band and epoxy coated ductile iron service saddle with AWWA/cc taper thread outlet shall be supplied for mounting on the water main: Service saddles shall be Ford Style FC 202, Smith-Blair Style 317, or Mueller equivalent. Brass corporation stops (1-1/2 and 2 inch) shall be Ford FB 600 Ballcorp, with No. L04 quarter bend same as specified for 3/4 inch and 1 inch services, or Mueller equivalent.

8. Couplings. Couplings shall be Ford C44 pack joint (CTS), three-part compression type.

9. Copper Tubing. All copper tubing shall conform to ASTM Specifications B-88, Type K, for seamless copper water tube. Service lines, from corporation stop to curb stop, and from curb stop to meter, must be one continuous copper line without joints.
10. HDPE Tubing. All HDPE tubing for water services shall conform to ANSI/AWWA C901-08 for pressure pipe and tubing between ½ In. through 3 In. for water service. HDPE tubing shall only be used from the meter pit into the dwelling/ building.
11. Meter Pits. All new water services must be provided with an exterior meter pit. The meter pit shall be located beyond the curb line, or right-of-way line, with the final location approved by the authority. The meter pit shall conform to the requirements set forth on the detail drawings.
12. Curb Stop. Curb stops for : and 1 inch shall be Mueller, Ford, inverted key style with pack-joint (CTS) compression type ends, or approved equal. Curb stops for 1½ and 2 inch services shall be Mueller, Ford, ball valve curb stop with pack-joint (CTS) ends, or approved equal.
13. Curb Boxes. Curb boxes shall be cast iron Bingham and Taylor or Opelika Foundry Figure No. 4901-B, buffalo type, 2 1/2 inch shaft or approved equal. The lids shall be recessed in the top section and shall be marked "Water". The boxes and lids shall be coated with bituminous paint. Curb box shall be furnished with brass pentagonal head screw to fasten the lid to the upper box section. Curb boxes shall be adjustable screw type extending to 48 inch maximum cover on the service pipe. An enlarged base Figure No. 4980 shall be supplied for 1 1/2 and 2 inch services.
14. Service Pipe. Between all corporation stops and curb stops, there shall be installed copper service pipe, Type K soft temper conforming to ASTM Specifications B-88, having the same diameter as the stop, suitable for underground service. A minimum cover of four (4) feet shall be maintained. The service line for single-family dwelling units shall be a minimum ¾" size copper tube. Only compression type joints shall be used for buried service piping and components.
15. Steel Casings. Steel casing pipe shall be used for protection of water pipe in tunnels and borings under railroad tracks, most State highways, limited access roads and other locations as required. The Contractor shall be responsible for securing all occupancy permits and pay such fees required for said occupancy.

2.03 BURIED SANITARY SEWER MAINS

A. PIPE AND FITTINGS

All buried sanitary sewer mains and laterals shall be ductile iron pipe, or PVC pipe, in the required sizes, as indicated on the Drawings. For DIP pipe, pipe barrel shall conform to ANSI A21.51/AWWA C151. All pipe shall be gasketed, push-on type and/or mechanical

joints, and all fittings must be mechanical joint, but, in special circumstances, flanged pipe and fittings may be utilized, if approved by the Engineer. Mechanical joint/push-on joint pipe shall be thickness Class 50 for sewer mains and laterals. Class 50 pipe shall have a 350 psi maximum working pressure, as per A21.51/AWWA C151. Flanged joint pipe shall be as specified below.

Polyvinyl chloride (PVC) plastic pipe and fittings shall conform to ASTM D-3034, latest revision. The standard dimension ratio (SDR) of all pipe and fittings shall not exceed 26. Push-on type gasketed joints shall conform to ASTM D-3212 for flexible elastomeric seals (gaskets) for joining plastic pipe. All PVC sewer pipe shall be manufactured with integral bell and elastomeric seal joint, and smooth inside pipe wall surface.

All buried DIP sewer pipe and fittings shall be "Protecto 401" ceramic epoxy lined, nominal dry film thickness of 40 mils, as manufactured by U.S. Pipe, or Engineer approved equal.

Mechanical Joint/push-on joint ductile iron pipe and mechanical joint fittings shall conform to the following standards:

ANSI A21.51/AWWA C151 - Ductile Iron Pipe (Class 50)

ANSI A21.11/AWWA C111 - Gasket-Type Joints

ANSI A21.10/AWWA C110 - Gray Iron and Ductile Iron Mechanical Joint Fittings

Flanged ductile iron pipe shall be thickness Class 53 with a 250 psi maximum working pressure and shall conform to ANSI A21.15/AWWA C115. Flanges shall be flat faced, Class 125, ANSI B16.1 and shall also conform to ANSI A21.15/AWWA C115. All flanged fittings shall be either ductile iron or gray iron having a working pressure rating which equals or exceeds that of the flanged pipe and shall conform to ANSI A21.10/AWWA C110 standards. Flanges shall be flat faced, Class 125, drilled to ANSI B16.1 standards.

Flanged joints shall be flat faced (raised face flanges shall not be used), gasketed and bolted, with all joint materials conforming to the requirements of Appendix A to ANSI A21.15/AWWA C115.

B. PRECAST CONCRETE MANHOLES

1. General. Precast concrete manholes shall be as manufactured by Atlantic Concrete Products, Inc., Tullytown, Pennsylvania, or Engineer approved equal. The design and manufacture of precast manholes shall conform to the requirements of ASTM C-478, latest revision, for Precast Reinforced Concrete Manhole Sections. Manhole shall have an internal diameter of 48 inches unless noted otherwise in the Specifications and/or on the Construction Plans. The top section shall be an eccentric cone type with a 24 inch opening for mounting a round casting.

The precast bases, risers, and top sections shall be reinforced with steel as required in ASTM C-478, latest revision, with a minimum yield strength of 60,000 psi. Concrete strength shall be 4,000 psi minimum in 28 days. Top slabs for shallow manholes less than 5 feet deep shall be designed to withstand AASHTO HS-20 load conditions.

The entire exterior surface of precast concrete manholes shall be coated with 2 coats of bitumastic, Carboline Super Service Black or equal, applied as recommended by the manufacturer.

2. Joints of manhole sections shall be sealed with two (2) rows of ASTM C-990 preformed butyl rubber sealant similar and equal to ARam-Nek® as manufactured by K.T. Snyder Company, Inc. or AMas-Stik® as manufactured by Concrete Products Supply Co.
3. Manhole steps shall be installed at 12" intervals and shall be aluminum 6061-T6 alloy, drop front, safe tread as manufactured by Alcoa (No. 16829). Provide plastic inserts cast integrally in the concrete wall, to secure steps in uniform alignment and projection, and to prevent corrosion of aluminum in contact with concrete.
4. Pipe connections to new manholes shall be made with a rubber gasket seal, cast integrally in the precast concrete manhole wall, meeting ASTM C923 specifications for resilient connectors, as manufactured by A-Lok Products, Inc. or Dura-Seal III by Dura-Tech. The flexible rubber connectors between precast reinforced concrete manhole walls and pipes shall be properly mated for the size of pipe and located as required. No concrete or mortar may be placed around the connector on the outside or inside of the manhole.
5. All openings for lifting precast concrete manhole sections shall be filled with non-shrink, non-metallic grout, prior to backfilling.
6. Inserts for the purpose of anchoring the cast iron frame and cover to the conical section or flat top slab shall be cast into the structure.
7. Pipe Connections to poured-in-place concrete manhole bases (doghouse manholes) shall be made with an approved gasket type waterstop, of elastomeric polyvinyl chloride, as manufactured by Fernco, CMA concrete manhole adapter or approved equal.
8. Pipe connections to existing manholes shall be made by core-boring only, sealed with a mechanical compression ring of rubber links, Link-Seal as manufactured by Thunderline Corporation or approved equal.
9. Precast manholes shall be manufactured with shop formed and finished channels. Inverts and channel contours shall be poured at the precast plant using precision

forms to meet the specific requirements of the particular manhole design. Channels and benches shall be made of plain non-reinforced 4,000 psi concrete. Depth of channel shall be three-quarters (3/4) of the nominal pipe diameter. Channels shall be sloped a minimum of 0.10 foot from the influent side to the effluent side of the manhole to assure adequate flow velocity to carry solids, without deposition. Benches shall be sloped toward the channel(s) and have a skid resistant finish.

10. When drop manholes are required, the drop shall be an outside drop.

C. MANHOLE FRAMES AND COVERS

1. Casting shall be of uniform quality, free from blow holes, porosity, hard spots, shrinkage, defects, cracks, or other injurious defects. They shall be smooth and well cleaned by shot blasting, unless otherwise specified. Castings shall be designed for AASHTO Highway Loading Class HS-20.
2. Material used in the manufacture of the castings shall conform to ASTM Specification A-48, Class 35. A notarized certificate shall be submitted if required by the Engineer, verifying the minimum tensile strength of the casting of 35,000 psi.
3. All castings shall be manufactured true to pattern and with a close fit of component parts. Round frames and covers shall be of non-rocking design and with machined bearing surfaces so that fitting parts will not rock.
4. The flange of all manhole frames shall have four 1" diameter holes spaced 90 degrees apart for bolting the frames to the precast cone section of the manhole.
5. All covers shall have "SANITARY SEWER" cast thereon in two inch letters.
6. Standard Manhole frames and covers shall have self-sealing lids with concealed pickholes. They shall be similar and equal to Neenah Foundry Company; Model R-1642 with depressed square pocket (Type 'B') pattern lid, for all manholes located in roads, streets, driveways, parking lots and other ground surfaces not prone to flooding.
7. Watertight frames and covers shall have self-sealing lids with concealed pickholes. The lids are to be bolted to the frame with at least four 1/2" diameter stainless steel bolts. They shall be similar and equal to Neenah Foundry Company; Model R-1916-F.

2.04 CONCRETE

A. GENERAL

1. All concrete shall conform to the Commonwealth of Pennsylvania Department of Transportation Specification Section 704 Form 408 for Class A or Class C cement concrete. All concrete shall be Class A, unless otherwise indicated in these specifications and/or the Contract or Detail Drawings. Concrete shall be both watertight and chemical resistant. Class A concrete shall have a minimum compression strength of 3,300 psi at 28 days. Class C concrete shall have a minimum comprehensive strength of 2,000 psi at 28 days.
2. The maximum allowable slump for all concrete shall be 4 inches. Slump determination shall be in accordance with ASTM C-143.
3. All concrete shall be plant mixed and air-entrained (+/- 5.5% +/- 1.5% air-entrainment).

B. MIX PLANT

Ready-mix concrete only shall be used in the work. The Contractor shall select an experienced ready-mix plant in the community that has experience in dealing with controlled concrete mixes. Authorized representatives of the laboratory shall certify, in writing, to the Engineer the controlled concrete mixes to the project. All concrete shall be transported to the site by truck mixers. Failure to make prompt, scheduled deliveries of concrete during scheduled pours may, at any time, be cause for rejection of the plant as a concrete supplier by the Engineer.

C. TESTS DURING CONSTRUCTION

1. The exact proportions of material used in the work, as it proceeds, shall be subject to the approval of the Engineer, and shall not be changed without his approval. The Contractor shall make tests of the consistency of the concrete from time to time during the progress of the work and shall make standard test cylinders of the concrete being incorporated into the work. The Contractor shall furnish the necessary labor and materials for making these tests, and shall be responsible for storing test cylinders and delivering same to an approved testing laboratory. Laboratory costs shall be borne by the Contractor.
2. A standard sample shall consist of four test cylinders obtained by the wheelbarrow from a single truckload. Two cylinders will normally be broken at 7 days and the remaining two will be broken at 28 days. Concrete shall normally be sampled at the frequency of one sample per 10 yards of concrete.

During any day when 6 yards or more of concrete are poured, a minimum of one standard sample shall be taken. If tests do not show satisfactory results, the mix

shall be adjusted as directed. Concrete which does not meet the strength requirements is subject to rejection and removal from the work, at the expense of the Contractor.

3. Test cylinders shall be made, stored, and cured in accordance with AStandard Methods of Making and Curing Compression and Flexure Test Specimens in the Field, AASTM Designation C-31, latest revision. The Contractor shall furnish suitable waxed paper cylinder forms, and shall store and cure the cylinders under the supervision of the Engineer. Compression tests of cylinders shall conform to “Test for Compressive Strength of Moulded Concrete Cylinders,” ASTM Designation C-39, latest revision. Consistency of concrete shall be tested in accordance with “Slump Test for Consistency of Portland Cement Concrete,” ASTM Designation C-143, latest revision. The cost of all testing work shall be borne by the Contractor. Copies of certified test results shall be submitted in duplicate to the Engineer by the testing laboratory.

2.05 GROUT

Grout, as shown on the Contract Drawings, shall be the non-metallic type, and shall be mixed in the proportion of one part cement to three parts sand by volume. Non-shrink grout shall be Embecco, Master Builders, SIKA, or Engineer Approved equivalent.

2.06 CRUSHED STONE BACKFILL AND BEDDING

All crushed stone backfill and bedding shall conform to the grading and quality as specified in Section 703 of the Commonwealth of Pennsylvania Department of Transportation Specifications Form 408 for No. 2A modified aggregate.

2.07 MISCELLANEOUS METALS

A. GENERAL

1. Description
 - a) Items required by the Contract Drawings, but not specifically noted herein, shall be furnished and installed as if so noted, and shall conform in quality and workmanship to similar items which are described hereafter.
 - b) The other sections of the Specifications and Contract Drawings shall be referred to for specific locations, quantities, materials and types of miscellaneous metal items covered under their section.
2. Submittals. Shop drawings shall be submitted in accordance with Section 1.08 of these Specifications.

3. Field Measurements. Check all critical fit dimensions in the field for the accurate installation of the work.
4. Storage. Store all items covered by this section above the ground on platforms or other supports and protect from weather with suitable covering. The Contractor shall not permit the ponding or collecting of moisture or water on the stored items.

B. MATERIALS

1. Structural steel shapes, plates, and bars shall conform to ASTM A36, AWWA D100.
2. Aluminum alloys shall be 6061-T6 for all rolled sections, plate, pipes, and all bolts and screws. The aluminum alloy shall conform to the standards established by the Aluminum Association for the above-referenced grade of aluminum.
3. Stainless steel shall conform to the following:
 - a) Type 316 (18-8) general for sheets, angles, and plates.
 - b) Type 316 for all nuts, bolts, and washers.
4. Low carbon steel, standard threaded fasteners shall conform to ASTM A307. High-strength steel bolts, nuts, and washers shall conform to ASTM A325.
5. Electrodes for welding structural steel conform to E-70 Series of American Welding Society (AWS) A5.1. Welding shall comply with the requirements of American Welding Society.
6. Electrodes for welding aluminum shall conform to AWS A5.10. Welding shall comply with requirements of American Welding Society and the Aluminum Association.
7. Electrodes for welding Type 316 stainless steel shall comply with the requirements of the American Welding Society.
8. Machined elements, parts, and other metals shall be appropriate for the use intended, and subject to the approval of the Engineer.
9. Materials specifically mentioned and/or specified for items and use under each individual heading and/or section shall take precedence over requirements in this Section.

C. FIELD ALTERATIONS

Field alterations, such as field cutting or drilling of structural members or grating covers, will be permitted only with the express approval of the Engineer.

D. ITEMS EMBEDDED IN CONCRETE OR MASONRY

1. Furnish stainless steel sleeves, anchor bolts, edge angles, inserts, and masonry anchors required for attaching miscellaneous metals to concrete and masonry.
2. Anchor bolt size and location shall be as shown on the Contract Drawings. In the instance that anchor bolts information is not indicated on the Contract Drawings, the Contractor shall reference the various certified equipment shop drawings for anchor machinery and equipment.

2.08 BITUMINOUS CONCRETE PAVEMENT

A. PAVEMENT

All material and construction used in the repair and/or placement of street paving shall conform to PennDOT Publication 408, 1990 edition, as follows.

1. Aggregate Base. Shall conform to the requirements specified in PennDOT Publication 408, Section 350.02.
2. Bituminous Concrete Base Course. The materials, composition of mixture, and methods used to construct the bituminous concrete base course shall conform to applicable requirements specified in PennDOT Publications 408, Section 305, for Bituminous Concrete Base Course, except that the bituminous material used in the mixture is limited to asphalt cement, Class AC-20.
3. Bituminous Concrete Binder Course ID-2. The materials, composition of mixture, and methods used to construct the bituminous concrete binder course shall conform to the applicable requirements specified in PennDOT Publication 408, Section 421, for Bituminous Binder Course ID-2. The bituminous material shall be asphalt cement, Class AC-20.
4. Bituminous Tack Coat. Shall be bituminous material conforming to PennDOT Publication 408, Section 460.2.
5. Bituminous Concrete Wearing Course ID-2. The materials, composition of mixture, and methods used to construct the bituminous concrete surfaces course shall conform to the applicable requirements specified in PennDOT Publication 408, Section 420, for Bituminous Wearing Course ID-2.
6. Bituminous Joint Seal AC-20 Asphalt Cement. Shall conform to PennDOT Bulletin No. 25, Specifications for Bituminous Materials.
7. PA 2A Modified Coarse Aggregate and Select Granular Material. Shall conform to the grading requirements specified in PennDOT Publication 408, Section 703.2

for 2A coarse aggregate. The PA2A crushed stone shall be made from stone meeting the quality requirements for Type C stone aggregate, as specified in PennDOT Publication 408, Section 703.2. Samples of this crushed stone shall be submitted to the Engineer for approval, and none shall be used until such approval is obtained. Select granular material shall conform to PennDOT Publication 408, Section 703.3.

8. E-1A Emulsified Asphalt. Shall be bituminous material conforming to PennDOT Specifications for Bituminous Materials - Bulletin No. 25.

B. BATCH PLANT

Plant batched bituminous concrete only shall be used. The Contractor shall select an experienced asphalt batch plant in the community that has experience in controlled asphalt batching. Bituminous concrete shall be delivered to the site by truck. Failure to make prompt, scheduled deliveries of bituminous concrete during scheduled pavement placement may, at any time, be cause for rejection of the plant as a bituminous concrete supplier by the Engineer.

C. PAVEMENT MARKING

Material methods utilized for pavement painting shall conform to Section 962 of PennDOT Publication 408 for conventional traffic paint (Type 1). Paint shall be mixed with glass beads to provide a reflectorized surface at a rate of 6 pounds/gallon of paint.

2.09 WATER SERVICE FACILITIES

A. GENERAL

This section prescribes the materials required for construction of water service facilities, including pipe, fittings, valves, meter pits and vaults, for the purpose of supplying water to any customer of the Authority.

B. DOMESTIC SERVICE

All Materials used to construct water service lines shall confirm to NSF Standard 61 and only including the following:

1. Copper tube, seamless Type K, as specified in Section 2.02 shall be used for domestic service lines 3/4, 1, 1 1/2, and 2 inch diameter.
2. Ductile iron pipe, Class 52, and fittings, as specified in Section 2.02 shall be used for domestic service lines 3 inches diameter and larger.

3. Corporation stops, curb stops and couplings used in copper service lines shall be Ford Meter Company brass conforming to AWWA Standard C-800-89 or latest revision thereof, ASTM B-62, and the catalog numbers listed in Section 2.02.
4. HDPE Tubing. All HDPE tubing for water services shall conform to ANSI/AWWA C901-08 for pressure pipe and tubing between ½ In. through 3 In. for water service. HDPE tubing shall only be used from the meter pit into the dwelling/ building.
5. Meter Pit. An exterior meter pit shall be required on all new water services. When the meter pit incorporates a shut off valve for the service, a curb stop will not be required.

Abandonment of Water Service. When a water service is abandoned, the water service shall be removed all the way to the water main. A plug shall be used to seal the main. The plug shall be a A.Y. McDonald, 74754-22 PLUG, or approved equivalent. Any abandonment of a water service shall be done in the presence of WMA personnel, or their designated representative.

C. FIRE PROTECTION (SPRINKLER) SERVICE

Materials used to construct water service lines for supply fire protection and/or fire sprinkler systems shall conform to NSF Standard 61 and the standards specified above for Domestic Service.

D. METER PITS AND VAULTS

1. General. Where required by the Authority, meter pits and vaults shall be furnished by the Contractor in accordance with these Specifications and the Detail Drawings. All materials and components shall be new and produced by the manufacturer specified, or equal approved by the Authority Engineer. The Contractor is responsible to furnish to the Authority Engineer for approval, shop drawings, catalog cuts and submittals for all materials, including but not necessarily limited to, the pit or vault structure, access covers and doors, pipe, fittings, valves, meter setters, and appurtenances. The submission of shop drawings and catalog cuts for review and approval by the Authority Engineer shall occur prior to the Contractor ordering material(s) from the manufacturer or vendor.
2. Preassembled Pits and Vaults. In order to maintain a standard of quality and ensure uniformity of meter pit and vault installations within the Authority=s service area, preassembled or factory assembled pits and vaults, complete with all piping, meter setters and appurtenances, ready to install in the ground, are preferred and should be furnished by the Contractor to minimize field labor and inspection time. If the Contractor chooses to purchase the pit or vault and then assemble the piping on the project site (field assemble), all materials and workmanship shall be similar and equal to that of preassembled or factory assembled units. The materials and

specific details for assembly of meter pits and vaults, as indicated on the Detail Drawings, apply to both preassembled and field assembled installations.

Note: All meter pits and vaults shall be installed by the Contractor less the meter(s). Meters will be supplied and installed by the Authority.

3. Approved Manufacturers. Meter pits and vaults produced by the following manufacturers are pre-approved for compliance with these Specifications and the Detail Drawings.
 - a) For services sizes 2 inches diameter and smaller, plastic pit settings shall be as manufactured by the Ford Meter Box Company, YA McDonald, or engineer approved equal.
 - b) For all service sizes larger than 2 inches diameter, precast concrete meter pits or vaults shall be as manufactured by A.C. Miller Concrete Products Company of Spring City, Pennsylvania, or engineer approved equal.

E. BACKFLOW AND CROSS-CONNECTION PREVENTION

All water services for both residential and commercial shall be equipped with a double check back-flow device directly after the water meter. In the case of meter pits, the backflow device shall be in the meter pit. The detail drawings for the meter pits show the required backflow prevention device and specs the required model.

For water services within a house, a double check backflow device shall be installed after the meter. The meter assembly on in-coming water service shall consist of a ball valve, meter yoke, ball valve, and then the backflow device. The backflow device shall be a double check, sized the same as the water service, and be testable to meet the cross-connection requirements. The meter assembly shall be accessible to Authority personnel and be installed a maximum distance of 2 ft. from any wall. Backflow prevention device shall be manufactured by Watts, Zurn, or Authority approved equal.

2.10 SANITARY SEWER SERVICE FACILITIES

A. GENERAL

This section prescribes the materials required for construction of sanitary sewer service facilities, including pipe, fittings, and appurtenances for the purpose of conveying sewage and other wastes from any customer=s premise to the Authority=s collection system.

B. BUILDING SEWERS

Materials used to construct building sewers shall include only the following:

1. Ductile iron pipe, Class 50, and fittings as specified in Section 2.03.

2. Cast iron pipe and fittings, Service Weight (SV) and Extra Heavy (XH), conforming to ASTM A-74, latest revision, for hub and spigot type joints with compression rubber gaskets conforming to ASTM C-564, latest revision.
3. Polyvinyl chloride (PVC) plastic pipe and fittings conforming to ASTM D-3034, latest revision. The standard dimension ratio (SDR) of all pipe and fittings shall not exceed 26. Push-on type gasketed joints shall conform to ASTM D-3212 for flexible elastomeric seals (gaskets) for joining plastic pipe. All PVC sewer pipe shall be manufactured with integral bell and elastomeric seal joint, and smooth inside pipe wall surface.

Note: The Authority reserves the right to determine the type of pipe the Contractor must use to construct any Building Sewer, or any portion(s) thereof. The minimum size pipe used in any building sewer shall not be less than 4 inches nominal diameter.

C. MANHOLES

Building sewers 8 inches diameter or larger shall have manholes for cleanouts. All manholes in building sewers and wastewater sampling manholes shall be constructed to conform to Section 2.03 B and 2.03 C of these Specifications and the Standard Details.

D. PIPE COUPLINGS AND ADAPTERS

Couplings and O-ring adapters utilized for joining pipes of dissimilar materials, such as cast iron soil pipe to ductile iron pipe or cast iron to vitrified clay, and/or for making secure watertight connections between pipes of different nominal sizes, such as a 4 inch building sewer to a 6 inch lateral, shall be flexible elastomeric polyvinyl chloride (PVC) as manufactured by Fernco, Inc. or Engineer approval equal. Couplings shall be supplied with 316 stainless steel band clamps, fasteners and shear rings as applicable to the sizes and types of pipes to be connected together. Couplings and adapters shall conform to applicable parts of ASTM C443, C425, C564, D1869, and C1173.

SECTION III - EXCAVATION AND BACKFILL

3.01 GENERAL

Trenches shall be excavated, protected and backfilled as necessary for the completion of the work to be done as shown on the construction drawings. All excavation shall be open trenches except where and to such extent as the Engineer may authorize or require tunnel or other form of closed (trenchless) excavation. In general, trenches may be excavated and backfilled either by machinery or by hand. The Contractor may be required to use hand excavation and backfilling where it is necessary to protect existing structures, utilities, and private or public properties.

The Contractor shall perform all excavation of every description and of whatever substance encountered, to the depths indicated by the drawings, as specified herein, or as required by the Engineer. In performing the work as specified in this Section, the Contractor shall conform to the current regulations of the Pennsylvania Department of Labor OSHA regulations. All excavated materials not required for backfill shall be removed and wasted or otherwise disposed of as required or specified.

If excavation is stopped on any trench for any reason and the excavation is left open for an extended length of time (as determined by the Engineer) in advance of construction, the Contractor shall backfill the trench and not excavate again until work proceeds.

3.02 CLASSIFICATION

All trench excavation shall be considered unclassified. No consideration will be given to the nature of the materials excavated. It should be understood that unclassified excavation shall include both earth excavation and rock excavation.

3.03 RESPONSIBILITY FOR CONDITION OF EXCAVATION

The Contractor shall solely be responsible for the condition of all excavations made by him. All slides and cave-ins shall be removed by the Contractor at whatever time and under whatever circumstances they may occur.

The failure and refusal of the Engineer to require the use of bracing or sheeting or a better quality, grade, or section, or larger sizes of steel or timber, or to require sheeting, bracing struts, or shoring to be left in place, shall not in any way or to any extent relieve the Contractor of any responsibility concerning the condition of excavation, nor impose any liability on the Engineer or the Authority, nor shall any delay, whether caused by any action or want of action on the part of the Contractor, or by any act of the Engineer, Authority or their agents, or employees, resulting in the keeping of an excavation open longer than would otherwise have been necessary, relieve the Contractor from the necessity of properly and adequately protecting the excavation from caving or slipping, nor from any of his obligations relating to injury of persons or property.

3.04 ACCOMMODATION OF TRAFFIC

Streets shall not be unnecessarily obstructed, and unless the Contractor has been authorized in writing, he shall not completely close the street and shall take such measures as may be necessary to keep the street or road open and safe for traffic. If any streets are authorized to remain closed, the Contractor is required and responsible to provide proper and adequate detour routes and signs. The closing and detouring of any street must be approved by the Engineer and the municipal government, prior to said closing and detour taking place.

It is the Contractor's responsibility to notify all agencies, such as PennDOT, Township or Borough, the Police Department, Fire Department, School District, Ambulance Companies, etc. of any road closings and detours.

The Contractor shall construct and maintain such adequate and proper bridges over excavations as may be necessary or as required for the safe accommodation of pedestrians or vehicles. The Contractor shall furnish and erect substantial barricades at crossings of trenches, or along the trench, to protect the traveling public.

The Contractor shall not obstruct fire hydrants.

In narrow or congested areas, when so required, the Contractor shall complete his work up to a point designated by the Engineer before opening the work ahead, in order to give access to driveways and other places. The Contractor shall in all cases so arrange his work as to cause the least inconvenience to the general public consistent with the proper prosecution of the work.

Storage of all materials, equipment, machinery, tools, etc. is the Contractor's responsibility. The Contractor is prohibited from storing any and all materials, equipment, machinery, tools, etc. on streets, shoulders, sidewalks, etc. All items must be stored and parked within the provided easement in unimproved areas.

All work pertaining to traffic control shall be performed by the Contractor.

3.05 PREPARATION OF THE SITE

Prior to any excavation, the Contractor shall properly prepare the right-of-way or site of the work.

The Contractor shall first provide adequate protection for all lawns, trees, shrubs, land-scape work, fences, utilities, and sidewalks that are to remain in place, and for such other existing similar growth, structures and facilities. Such protection shall be maintained so long as necessary to prevent damage due to the operations of the Contractor.

The structures and obstructions such as fences, shrubs, etc. which are to be removed prior to the start of construction must be removed, stored and protected by the Contractor. It is the Contractor's responsibility to replace these features to an equal or better condition than when they were removed.

All clearing and grubbing must be performed by the Contractor. All trees, roots, trunks, organic material and unsuitable material must be removed from its site by the Contractor. Burning of this refuse and other debris will NOT be permitted.

All personal property and utility damage cause by the Contractor during the clearing and grubbing operation shall be remedied at the Contractor's expense.

All grass and sod shall be carefully removed from all lawns and stored, protected and re-laid following backfill and tamping of the excavated areas, provided it is in suitable growing condition. If the sod is not satisfactory for replanting, the Contractor shall seed the excavated area. The Contractor shall also remove all plant material, where required, store and replant the material following completion of the work or replace with a suitable material. The plant material shall be examined by the Engineer from time to time after being planted and during the maintenance period. All material that has died or is dying shall be replaced by the Contractor at his expense.

The Contractor shall neatly cut existing pavement prior to the start of excavation. All cut edges shall be straight both horizontally and vertically. All concrete paving must be cut with a concrete saw.

3.06 WIDTH AND DEPTH OF TRENCHES

The trench excavation shall be of the required depth and of sufficient width to provide adequate room for the construction and installation of the pipe. From the excavated trench subgrade to a point one foot above the top of the pipe the width of the trench shall not be less than 12 inches or more than 16 inches wider than the outside diameter of the pipe. The pipe shall be installed so that a clear space of not less than 6 inches in width is provided on each side of the pipe.

From a point 12 inches above the top of the pipe to the surface, the trench walls shall be kept as vertical as possible and in no case shall the trench width at the top exceed 40 inches plus the outside diameter of the pipe in all streets, roads, highways, paved surfaces, etc. The sanitary sewers which are to be constructed in rights-of-way or easements may exceed the maximum trench width if approved by the Engineer and provided sufficient work area is maintained and all work is performed and contained within the rights-of-way or easements. The depth of the trench shall be made to a minimum of 6 inches below the bottom of the pipe. Bedding of 2A Modified Aggregate shall be provided as shown in the Detail Drawings.

When the material encountered at trench subgrade is determined by the Engineer to be unstable, it shall be removed to a minimum depth of 1 foot below the invert of the pipe. Maximum depth shall be determined by the Engineer. The Unclassified Trench Excavation Below Subgrade of such unsuitable material shall be backfilled with a 2A modified aggregate to the bottom of all ductile iron pipe. In rock excavation, if trenches are shattered by blasting below or beyond the lines of excavation specified herein, the trench shall be refilled to specified lines of excavation with Class C concrete. All work, tools, equipment, labor, material, etc. required for the Unclassified Trench Excavation Below Subgrade shall be provided by the Contractor. If earth trenches are excavated beyond the specified depths, without the approval of the Engineer, the Contractor shall backfill the excavation below subgrade with 2A modified aggregate.

The bell end of the pipe shall be carefully placed in the bedding so that no part of the trench load is supported by the bells. In all cases the bottom of the pipe shall be fully and uniformly supported; the full load of the pipe resting on the barrel of the pipe.

Trenches shall at all times during the progress of the work be excavated to the required width and depth for a distance of at least 20 feet in advance of the end of the pipe in place. No trench shall be excavated more than 100 feet in advance of the completed line.

Test pits shall be dug by the Contractor as directed and approved by the Engineer to a depth and size as may be necessary. If the Contractor without being required in writing by the Engineer to do so, excavates for test pits, or any other miscellaneous items for the purpose of satisfying himself as to the location of underground obstructions or conditions, this shall be done at his own expense.

3.07 SHEETING, BRACING AND SHORING

All work performed and materials used for sheeting, bracing and shoring shall be in conformity with the requirements of the State Department of Labor and Industry and other State and Local laws and requirements.

All plank used for sheeting and sheet piling and all timber used for braces, shores and stringers or waling-strips shall be sound, straight gained yellow pine, Douglas fir or other material of equal strength. All plank and timber shall be free from cracks, shakes, and large or loose knots. Plank shall be tongue and grooved or grooved and splined, if so required. Steel sheeting, if used, shall be the standard and generally accepted product of a recognized manufacturer. All materials used in the work shall conform to the current regulations of the Pennsylvania Department of Labor and Industry for Excavations and Construction and shall be at least equal to the dimensions set forth therein.

Material for sheet piling, sheeting, bracing and shoring shall be furnished and driven or set in place by the Contractor in accordance with current regulations of the Pennsylvania Department of Labor and Industry for Excavations and Construction, or wherever required by the Engineer to protect the workers and the public or to maintain the maximum trench widths regardless of whether the same is or is not considered necessary by the contractor.

Whenever, in the opinion of the Engineer, the materials being used or the methods being followed are not in conformance with generally accepted practices for that type of work, the Engineer may stop that phase of the work.

All sheeting, sheet piling, braces and shores shall be driven or put in place by men specially skilled in such work, and shall be so arranged that they may be withdrawn as the trenches are backfilled, without injury to or settlement of adjacent structures and pavements.

Where the maximum width of trench may be exceeded under these Specifications and where permitted under the Regulations of the Pennsylvania Department of Labor and Industry, the sides of the trench may be sloped in lieu of providing sheeting and bracing. If the sloping of the trench

banks is permitted, the slope shall begin at a point 12 inches above the top of the pipe. Sheeting shall be installed as required by the Department of Labor and Industry Regulations to support the vertical part of the excavation.

Sheeting, sheet piling, bracing and shores shall be withdrawn and removed as the trenches are being backfilled, except where and to such extent as the Engineer shall require in writing, that the same be left in place, or where he shall permit the Contractor to leave the same in place at the Contractor's own request.

In withdrawing sheeting and sheet piling, special care shall be taken to ensure that all voids or holes left by the planks as they are withdrawn, are filled with satisfactory material and thoroughly rammed with thin rammers provided especially for that purpose.

The Contractor shall cut off any sheeting or sheet piling left whenever and at such points as the Engineer shall require and shall remove from the site the portion cut off. All sheeting left in place shall be done so at the Contractor's own expense. This includes all sheeting, left in place as directed by the Engineer.

The failure of refusal of the Engineer to require the use of sheeting or sheet piling or a better quality or larger sizes of timber, or to require sheeting, sheet piling, bracing, or shores shall not in any way or to any extent relieve the Contractor of any or all of his obligations under the contract, nor impose any liability on the Engineer.

3.08 DEWATERING

The Contractor shall remove by pumping, bailing or other means, any water which may accumulate or be found in the trenches or other excavations and shall form all dams, flumes, or other works necessary to keep them entirely clear of water while the sewers and other structures are being constructed. The Contractor shall have sufficient pumping machinery available at all times on the site ready for immediate use. At no time is water to run through the pipes or its bedding material.

The water from the trenches and excavations shall be disposed of in such a manner as will not cause a public health nuisance or injure public or private property, work completed or in progress, street surfaces, or cause interference with use of the area by the public. Where points of drainage discharge are in question, approval shall be obtained from the Municipal Authority. In addition, all such work shall be conducted in accordance with the recommendations and regulations of the Pennsylvania Department of Environmental Protection with respect to soil erosion and sediment control.

3.09 UTILITIES

In accordance with P.L. 852 (Act 287) as amended by Act 187, it is the Contractor's responsibility and obligation to contact all utility companies for utility location verification, regardless of the utility location shown on the Construction Drawings, 72 hours prior to the start of any and all excavation. Any utility damages by the Contractor must be repaired in a manner acceptable to the

utility's representative. The Contractor shall carefully support and protect from any damage all existing gas pipes, water pipes, steam pipes, electric conduits, sewers, drains, hydrants, valve boxes and other structures which may be encountered during the performance of the work.

Where dead ends shall exist following removal of pipes, conduits or sewers they shall be carefully plugged or bulkheaded with brick and mortar.

3.10 BARRICADES, GUARDS, AND SAFETY PROVISIONS

To protect persons from injury and to avoid property damage, adequate barricades, construction signs, torches, red lanterns and guards, as required, shall be placed and maintained during this progress of the construction work and until it is safe for traffic and pedestrian use. All materials, stockpiles, equipment and pipe which may serve as obstructions and safety hazards to the public shall be enclosed by fences and barricades, and shall be protected by proper lights when visibility is poor.

If required during ant street opening, watchmen shall be provided by the Contractor to prevent accidents. All rules and regulations of local, state, and county authorities regarding safety provisions shall be observed.

3.11 DRAINS, CULVERTS, SEWERS OR OTHER OBSTRUCTIONS

Adequate provision shall be made for the flow of sewers, drains, culverts and watercourses encountered during the construction. The structures which may have been disturbed during construction shall be satisfactorily restored upon completion of the work. Where concrete gutter drains along State highways or Municipal roadways are disturbed, the entire gutter shall be replaced unless construction joints permit replacement of these sections disturbed. All pipes or crushed stone and gravel, located under these gutters that are removed or disturbed shall be completely replaced. All this work shall be in complete accordance with the requirements of the Pennsylvania Department of Transportation and/or local governing officials.

3.12 EXPLOSIVES AND BLASTING

The use of explosives shall be governed by the "Regulations for the Storage, Handling, and Use of Explosives" of the Pennsylvania Department of Labor and Industry.

All blasting shall be field monitored using seismographic type equipment and shall be performed under the supervision of a Professional Engineer or Geologist, licensed to practice in the Commonwealth of Pennsylvania.

The Contractor is responsible to keep and submit to the Authority an accurate record of each blast. The record shall show the general location of the blast, depth and number of drill holes, the kind and quantity of explosives used, ground velocity and displacements, and other data required for a complete record.

All blasting will be permitted only after securing written approval from the Authority and all appropriate permits are obtained. No blasting shall be done adjacent to existing lines or structures which may be damaged through blasting operations, and under no circumstances shall blasting be done on the site during or for a period of at least 48 hours after the placement of concrete.

Rock excavation within 10' of water or gas mains shall be done by hand and with light charges of explosives, and the utmost care shall be executed to avoid disturbances of the main. All exposed sewers and special structures shall be carefully protected from the effects of the blast, and any damage to them by blasting shall be promptly repaired by the Contractor at his expense, and in no case shall the blasting be done within 40 feet of newly laid sewer.

All shots shall be covered with cable or rope mats placed in accordance with governing regulations, and special care shall be exercised in areas where high tension power lines are located.

Prior to blasting, sufficient warning shall be given to all persons in the vicinity and traffic shall be stopped at the proper distance from the site and controlled by watchmen.

The contractor shall use the utmost care in the use of explosives necessary for the completion of the work and not to endanger life or property. All blasting operations shall be done by experienced men who have proper certificates or licenses. The handling and use of explosives shall be done strictly in accordance with their specifications issued by the United States Bureau of Mines and with any Federal or State regulations now in affect or that might become effective in the future; and in compliance with the local and state laws. Failure to observe necessary precautions will be sufficient grounds for temporary suspension of the work. All explosives shall be transported and stored in a secure manner in accordance with the local and state laws. All vehicle and such storage places shall be marked clearly "Dangerous - Explosives," and shall be in care of competent watchmen at all times. In no case shall caps or other detonators be stored or transported with dynamite or other explosives. The location of magazines or the storage of explosives and the separate storage of detonators shall be subject to the approval of the Engineer and applicable state agencies.

All blasts shall be properly matted and securely covered. The Contractor shall be solely responsible for injury to persons on property located within or beyond the area or scope of the project that may result from his use of explosives.

A permit must be secured from the Pennsylvania Fish Commission if the use of explosives is required. The following P.F.C. Waterways Patrolman must be notified when the project is started, when explosives are to be used, and when the project is completed for final inspection.

The Contractor shall also contact the Warminster Township Fire Marshal, Telephone (215)443-5423 to obtain any required approval and/or permit for use of explosives and blasting.

3.13 BACKFILLING

Immediately after a section of the piping is laid, sufficient backfill material shall be placed along each side of the pipe to hold pipe to line and grade. Backfill around and over ductile iron pipe shall be as indicated in the detail drawings. Compaction of all backfill material will be accomplished in eight (8) inch lifts by means of vibratory tampers or other modern methods so designated by the Engineer depending on soil conditions within the specific areas.

All trench excavation and backfill on State Highways will be subject to inspection by representatives of the Commonwealth of Pennsylvania, Department of Transportation, and the work must be performed in accordance with the requirements of that department without additional payment even though such requirements may entail more labor or services than the methods herein described.

Within State Highway rights-of-way all trenches shall be backfilled in eight (8) inch compacted layers for the entire length of the trench, and each layer shall be compacted by vibratory tampers of a type and size satisfactory to the Engineer and the Commonwealth of Pennsylvania Department of Transportation. Compacting of any backfill by puddling and jetting will not be permitted. All trenches within the roadway and shoulder paving of all State Highways shall be backfilled from a point one (1) foot above the top of pipe to the bottom elevation of the required replacement paving with No. 2A modified aggregate conforming to the grading requirements specified in Section 703 of the Commonwealth of Pennsylvania Department of Transportation Specifications Form 408 for No. 2A modified aggregate.

All trenches within paved Township streets, driveways, parking lots (all paved surfaces) shall be backfilled in eight (8) inch lifts as previously specified to a point 2 inches below the existing pavement. The backfill material shall be the same as the material used for backfilling State Highway roadways, 2A modified aggregate.

All trenches in unimproved areas shall be backfilled and compacted from a point one (1) foot above the top of pipe with clean earth backfill material.

The backfill material shall be clean fill of good earth, sand and gravel. The backfill material may contain stones not more than six (6) inches in largest diameter but not in a proportion exceeding twenty (20) percent of the total volume of the backfill material. The use of organic materials may NOT be used as backfill material.

Backfilling and tamping shall be started immediately after preliminary alignment inspection is made and shall continue without interruption to completion, unless otherwise directed by the Engineer.

The use of a HYDRA-HAMMER for compacting backfill in trenches is prohibited.

The density of the backfill material after compaction in trenches in paved surfaces shall be no less than ninety (90) percent of the maximum density determined at optimum moisture content as determined by ASTM Standard D-1557.

The Contractor shall immediately upon completion of the tamping, place and roll a 2 inch layer of temporary paving, as specified in Section VI, in all roads, streets, State Highway roadways, driveways, parking lots (all paved areas), etc. The contractor shall not proceed to excavate additional trench, until this work is completed and approved, unless specifically directed otherwise by the Engineer.

In all unpaved areas where such areas are not used as a traffic way, the Contractor shall crown to such a height as determined by the Engineer, the top of all backfilled excavation. This crown is to be constructed after the trench backfill material has been tamped. As the trenches are filled in, the work completed, the Contractor shall cart away, remove and make use of all surplus material, without additional compensation, to such a point as the Engineer may designate.

When the trenches do not furnish sufficient material of suitable quality for refilling, the Contractor shall procure and supply such deficiency without extra charge. Frozen material shall not be used for backfilling.

All trenches must be backfilled at the end of the day. If the contractor does not backfill the trenches at the end of the day with approval of the Engineer, all open trenches must be enclosed with snow fences, securely staked. Blinking barricades must also be placed around the area to the satisfaction of the Engineer.

Any settlement of backfill is the complete responsibility of the Contractor and all finished grades shall be rendered permanently to the proper grades for good surface drainage, surfacing, resurfacing, repaving or laying of concrete walkways. Puddling will NOT be permitted.

After the backfill material has become or has been made sufficiently compact, the Contractor shall substantially and neatly grade the entire disturbed area. All excess backfill material shall be removed by the Contractor.

The Contractor shall be responsible for all settlement for a period of 24 months after acceptance by the Authority and shall repair settlement within 24 hours after notice is received of a settlement condition

SECTION IV -
INSTALLATION OF WATER AND SEWER PIPE AND PIPING APPURTENANCES

4.01 GENERAL

A. DESCRIPTION

1. The work included in this Section consists of furnishing, installing, and testing all water and sewer main piping, fittings, and appurtenances, as indicated on the Drawings and specified herein, or as required to complete the work.
2. All work shall be done in a neat and workmanlike manner to the lines and grades on the Drawings, or as required for the equipment. All piping shall be properly supported, and provisions shall be made for expansion and contraction.
3. Whenever the word Apiping@ is used in this Section, it shall be understood to refer to all buried water and sewer main pipes, fittings, valves, flanges, hydrants, manholes, and all water and sewer service facilities comprising any given system.

B. RELATED WORK SPECIFIED ELSEWHERE INCLUDES:

Specification Section II - Materials
Specification Section III - Excavation and Backfill

C. INSPECTION AND QUALITY CONTROL

1. The quality of all materials, the process of manufacture, and finished pipe shall be subject to inspection and approval of the Engineer. Pipe may be inspected at the place of manufacture, and on the work site, and shall be subject to rejection at any time, even though submitted samples may have been approved. In addition, the Authority reserves the right to have any, or all, pipe or fittings inspected or tested, or both, by an independent inspection service at either the manufacturer=s plant or elsewhere. Such inspections and/or tests shall be at the Authority=s expense. In the event the test fails, the Contractor shall assume costs of the test.
2. All pipe, fittings, and appurtenances shall be carefully inspected in the field before installation. All piping found to be defective, as determined by the Engineer, shall be marked defective, tagged in such a manner as not to deface or damage it, and the pipe shall then be removed from the job site by the Contractor, at his own expense. Results of shop tests which may be required shall be submitted to the Authority prior to installation of the pipe for which said tests were ordered.

D. EXISTING CONDITIONS

1. The Drawings show existing piping to the best of available information, but cannot be considered accurate as to exact locations and elevations of existing piping.
2. Before connection to existing piping, the Contractor shall first locate the existing pipe and then plan the connection. Contractor shall make all the connections to existing piping, at a time agreeable to the Authority.
3. The Contractor shall prepare a detailed schedule, and plans of these connections showing time required, method, and pipe fittings used to make a tie-in. This plan shall be approved by the Engineer before any work is started.

4.02 MATERIALS

Piping materials shall be as specified in Section II, "Materials," of these Specifications, unless otherwise indicated in this Section.

4.03 EXECUTION

A. WATER MAIN INSTALLATION GENERAL

1. Any conflicts arising during the erection of piping shall be brought to the attention of the Engineer. No improvising or field changes will be permitted without the approval of the Engineer.
2. All piping shall be erected in such a manner as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending moments at joints or connections to equipment.
3. Full lengths of pipe shall be used whenever possible. Short lengths of pipe with couplings will not be permitted, except as may be approved by the Engineer to eliminate overstressing or misalignment. All pipe shall be cut to exact measurement and shall be installed without forcing or springing.
4. Tool marks and unnecessary pipe threads shall be avoided. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care and free of cuttings and foreign matter.
5. Where piping is pitched for drainage, an accurate grade shall be maintained. Piping shall be supported in such a manner as to prohibit deflection due to gravity that would be sufficient to pocket the lines when full of liquid. All changes in direction shall be made by using pipe fittings, unless otherwise shown on the Drawings, or as approved by the Engineer.

6. Raised face flanges shall not be used for connection to Class 125, ANSI B16.1 cast iron flanges. The raised face shall be removed before use and full-face gaskets shall be employed.
7. Pipe anchors, thrust blocks, expansion joints, loops, and bends shall be installed, as indicated on the Drawings, and as required to properly protect the piping against vibration, misalignment, and overstressing.
8. All buried bolts, nuts, lugs, rods, brackets, etc., except stainless steel, shall be given one heavy coat of coal tar epoxy coating prior to backfilling.
9. All piping shall be installed in such a manner that it shall be free to expand and contract without injury to itself, structural steel, or anchors.
10. When pipe is cut in the field, the cut end shall be tapered back approximately 1/8 inch, at an angle of 30° with the centerline of the pipe, with a coarse file or grinder to remove any rough edges which might injure a gasket, where applicable.
11. The Contractor shall furnish and install all valves and piping not mentioned in Specification Section II, A Materials, @ but shown on the Drawings.
12. All joints shall be made drip-tight under all pressures up to the specified field test pressure of the line in which installed.

B. BURIED WATER MAIN INSTALLATION

1. Trench excavation, backfill, and installation of all buried piping shall be in accordance with AWWA Standard for installation of ductile iron water mains, AWWA C600, the Ductile Iron Pipe Research Association (DIPRA) guidelines, except as modified herein.
2. After the trench has been excavated to the proper subgrade, the bedding material shall be placed in the trench at a minimum thickness of 6 inches. The bedding material shall conform to the grading requirement, as specified in Section 703.2 of the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408 for 2A modified aggregate. The pipe shall then be placed so that the entire length of the pipe is resting on the bedding, with the bells up grade. Each length of pipe shall be carefully handled, and accurately laid, by skilled workmen to line with a minimum 4' - 0" cover in dry trenches, without the use of any form of blocking. Each length shall be cleaned, the joint prepared in accordance with the manufacturer=s recommendations, and be pushed home against the previously installed length.

3. Suitable tools and equipment shall be used for proper handling, storing, and placing of the pipe and fittings in the trench. In order to avoid damage to the interior of pipe, lifting hooks or bars shall not be inserted therein. Each pipe and fitting shall be checked for defects and injuries as laying proceeds. Imperfect pipe materials shall be rejected, marked, and immediately removed from the work site.
4. If pipe must be cut to fits as closing pieces, such cuts shall be evenly and squarely made in workmanlike manner, with approved equipment. Injury to linings or coatings shall be satisfactorily repaired.
5. Where pipe is laid on a radius or curvature, each section of pipe shall be deflated at its joint equally with each adjacent pipe.
6. Mechanical Joints are to be made in strict accordance with the ANotes on Installation of Mechanical Joints@ following Section 11-7 of Specification ANSI 21.11/AWWA C111.
7. The pipe shall be covered with 2A modified aggregate to a point 1 foot above the top of the pipe. Any section of pipe disturbed after it is set must be reset by the Contractor, as directed by the Engineer.
8. From a point 1 foot over the top of the pipe, backfilling procedures may commence, as per Section III, AExcavation and Backfill,@ of these Specifications.
9. Where it is necessary to join pipes of different types and/or sizes, the Contractor shall furnish and install the necessary adaptor and/or reducer/increaser, approved by the Engineer. Adapters and/or reducer/increaser shall have ends conforming to specifications for the appropriate type of joint to receive the adjoining pipe.
10. The Contractor shall furnish and install al supports necessary to hold the piping and appurtenances in a firm, substantial manner, at the lines and grades indicated on the Drawings, or as directed by the Engineer.
11. Bends, trees, and other fittings in pipelines buried in the ground shall be provided with thrust blocks, as shown on the Detail Drawings. Thrust blocks are to be placed against undisturbed earth where firm support can be obtained. If the soil does not provide firm support, then suitable threaded rods, lugs, riser clamps, retainer glands, and accessories to brace the fitting properly shall be provided. Such restraining rods, etc. shall be coated thoroughly and heavily with an approved bituminous paint after assembly or, if necessary, before assembly. All flanges, glands, bolts, nuts, and accessories shall be protected from contact with concrete, and shall not be encapsulated with concrete. In lieu of restraining rods, lugs, clamps, or retainer glands, the Contractor may use "Megalug" glands, as manufactured by EBAA Iron Sales, Inc., of Eastland, Texas, or Uni-Flange, Series 1400, retainer gland. It shall be noted, however that the final responsibility for installing adequate and necessary thrust restraints resets with the Contractor. The costs associated with

furnishing and installing restraining rods, lugs, riser clamps, retainer glands, "Megalug" glands, and all accessories shall be included in the cost of pipe and fittings.

12. The Contractor must plug the end of the pipe at the end of each working day. The plug should be capable of keeping water from entering the pipe.
13. All water mains must receive, and pass, the required tests, as specified herein. Pipes that fail the test must be repaired and retested. Mains will not be approved for use until they pass the required tests.
14. A minimum horizontal separation of 10 feet must be maintained between water mains and sanitary sewers, in accordance with PA DEP requirements. Where a water main crosses above or below a sanitary or storm sewer, a vertical separation of at least 18 inches shall be maintained between the pipes.
15. If water exists in the pipe trench, no pipe may be placed until the water is removed by the Contractor.

C. FIRE HYDRANT AND VALVE INSTALLATION

1. General. Hydrants and valves shall be installed in strict accordance with the applicable requirements hereinafter set forth, unless otherwise directed by the Engineer.
2. Setting Hydrants, Valves, and Valve Boxes
 - a) All gate valves shall be set with the stems vertically above the centerline of the pipe. Special care shall be taken to avoid closing valves with sand, stones, or other substances lodged in the valve seat. Hydrants, valves and valve boxes shall be set plumb, with valve boxes placed directly over the valves. After being correctly positioned at street grade, stone fill shall be carefully tamped around the valve box.
 - b) Each hydrant base elbow shall be placed upon a slab of stone, brick or cement not less than 4 inches thick and 15 inches square, or placed at the backside of the hydrant, opposite the pipe connection, and be firmly wedged against the vertical face of the trench to prevent the hydrant from blowing off the line. If the character of the soil is such that the hydrant cannot be securely wedged with a thrust block, then threaded rods, lugs, and riser clamps shall be used. The threaded rods shall be not less than : inch stock and shall be thoroughly protected by painting with bitumastic paint. Around the base of each hydrant shall be placed not less than 7 cubic feet of crushed stone to ensure the complete drainage of the hydrant when closed. All backfill around hydrants shall be in 4 inch layers or less and shall be thoroughly compacted to the surface of the ground. The bottom of the

safety flange shall be 2 inches aboveground. General location of the hydrant assembly is as shown on the Drawings. Exact locations of hydrant assembly shall be as directed by the Engineer at time of construction. Extension sections of required length, shall be furnished, to raise standpipe to finished grade.

- c) Before installing any hydrant or valve, care shall be taken to see that all foreign matter and material is removed from the interior of the barrel. Stuffing boxes shall be tightened, and the hydrant or valve opened and closed to see that all parts are in working order and condition. Care must also be taken to prevent fouling or blocking the hydrant drain parts when placing concrete thrust blocks.

3. Painting Hydrants

- a) After installation, the upper barrel, bonnet and nozzle caps shall be finish painted by the Contractor, before final acceptance by the Authority. All surfaces to be painted shall be cleaned and free of dirt, rust, grease, oil or other foreign substances. Wire brushing by hand or power tool cleaning shall be performed if determined by the Engineer to be necessary for proper surface preparation.
- b) Each hydrant shall receive two (2) coats of weather and rust resistant oil base enamel as follows:
 - 1. Upper barrel above and including the breakaway coupling; Sherwin-Williams Industrial Enamel (B54WZ0401-16) Pure White.
 - 2. Bonnet, nozzle caps and keeper chains; Sherwin-Williams Industrial Enamel (B54EZ0439-16) Safety Orange, except hydrants on/at dead-end mains shall be Safety Red (B54RZ0438-16), where directed by the Authority.
- c) All surface preparation and application of paint shall follow the instructions printed by the paint manufacturer.

D. CONCRETE CONSTRUCTION

- 1. Thrust blocks and vertical anchor blocks shall be provided, as shown on the Detail Drawings, and as required to restrain either flanged, mechanical joint, or push-on joint pipe.
- 2. Materials used for concrete construction shall conform to section II, "Materials," of these Specifications. All pours shall be monolithic.

3. If forms are used by the Contractor, they must be adequately constructed and supported to avoid bulging of and/or deforming, the concrete. Forms are to be coated with cup grease, or an approved equal, in order to facilitate removal.
4. All forms must be removed by the Contractor after the concrete has sufficiently hardened.
5. Water must be removed from all areas where concrete is to be poured.
6. The placing of concrete must be set up in order that the concrete will not drop more than 3 feet. Concrete must be tuckered and worked in a manner that will cause the concrete to fill all voids under and around pipes.
7. Backfilling over the concrete shall not be permitted until the concrete has sufficiently hardened.
8. All thrust blocks and/or concrete anchors shall be constructed to the dimensions specified in the Drawings. These items shall be required at the locations indicated on the Drawings. The Engineer may add additional thrust blocks or anchors in the field if they are required.

4.04 FIELD TESTING

A. GENERAL

1. During construction and at the completion of the work, the Contractor shall make tests, as directed by the Engineer, to ascertain if the pipe is properly aligned and the joints are tight. The Engineer will direct and witness all tests. The Contractor is responsible for providing a pressure gauge and a metering device if required for the test. The Contractor shall also furnish a suitable pump and all other apparatus required and shall pay all costs connected therewith. Defective work shall be repaired or replaced immediately, at the Contractor's expense.
2. All pipe lines shall be thoroughly flushed with water to obtain free flow through all lines. All obstructions and debris in lines shall be removed and any apparent defects corrected prior to testing.

B. TESTING OF BURIED WATER MAINS

Testing shall be in accordance with AWWA C600, Section 4, Hydrostatic Testing. Before the pipe is tested, concrete thrust blocks shall be in place and backfilling shall be completed. When the entire pipe line, or a designated portion thereof, is completed, it shall be tested hydraulically as follows:

1. The pipe line or designated portion thereof shall be filled by the Contractor with water from source of supply made available by the Authority, and shall be vented free from air or air pockets.
2. After the system has been full of water for 24 hours, the hydrostatic pressure shall be brought to 150 lbs/sq. in. minimum and maintained for a period of 2 hours, or as directed by the Engineer. Test pressure shall not vary by more than +/-5 psi for the duration of the test.
3. During the 2 hour period when the system is under the test pressure, no section of pipe of uniform diameter shall show a leakage in excess of 11.65 gallons per day per mile per inch of diameter. Allowable leakage is based on the following formula:

$$L = \frac{SD\&P}{133,200}$$

Where:

- L = allowable leakage, in gallons per hour
- S = length of pipe tested, in feet
- D = nominal diameter of pipe, in inches
- P = average test pressure during the leakage test, in pounds per square inch (gauge)

Any leaks shall be repaired in a satisfactory manner by the Contractor, at his own expense. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi of 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 over a period of time.

4. The entire cost of testing the system shall be borne by the Contractor and shall be included in the cost of the work for which payment is made. After the pipe is tested and accepted by the Engineer, the remainder of the trench shall be backfilled in accordance with Section 3.14 of these Specifications.
5. Water service connections shall be tested and checked for visual leakage under normal system operating pressure, after installation and prior to backfilling, as specified in Section 3.14.
6. All connections to existing piping shall be tested and checked for visual leakage under normal system operating pressure, after connections are completed and prior to backfilling, as specified herein.
7. A 1 inch diameter corporation stop shall be supplied and installed by the Contractor for the purpose of pressurizing the new main. The corporation stop for testing shall be installed at the point of highest elevation in the section of the new main to be hydrostatically tested. Upon completion of the test, the corporation stop shall be removed and a threaded brass plug shall be installed by the Contractor.

4.05 DISINFECTION

A. POTABLE WATER PIPING

Each unit of completed water supply lines and distribution system shall be thoroughly disinfected with chlorine before it is placed in operation. The disinfection shall conform to the requirements and standards set forth in AWWA C651-92, ADisinfecting Water Mains.@ The Engineer will provide a copy of these standards to the Contractor, upon request, and all procedures for disinfection shall be approved by the Engineer prior to initiation of work. The forms of chlorine that may be used in the disinfection operation are liquid chlorine, sodium hypochlorite solution and calcium hypochlorite granules or tablets. The standard for these forms of chlorine are defined in Section 2 of AWWA C651-92. he Warminster Authority will provide the chlorine tablets to use for disinfecting the new water lines.

The most common acceptable method for disinfection is the tablet method. If the tablet method is used, all procedures shall conform to Section 5.1 of AWWA C651-92. A food grade adhesive such as Permatex Form-A-Gasket No. 2 and Permatex Clear RTV Silicone Adhesive Sealant must be used. The amount of chlorine applied shall be such as to provide a dosage of not less than 25 parts per million. The methods and procedures for filling the water line for disinfection shall be approved by the Engineer. Following a contract period of not less than 24 hours, the heavily chlorinated water shall be flushed from the system as soon as possible with clean water until the residual chlorine content is not greater than 0.2 ppm.

The flushing procedures employed by the Contractor, and subsequent discharge location of the wasted water, shall be approved by the Engineer and the Authority prior to implementation. All valves in water lines being sterilized shall be opened and closed several times during the test period.

B. MATERIALS

1. Liquid Chlorine - Liquid chlorine shall conform to United States Army Specifications 4-1.
2. Hypochlorite - Liquid Hypochlorite shall conform to Federal Specifications FS O-B-441, Grade A.
3. Calcium Hypochlorite - Calcium Hypochlorite in tablet form, containing 65% available chlorine by weight.

After sterilization, the Engineer will determine the bacteriological quality of the line by laboratory testing. The test results must be certified by the laboratory that the water main/supply lines are free from coliform bacteria contamination. Failure of testing will require re-sterilization and testing, at the Contractor's expense.

4.06 FAILURE OF TESTS

If any of the above referenced testing or sterilization procedures produces unsatisfactory results, as determined by the Engineer, the Contractor will be responsible to perform any required corrective work and to retest the subject line(s) until satisfactory results are obtained. This will be done at no additional cost to the Authority.

4.07 SANITARY SEWER CONSTRUCTION

- A. Materials used in the construction of the sanitary sewers shall be in accordance with Section II of these Specifications.
- B. After the trench has been excavated to the proper subgrade, the bedding material shall be placed in the trench at a minimum thickness of 6 inches. The bedding material shall conform to the grading requirements, as specified in Section 703.2 of the Commonwealth of Pennsylvania Department of Transportation Specifications Form 408 for 2A modified aggregate for ductile iron pipe, and 1B for PVC pipe. The pipe shall then be placed so that the entire length of the pipe is resting on the bedding. If water is encountered in the trench, pipe shall not be placed in the trench until all water is removed. Ductile iron pipe shall be covered with 2A modified aggregate, and PVC pipe with 1B aggregate, to a point 1 foot above the top of the pipe. Any section of pipe disturbed after it is set must be reset by the Contractor, as directed by the Engineer.

The Contractor must check the pipe grade during installations, as directed by the Engineer.

Any section of pipe or joint found to be defective and/or leaking shall be replaced and removed from the project site.

From a point 1 foot over the top of the pipe, backfilling procedures may commence, as per Section III of these Specifications.

- C. The Contractor must plug the end of the pipe at the end of each working day. The plug should be capable of keeping water from entering the pipe.
- D. If water exists in the pipe trench, no pipe may be placed until the water is removed.
- E. Pipe stubs for connections to new doghouse type manholes shall be encased in Class C concrete.
- F. All sanitary sewers must receive and pass the required field tests, as per Section 4.10 of these Specifications. Sewers that fail the tests must be repaired and retested by the Contractor. Sewers will not be approved for use until they pass the required field tests.
- G. The Contractor shall build drop connections, as noted on the Detail Drawings, where a drop in the invert is 2 feet or more, or as required by the Engineer. They must be constructed in

conformance with the Standard Details and shall be of the same pipe material used to construct the main from which the drop connection is made.

4.08 LATERALS

A. NEW SEWER CONSTRUCTION

1. All laterals are to be 6 inch pipe, unless otherwise noted. The pipe is to conform to Sections II of these Specifications. If PVC pipe is used, the lateral pipe shall be SDR-26 from the sewer main to the end of the lateral behind the curb line.
2. All laterals shall be laid on a minimum slope of 2%. No lateral may be deeper than 9 feet at its free end, measured to the invert.
3. The Contractor is to construct all laterals to the property line and extend a maximum of 1 foot beyond the property line. The free end of all laterals **MUST** end with a plain-end section of pipe. The laterals must be laid on a bedding of a minimum thickness of 6 inches. The bedding material is to be 2A modified aggregate for DIP pipe, and 1B aggregate for PVC pipe.
4. The free end of all laterals must be plugged with an approved push-on type cap. All plugs must be capable of withstanding the required air test and must be watertight. Contractor shall brace the end cap to hold the cap tightly in place during air testing.
5. Excavation and backfill for all laterals shall comply with Section III of these Specifications. Rock in all lateral trenches must be removed to a point not less than 1 foot beyond the end of the pipe.
6. The lateral trench shall be backfilled with 2A modified aggregate for ductile iron, and 1B aggregate for PVC pipe to a height of at least 1 foot above the top of the lateral pipe. The remainder of the trench shall be backfilled according to Section III of these Specifications. All trenches in lawn areas will not be required to be backfilled with 2A modified aggregate.
7. The free end of all laterals must be marked by a 2" x 4" piece of lumber extending plumb from the invert of the lateral end to the top of existing grade. The marker shall be cut flush with the existing grade, or project above existing grade, as directed by the Engineer, and shall have reference location ties established from permanent structures. This is to be performed by the Engineer with assistance by the Contractor. The marker shall be painted with Asafety green@ paint one (1) foot below existing grade and on the portion projecting above grade.
8. If a lateral is deeper than 12 feet at the main, it is to be constructed as per the Detail Drawing for a deeper sewer service connection.

9. If water exists in the lateral trench, no lateral pipe may be placed until the water is removed.
10. If a new lateral must be installed where the sewer main exists, the pipe and fittings shall conform to Section II of these Specifications. The preferred method of installing a new connection to an existing main is to cut out a section of the main, and install a PVC “wye” fitting in the section with stainless steel FERNCO couplings. This will require temporary bypass pumping. This method is dependent on the condition of the existing main. When a cut in of the main is not practical, a saddle connection can be used. A cast or ductile iron saddle with stainless steel strap assembly, shall be furnished to facilitate connection of the new lateral pipe to the existing main. The opening in the wall of the existing main shall be made only with an approved sewer Atapping machine@, with a shell cutter suitable for the type of pipe material, generally vitrified clay or ductile iron, to be cut. The entire lateral installation shall comply with these Specifications, the Detail Drawings, and the Lateral Installation Agreement between the Authority and the property owner desiring sewer service.
11. Using Existing Laterals. When an existing lateral and on- site sewer facilities are to be reused as part of a project, those sewer pipes must be inspected by the internal televising of the pipes. A copy of this inspection shall be provided to the authority for review. If the existing line is determined to be leaking, damaged, or unsound, the lateral shall be replaced with new pipe to conform to these specifications.

4.09 MANHOLE CONSTRUCTION

A. SEWER MANHOLE

1. All manholes shall be precast reinforced concrete type, as per Section II of these Specifications, unless otherwise required in the Specifications and the Construction Drawings. They shall be constructed at points indicated on the Construction Drawings and as directed by the Engineer. All manholes shall be set to the grades surveyed and in strict accordance with the Detail Drawings.
2. Manholes may not be left open after they have been constructed. The Contractor must completely set the base, risers and top section of all manholes constructed during the working day. No manhole may be left open overnight. If the manhole is not completed by the end of the working day, the Contractor must use a safe, temporary method of covering the manhole.
3. Excavation and backfill shall conform to the requirements of Section IV of these Specifications. Excavation and backfill limit for all manholes is to be 1 foot around the outside diameter of the manhole.

Prior to setting of the precast bases on grade, a 6 inch minimum bedding of 2A modified aggregate shall be placed in the trench subgrade. The bedding shall be leveled and compacted.

4. The minimum length of pipe for all connections to all precast manhole bases shall be 6 feet. The minimum length of pipe for all connections to poured-in-place bases and connections to existing manholes shall be 2 feet.

The joints for all manhole sections shall be two (2) complete rings of a preformed butyl sealing compound. Each ring of sealer shall be placed uniformly around the entire circumference of the joints, as shown on the Detail Drawings. The use of round rubber gaskets for sealing manhole joints shall not be permitted.

No mortar is to be placed in the internal manhole section joints.

5. Manhole frames shall be set to final grade and bolted to the top section of the manhole, as per the Detail Drawings. Grade adjustments of the frames shall be made using precast concrete manhole grade rings. The use of brick will not be permitted. The grade rings shall conform to the requirements of ASTM C-478 and shall be a minimum of 2 inches thick. The joint between the manhole frame and the last grade adjustment ring shall consist of a double ring of preformed plastic sealing compound. Absolutely no mortar shall be used in this joint.

A 2 inch thick layer of mortar shall be neatly parged around the outside of the grade rings. The internal joints of the grade adjustment ring are to be pointed. Absolutely no mortar shall coat the inside of the grade adjustment rings.

The maximum height of all grade adjustments shall be 12 inches, measured from the top of the top manhole section to the bottom of the frame. If this height exceeds 12 inches, a 1 foot precast manhole riser section must be added to the manhole.

6. Channels and benches shall be shop or factory formed of 3,000 psi concrete. The depth of channels inside manhole bases shall be 3/4 the largest pipe diameter in the manhole. All benches shall slope toward the invert at a rate of 1 inch per foot, and have a skid resistant finish for personnel safety.
7. All manholes that are to have laterals tie into them must be constructed with an "A LOK" or ALink-Seal@ connector. A channel from the lateral pipe to the effluent pipe must be constructed in the base. Lateral connections to manholes are not permitted, however, except when no other feasible means of conventional lateral connection is possible.
8. All manholes shall receive an exfiltration or vacuum test, as per Section 4.10 of these Specifications. The manholes must be completely built, channels poured and frames set prior to receiving the test.

9. Manhole Encapsulation System: New and rehabilitated manholes shall be installed with WrapidSeal as manufactured by Canusa prior to completion of construction and shall conform to the requirements of ANSI/AWWA C216-94. Installation of the manhole encapsulation system shall be in accordance with the manufacture's recommended practices and shall be a wrap-around heat shrinkable system applied to the outside of manholes. Installation of the system shall be performed to create a barrier to water infiltration to protect the manhole from future damage. The system shall be applied to seal all joints between manhole base, riser (2"), and cone sections and shall completely encapsulate the entire upper portion of the manhole, including the top of the cone section, the grade rings, and the manhole frame. The encapsulating material shall extend a minimum of four (4") inches above and below each joint.

4.10 FIELD TESTING - SANITARY SEWERS, MANHOLES AND APPURTENANCES

A. GENERAL

During construction and at the completion of the work, the Contractor shall make tests, as directed by the Engineer, to ascertain if the pipe is properly aligned and the joints are tight. The Engineer will direct and witness all tests. The Contractor is responsible for providing a pressure gauge, test plugs and all equipment required for the tests. The Contractor shall also furnish a suitable pump and all other apparatus required and shall pay all costs connected therewith. Defective work shall be repaired or replaced immediately at the Contractor's expense.

1. All pipe lines shall be thoroughly flushed with water to obtain free flow through all lines. All obstructions and debris in lines or manholes shall be removed and any apparent defects corrected prior to testing.
2. Where there appears to be evidence of deficient workmanship and/or material by the Contractor, either in alignment or as evidenced by infiltration or by failure of a leakage test, the Engineer may order a televised survey of that portion of the line to determine the extent of the deficiency and the corrective action necessary. The costs of such survey or surveys shall be paid by the Contractor, including the Engineer's time, and shall be accomplished at no cost to the Authority.
3. Each sewer run shall be tested for leakage by a low pressure air test in accordance with the following procedures.

B. TESTING OF GRAVITY SEWERS

1. Each length of sewer between manholes shall be tested separately by plugging the open ends of the pipe in each manhole and each service lateral, if applicable, in the section to be tested.

2. Air from a compressor and control equipment shall be slowly admitted to this section through one of the manhole plugs until a constant test pressure of 3.5 psi is maintained. To allow for the presence of ground water, the height in feet between the invert of the pipe sewer and the height of groundwater in the section of pipe to be tested shall be determined, and this height shall be divided by 2.3 to establish the pounds of pressure that shall be added to the 3.5 psi stated herein.
3. By throttling the air supply, maintain 3.5 psi (or increased pressure as required above) for at least 2 minutes, prior to starting the test, to permit the air temperature within the pipe to equalize with the temperature of the pipe wall. After the stabilization period, adjust the air pressure to 3.5 psi, plus required increase in pressure, as required, due to the presence of groundwater and disconnect the air supply.
4. The requirements of this test shall be considered satisfied if the test pressure does not lose more than 1.0 psi in a 5 minute test period after the stabilization period.

C. TESTING OF MANHOLES

Before the AManhole Exfiltration Test@ is performed, the manhole shall be thoroughly cleaned and all openings sealed to the complete satisfaction of the Engineer. All pipe openings in the base and the walls shall be sealed with plugs designed to provide a watertight seal.

After the manhole has been properly cleaned and sealed, the manhole shall be completely filled with water. In order to make allowance for the amount of water which may be absorbed, the manhole to be tested shall be completely filled with water to the bottom of the cover seat a period of 1 hour prior to commencement of the Manhole Exfiltration Test.

At the time of commencement of the AManhole Exfiltration Test,@ the manhole shall again be filled with water to the bottom of the cover seat, and this water level shall be maintained for a minimum of 1 hour, during which period an accurate record of the amount of water to be added by reason of leakage (exfiltration) will be kept.

The manhole being tested shall be considered AAcceptable@ when the total rate of exfiltration does not exceed a rate of 0.069 gallons per foot of diameter per vertical foot per day.

If the manhole does not satisfy these testing requirements, the source(s) of exfiltration causing the test failure must be located and repaired in an approved manner and retested until the testing requirements are satisfied.

If the Avacuum@ testing procedure is used, the following requirements shall apply:

1. The vacuum test is to be performed as per the manhole tester manufacturer's recommendation along with the following:
 - a) The manhole tester is to be placed in the manhole frame, in order to test all grade adjustment ring joints between the bottom of the frame and the top of the manhole cone section.
 - b) The initial test vacuum shall be 10 inches of mercury.
 - c) The initial test vacuum may drop a maximum of 1 inch of mercury during the test period.
 - d) The test periods for the various depths and sizes of the manholes are as follows:

	Manhole Diameter		
Depth	48"	60"	72"
	Test Periods (Seconds)		
0-10	60	90	120
10-20	90	120	150
20-30	120	150	180

- e) All manholes exceeding the sizes and depths, as listed above, will require a test period of 180 seconds.

2. FAILURE OF TESTS

If the manhole (existing or new) does not satisfy these testing requirements, the source(s) causing the test failure must be located and repaired in an approved manner and retested until the testing requirements are satisfied.

4.11 BUILDING SEWERS

- A. All building sewers are to be minimum 4 inches diameter. Pipe and fittings shall conform to Section 2.10, Materials, of these Specifications.
- B. Building sewers shall be laid on a minimum slope of 2 percent (%) or one-quarter inch (1/4") per linear foot. If the Contractor finds conditions existing at the time of construction prohibit installation of sewer piping at 2% minimum slope, the Contractor shall immediately notify the Authority Engineer and obtain directions before proceeding with the work.

- C. Building sewers shall be installed beginning with the connection to the lateral. No building sewer or portion thereof shall be installed until the Contractor first determines the location and elevation of the lateral end.
- D. The minimum depth of cover on building sewers shall be 3 feet (36 inches) below finished grade.
- E. All building sewers shall be installed with at least ten (10) feet of undisturbed or completed earth separating the sewer pipe horizontally from any water service.
- F. After excavation of the trench to the proper elevation and slope, bedding material shall be placed in the trench bottom to a minimum depth of 6 inches. Material for bedding the sewer pipe shall conform to the gradation requirements specified in PennDOT Specifications Form 408 for 2A modified aggregate for cast or ductile iron pipe, and 1B crushed aggregate for PVC SDR 26 sewer pipe.
- G. After the pipe has been laid on bedding, the pipe shall be covered with the applicable bedding material to a point one (1) foot above the top of the pipe. Backfilling of the trench shall then commence in accordance with Section III of these Specifications.
- H. Building sewer pipe shall be joined to the lateral end by means of a flexible elastomeric PVC coupling as manufactured by Fernco or Engineer approved equal. A 6" x 4" reducing coupling must be used for connecting 4 inch building sewer to a 6" diameter lateral. The 4 inch building sewer shall extend 12 to 18 inches into the barrel of the 6" lateral, and a Fernco PVC O-Ring (6" x 4") shall be installed to center the 4" pipe inside the 6 A diameter lateral pipe.

Where the lateral end is a pipe bell, a Fernco Donut compression ring shall be installed, in addition to an O-Ring in the pipe barrel, to connect the building sewer to the lateral.

- I. Where a 6" diameter building sewer is to be connected to a 6" lateral, a Fernco flexible coupling shall be utilized for joining the two pipes of dissimilar materials. In order to maintain proper alignment, a stainless steel shear ring with manufacturer supplied bushings, if applicable, shall be supplied and installed by the Contractor.
- J. The Contractor is responsible to verify the pipe materials and diameters, before starting the work, in order to procure the correct size and type of coupling, O-Ring and/or Donut.
- K. A test tee located not more than five (5) feet from the lateral connection shall be installed to facilitate testing of the building sewer. After inspection of the lateral connection and the building sewer pipe to ascertain if the pipe is properly aligned, sloped and bedded, each building sewer shall be tested by plugging the open ends of the pipe at the test tee and inside the building. Testing shall be performed in accordance with Section 4.10 of these Specifications. If desired by the Contractor, the pipe may be tested by means of static water head of not less than 10 feet for a 10 minute test period.

- L. All building sewers shall have cleanouts located as follows:
1. A cleanout shall be installed within 10 feet of the lateral connection.
 2. The maximum distance between cleanouts shall not exceed 100 feet, unless a greater distance is approved by the Engineer.
 3. Cleanouts shall be installed at each change of direction greater than 45 degrees.
 4. A cleanout shall be provided at the junction of the building sewer and building drain in accordance with Section P-1103.5 of the 1993 BOCA National Plumbing Code.
 5. Cleanouts generally shall be located in lawn or landscape areas. Where necessary to locate a cleanout in bituminous or concrete pavement, a cast iron protective cover shall be installed flush with the pavement to provide access to a recessed threaded cleanout plug. Protective covers shall be approved by the Engineer.
 6. Building sewers 8 inches in diameter or larger shall have manholes for cleanouts. Manholes shall be located at every change of direction, grade and size of the building sewer, and at intervals not more than 400 feet.
 7. A wastewater sampling manhole, where required by the Authority, may be utilized for a cleanout.
- M. All manholes in building sewers, including sampling manholes, shall be constructed and tested in conformance with these Specifications.

4.12 WATER SERVICES

- A. Pipe and fittings utilized in the construction of water service lines shall conform to Section 2.09, Materials of these Specifications.
- B. No water service may be installed until the Contractor first determines the location and elevation of the building sewer and/or the lateral, in order to comply with the following requirements for separation of water services(s) and sanitary sewers:
1. All water service lines and piping shall be separated from any sanitary sewer by at least ten (10) feet of undisturbed or compacted earth.
 2. No water service pipe may be installed in the same trench with any sewer, unless the installation meets the following requirements:
 - a) If circumstances require the water service pipe to cross over the building sewer, the water service pipe shall be installed after the sewer pipe is in place, and the bottom of the water service pipe within 10 feet of the point

of crossing shall be a minimum of 18 inches above the top of the sewer pipe;
and

- b) The water service pipe shall cross over the building sewer at an angle not less than forty-five degrees (45°).
- C. The minimum depth of all water service pipe shall not be less than 48 inches, below finish grade, at any point in the trench.
- D. Excavation and backfilling of all water service trenches shall be accomplished as prescribed in Section III of these Specifications.
- E. Bedding material for ductile iron pipe shall be placed in the trench bottom to a minimum depth of 6 inches. Ductile iron water service lines shall be bedded and covered with 2A modified crushed stone aggregate, the same as specified for Buried Water Mains in Section 4.03.
- F. Copper water service lines may be laid directly on the trench bottom provided no rock or stone larger than 3 inch is present. Where the trench bottom is unsuitable as determined by the Authority, the Contractor shall place 6 inches of aggregate screenings for bedding on the trench bottom. After copper water service tube has been laid, the service line shall be covered by hand with aggregate screenings. Backfilling of the trench shall commence after covering the copper service line with at least 6 inches of material.
- G. Curbstops, valves and meter pits shall be located and installed as indicated on the Detail Drawings and the Drawings. No curb box or meter pit may be located in sidewalk or in a driveway.
- H. The service line from the main to the curbstop, and to the meter pit if applicable, shall be installed perpendicular to the main and in a straight line. Service lines shall be located to run in a straight line as near possible from the corporation stop or tapping sleeve to the building.
- I. Copper service lines shall be continuous without any joints between the main and curbstop, and curbstop and meter pit if applicable. Any joints in copper service lines between the curbstop and the building necessitate a meter pit at the property or right-of-way line, and such joints shall be made with a Ford C44 pack-Joint (CTS) three-part compression coupling.
- J. Tapping of new distribution mains, and installation of any service line to the curb stop shall be done only after the new main and appurtenances have been hydrostatically pressure tested, disinfected and approved by the Engineer for use and service.
- K. All tapping of water distribution mains shall be performed only by personnel of the Authority or its authorized subcontractor.

- L. Upon completion of installation of any water service pipe, the entire service or portion completed shall be filled with water from the Authority's main and then pressure tested as follows:
1. All copper services from the main to the curb stop shall be tested prior to backfilling, and visually examined for leakage under normal operating pressure of the distribution main.
 2. Ductile iron service lines shall be pressure tested as specified in Section 4.04. The entire service from the main to inside the building shall be tested, including any appurtenances and the meter pit if applicable, under a minimum hydrostatic pressure of 150 psi, except services for fire protection shall be tested at 200 psi minimum pressure.
- M. Service lines constructed of ductile iron pipe to supply potable water for domestic purposes and/or fire protection shall be disinfected in accordance with Sections 4.05 and 4.06 of these Specifications.
- N. No water service may be turned-on by any unauthorized person(s) or the Contractor, until the testing specified herein has been approved by the Authority and the meter(s) installed by Authority personnel.

SECTION V - EROSION AND SEDIMENTATION CONTROL

5.01 GENERAL.

- A. Throughout the project, the Contractor shall contain all excavation, fills, backfills, hauling, grading, etc., in such a manner as to prevent erosion of excavated materials. The Contractor shall be responsible for controlling all erosion and sedimentation for all areas disturbed during the construction of this project. The Contractor shall adhere to rules and regulations of the Department of Environmental Protection and the Bucks County Conservation District for the control of erosion and sedimentation.
- B. The contractor shall follow the AConstruction Sequence and Earth Disturbance Activities@ shown on the Drawings. All erosion control measures and facilities must be maintained by the Contractor for the duration of the project.
- C. The Contractor shall be responsible for the proper construction, stabilization, and maintenance of all temporary and permanent erosion and sedimentation controls for the duration of the project. Should such controls be found to be inadequate by the Authority, the Department of Environmental Protection or the Bucks County Conservation District, the Contractor shall perform immediate corrective and remedial work. The Contractor shall also be responsible for the payment of any, and all, fees, fines or penalties resulting from the failure of the Contractor to properly control erosion and sedimentation.
- D. The governing Pennsylvania Fish and Boat Commission Regional Field Office Supervisor and the Bucks County Conservation District must be notified by the Contractor a minimum of 10 days prior to the start of work as to when the project will start, when explosives are to be used, and when the project is completed for final inspection.

5.02 CONTROL MEASURES - GENERAL.

- A. All construction activities pertaining to earthmoving shall be performed in a manner that will minimize erosion.
- B. Silt fence shall be placed by the Contractor, as indicated on the Drawings and/or directed by the Engineer, to control sediment from migrating to adjacent areas or entering waterways. The silt fence must be located within the project property, construction easement, or right-of-way and staked as per the Drawings.
- C. All disturbed areas must be stabilized immediately.
- D. Topsoil shall be stripped from any area to be regraded and shall be stockpiled next to the trench and protected by a fabric filter silt fence.

- E. Every effort shall be made to limit the disturbed area to the actual excavation area. Adjacent areas shall be protected by the installation of fabric filter silt fence which shall cause sediment to drop out of suspension in water runoff.
- F. All trench excavation material must be placed up-slope of the trench opening.
- G. During the backfilling procedure of unimproved areas, the topsoil shall be placed back in the top of the excavation and the disturbed areas shall be regraded to pre-construction and/or finished elevations, as indicated on the Drawings, and seeded in accordance with the requirements of Section VI of these Specifications, and as shown on the Drawings.
- H. During non-growing seasons, all disturbed areas shall be mulched or otherwise stabilized until the next growing season. The Contractor shall then return and reseed the area.

5.03 DRAINAGE DITCH CROSSINGS.

- A. Siltation control shall be provided at all drainage ditch crossings.
- B. All excess material and debris removed from the ditch bed during construction must be removed, disposed of, and not remain in the drainage area, as designated by the Engineer.
- C. Rock filters are to be placed downstream of all drainage ditch crossings by the Contractor, as directed by the Engineer. These filters are to be constructed as per the Drawings, and are to be maintained by the contractor for the duration of the project.
- D. The Contractor must begin the backfilling operation immediately upon completion of the pipe installation, as determined by the Engineer. The backfilling operation shall be performed so as to avoid the formation of a permanent ridge in the ditch bed. After backfilling is complete, the Contractor shall remove all excess material and debris from the ditch bed.
- E. Construction of the drainage ditch crossings shall be completed in one operation. The Contractor may not start another operation until the ditch crossing is completed and the ditch bed restored, unless otherwise approved by the Engineer.
- F. The Contractor is responsible for dewatering the trenches throughout the construction of all drainage ditch crossings.
- G. The drainage ditch crossings are to be constructed by the contractor.
- H. The rock filters and all filter material shall be removed upon completion of the and disposed of by the Contractor. The ditch bed is to be returned to its original condition and the banks stabilized with the sowing of grass seed when construction is completed.

5.04 STREAM CROSSINGS.

- A. The Contractor shall maintain a stream buffer area which shall extend 50 feet from the stream banks. All clearing operations, sod disturbance, excavation, and equipment traffic shall be minimized within the buffer areas. Activities, such as stacking cut logs, storing material, welding, and refueling and maintenance of construction equipment, shall not be permitted within the buffer area.
- B. Streambed shall not be used as a roadway by the Contractor for moving any equipment and vehicles from one site to another. Temporary stream crossing must be constructed for such crossings, as per the details on the Contract Drawings.
- C. Siltation control shall be provided by the Contractor at all stream crossings.
- D. All excess material and debris removed from the streambed during construction must be removed, disposed of, and not remain in the stream buffer area as designated by the Engineer.
- E. Temporary stream crossing facilities must be constructed by the Contractor prior to the start of construction on any stream crossing. These are to be constructed, as per the Drawings, at the location indicated on said Drawings.
- F. The Contractor must start the backfilling operation once the concrete has sufficiently set, as determined by the Engineer. The backfilling shall be performed so as to avoid the formation of a permanent ridge in the streambed. After backfilling is complete, the Contractor shall remove all excess material and debris from the streambed.
- G. Construction of the stream crossings shall be completed in one operation. The Contractor may not start another operation until the stream crossing is completed, the streambed restored, and the temporary crossing facilities removed, unless otherwise approved by the Engineer.
- H. The Contractor is responsible for dewatering the trenches and the temporary dam enclosures throughout the construction of all stream crossings.
- I. All temporary stream crossings must be removed immediately upon completion of construction. This includes all dams, pipes, fill material, dewatering facilities, etc. The streambed is to be returned to its original condition and the banks stabilized with the sowing of grass seed when construction is completed.

5.05 REMOVAL OF EROSION AND SEDIMENTATION CONTROLS.

- A. The supplying, installing, maintaining, and removing of all erosion and sedimentation controls are the responsibility of the Contractor.

- B. All areas disturbed due to the removal of these controls must be stabilized by the Contractor to reduce erosion. These areas are to be maintained by the Contractor until adequate vegetation is established.

SECTION VI - RESTORATION

6.01 GENERAL

Restoration shall include all paved and unimproved areas. The Contractor is responsible and liable for all restoration, as described in the Construction Specifications and on the Drawings, and the replacement, repair, and restoration of any item damaged by the Contractor while performing the work.

All existing features, such as fences, guide rails, mailboxes, signs, etc., which were removed by the Contractor, must be put back in their original location, provided they were not damaged by the Contractor. If damaged by the contractor, they must be replaced in kind.

6.02 STREET RESTORATION

- A. All pavements, road surfaces, or driveways which the Contractor is required to replace shall be reconstructed in accordance with the Drawings.

The Engineer shall make an examination of all surfaces where pipelines have been constructed and shall note any depressions due to breakage, settlements, washouts, or other causes that may be attributed to the construction.

Upon written order from the Engineer, the Contractor shall repair breaks, refill depressions, remove any surplus material that has previously been left upon the trenches, or make other repairs or replacements which are necessary to place all the work in first class condition.

Materials used in replacing roadways, driveways, and gutters shall be at least equal to the same quality as those in the original construction or as called for herein. Before use, samples of all materials shall be submitted to the Engineer for testing, and no material shall be used until approved. Finishes shall match existing surfaces where required.

B. REMOVAL AND PROTECTION OF PAVEMENT

1. General. Unless otherwise specified or required by the Engineer, street, roadway, or shoulder pavement shall be cut to neat lines equidistant from the centerline of the trench using equipment suitable for such work and the edges of the pavement shall be protected and maintained by the Contractor until the repaving is completed. If the pavement edges are not maintained to the satisfaction of the Engineer, the pavement shall be re-cut when the repaving is done, and the extra width of pavement removed and repaving thereby made necessary shall be done by the Contractor, at his own expense.

All street, roadway, and shoulder pavement shall be cut by a mechanical saw.

The Contractor shall also protect the paved surfaces outside of the pavement removal and overlay limits and shall repair, at his own expense, all damage done thereto as a result of his operations.

In case the Contractor removes or disturbs the paving for a greater width than those stated hereinafter in Paragraphs (2) and (3), or in case he removes or disturbs any paving because of settlement, slides, blasting or cave-ins or in making excavation outside the lines of work without the written authorization of the Engineer, the Authority will require the Contractor to replace all such pavement removed or disturbed without compensation.

2. State Highways

a) General: Except as otherwise specified hereinafter or as otherwise approved by the Engineer, the street, roadway, and shoulder pavement (both base and surface courses) shall be removed for a width not to exceed the Allowable maximum trench width, @ as specified in Section 3.07.b of these Specifications, plus 2 feet and not less than 1 foot on each side of the trench excavation, except where the street roadway or shoulder paving consists of a concrete base course and a bituminous surface course, in which case, the bituminous surface course shall be removed for a width not to exceed the Allowable maximum trench width @ plus 3 feet and not less than 1'-6" on each side of the trench excavation.

b) Milling: The bituminous roadway and shoulder pavement surface shall be milled to a depth of 12 inches for the lengths and widths, as shown on the Drawings. All milling operations shall conform to Pennsylvania Department of Transportation Specifications, Section 491 of Publication 408. The milling shall be performed by an approved milling machine and all milled material shall be disposed of in a manner satisfactory to the Engineer. Care shall be taken when milling along existing curb and around existing drainage and utility facilities. Unless otherwise authorized by the Engineer, the milling operation shall not be performed until immediately prior to the permanent pavement restoration.

3. Paved Streets, Roads and Driveways, Other Than State Highways. The street, roadway, pavement (both base and surface courses) on paved streets, other than State highways, and on paved driveways, shall be removed for a width not to exceed the Allowable maximum trench widths, @ as specified in Section 3.07.b of these Specifications, plus 2 feet and not less than 1 foot on each side of the trench excavation. Milling of paved surfaces other than State highways shall be performed in accordance with Section 6.02.B.2(b) herein.

C. REPLACEMENT OF PAVEMENT

1. General. The work of this section shall be performed after the trenches for any run of pipe have been acceptably backfilled.

Construction methods used for repaving or overlay of roadways and shoulders of all streets which may be under the control or jurisdiction of the Pennsylvania Department of Transportation shall, in addition to the requirements specified herein, conform to the current specifications and special requirements of that Department. On all other streets and paved driveways where either repaving or restoration is required, the construction methods used shall be as specified herein, or as required by the Engineer.

Prior to the permanent replacement of pavement, representatives of the Authority, Engineer and Pennsylvania Department of Transportation shall make a determination as to the suitability of the permanent pavement replacement specified herein. In the event that the Pennsylvania Department of Transportation or the municipality having jurisdiction requires a greater thickness or different type of either base or surface or both for permanent replacement of pavement, other than those specified herein, the applicable unit price bid for permanent replacement pavement will be adjusted as provided in Articles 10 and 11 of the AGeneral Conditions@ Section of the Contract Documents.

The placing of bituminous material for base and surface courses of permanent pavement replacement shall terminate between October 15 and October 31 and shall not be resumed prior to April 1 and April 15 as determined by the Engineer, depending upon weather conditions. Bituminous material for base and surface courses of permanent pavement replacement shall not be placed when the air temperature is 40°F. or lower, as determined by the Engineer.

At joints between existing pavements and repaving work, the edges of existing pavements shall be cut back parallel with the trench and at right angles, neatly trimmed and as approved by the Engineer. An application of Class AC-20 asphalt cement, conforming to the Commonwealth of Pennsylvania Department of Transportation Specifications, Section 471 from Publication 408, shall be provided at all locations where new bituminous pavement joins existing bituminous pavement. The edges of all new bituminous pavement shall be made flush with the existing adjacent pavement.

Backfilling of trenches and the preparation of subgrades shall conform to the requirements of Section III of these Specifications.

The minimum requirements for temporary and permanent replacement pavement shall be as specified hereinafter.

2. Temporary Pavement. The Contractor shall continuously maintain temporary pavement over trench backfill areas, as per Section 3.13 of these Specifications, without additional compensation, until it is replaced with permanent pavement.
- a) State Highways and Township roads. On paved roadways and shoulders of State highways and Township roads, provide ID-2 binder course temporary pavement over all areas where the pavement has been removed. The bituminous material of the temporary pavement shall be properly cured, after which it shall be placed and compacted. The temporary pavement shall have a minimum thickness after compaction of 2 inches, and the top surface thereof shall be flush with the surface of the adjacent pavement.
 - b) Paved Streets, Roads and Driveways, Other Than State Highways or Township roads. Unless otherwise specified, on all paved roadways or streets and paved driveways, after the trenches have been acceptably backfilled, the Contractor shall provide, over all areas where the existing pavement has been removed, a temporary pavement conforming to the requirements specified herein. The temporary pavement shall have a minimum thickness after compaction of 2 inches, and the top surface thereof shall be flush with the surface of the adjacent paving. All costs in connection therewith shall be included as part of the applicable work and cost for permanent replacement pavement.
 - c) The temporary paving shall be placed immediately after the trenches are properly backfilled. If ID-2 bituminous binder pavement material is seasonally unavailable, the Contractor may substitute, with approval from the Engineer, Type 2P bituminous stockpile patching material for temporary pavement.

3. Permanent Pavement

- a) State Highways and Paved Township Streets. The Contractor shall notify the Engineer, in writing, a minimum of seven days prior to the placement of permanent pavement of State highways. The specified thicknesses of replacement paving are the compacted thicknesses. The minimum requirements for permanent replacement pavement to be provided where the existing pavement has been removed shall be as specified in the Pennsylvania Department of Transportation Specifications, Publication 408, and as shown on the Drawings.

The permanent replacement pavement shall consist of a 5 inch thick bituminous concrete base course, a 2 inch thick bituminous concrete binder course ID-2 and a 12 inch thick bituminous wearing course ID-2.

Upon completion of the base and binder course installation, half of the roadway width, as shown on the Drawings, shall be milled 12 inches to allow for the placement of a wearing course overlay. Permanent replacement pavement for overlay areas shall consist of ID-2 wearing course placed for a compacted thickness of 12 inches.

Following completion of the trench restoration in all required overlay areas and the previously milled areas as shown on the Drawings, up to, and including, the 2 inch thick bituminous concrete binder course ID-2, a 12 inch thick bituminous pavement overlay wearing course ID-2 shall be placed. The pavement overlay course shall be made flush with any existing adjacent pavement. Prior to the placement of the overlay pavement, pavement, the existing pavement surfaces shall be conditioned and treated with a bituminous tack coat application conforming to Pennsylvania Department of Transportation Specifications, Section 460, of Publication 408.

6.03 RESTORATION OF UNIMPROVED AREAS AND LANDSCAPING

A. GENERAL

The Contractor shall, in the preparation of the site, provide adequate protection for all lawns, trees, shrubs, and landscaped work that are to remain in place or shall remove and preserve all topsoil within areas in which the lawns cannot be protected. Such protection or preservation shall be maintained so long as necessary to prevent damage or deterioration due to the operations of the Contractor.

All landscaped work and topsoil that must be removed shall be stored and protected and replanted or relaid following backfill and compaction of the excavated areas, provided it is suitable for reuse. If such material is not suitable, it must be replaced.

All areas other than traveled roads and landscaped areas that are disturbed shall be graded and a temporary ground cover of rye grass planted, as shown on the Drawings, so that erosion of said areas is kept to a minimum until natural vegetation flourishes and predominates.

B. LAWNS AND/OR EASEMENT AREAS

1. All lawns and/or easement areas which are damaged due to the execution of this work shall be replaced in accordance with these instructions. The specific requirements for restoration of any lawn and/or easement area shall be as indicated on the Drawings, and shall be performed in accordance with the requirements of this specification section.

The sowing of seed shall be done only within the seasons extending from September 1st to October 15th and from April 15th to June 1st, except at such times therein as the Engineer may deem inadvisable because of weather or other conditions, and except as otherwise specified. In the event that seasonal and other conditions permit, and upon approval of the Engineer, seeding may start earlier and/or be continued later than the specified date. The sowing of seed shall be started on all areas during the first planting season after the areas have been released to the Contractor for lawn operations.

The preparation of lawn and/or easement areas shall not start until immediately preceding the season for seeding, except that topsoil may be spread at the option of the Contractor, provided that it be thoroughly loosened for its full depth and brought to a pliable mellow condition before the seed is placed.

2. All topsoil that was removed and preserved prior to excavation shall be used for lawns and planting, provided it is suitable for such use. Any additional topsoil to be furnished shall be fertile, friable, natural topsoil, typical of topsoil of the locality. It shall be free from stones, without admixture or subsoil, plants, or roots, sticks or other extraneous matter, and shall not be used for planting operations while in a muddy or frozen condition.

The topsoil shall be spread and brought to the finished grade, then leveled through the use of straight edges and finally rolled, but not compacted, the topsoil to have a depth of not less than 6 inches after final rolling. The surface shall be rolled with a 200 pound roller. The surfaces, when finished and settled, shall conform to the finished grade and shall be free of hollows or other inequalities and from stones, sticks and other debris. The topsoil requirements shall apply to seeding and sod work.

3. The Contractor shall apply limestone and commercial fertilizer, at the rates shown on the Contract Drawings. The commercial fertilizer shall bear the manufacturer's guaranteed statement of analysis and contain at least 16% available phosphoric acid, and contain at least 4% total ash. The super-phosphate shall have a minimum guaranteed analysis of 20% available phosphoric acid. Commercial fertilizer bearing the trade name "Scotts Turf Builder," or approved equal, shall also be approved under these Specifications.

The fertilizer shall be thoroughly incorporated into the top 3 to 5 inches of topsoil at least 2 days prior to seeding.

4. A seed mixture of 20% Perennial Rye, 30% Red Fescue and 50% Kentucky Bluegrass shall be sown evenly at the rate of 7 pounds to 1,000 square feet of disturbed area, one-half sown in one direction and the balance in quarterly direction, and shall be lightly rolled into the surface. The area shall then be lightly

rolled once and thoroughly watered with a fine spray. Care shall be taken that the seed is not washed out.

All area with grades exceeding a slope of 4:1 shall be replanted with Crown Vetch and Rye Grass. A seed mixture of 50% Crown Vetch and 50% Perennial Rye Grass shall be sown evenly at a rate of 10 pounds to 1,000 square feet of disturbed slope area, one-half sown in one direction and the balance in a quarterly direction, and shall be lightly rolled once and thoroughly watered with a fine spray. Care shall be taken that the seed is not washed out. The slope shall then be protected with an erosion control blanket. The erosion control blanket shall be "North American Green SC150BN," or approved equal, for slopes of 4:1 to 2:1 and "North American Green C125BN," or approved equal, for slopes exceeding 2:1.

No seeding shall be permitted after rain unless the surface of the ground is loosened, nor when the velocity of the wind exceeds a gentle breeze of about 5 miles per hour. Extreme care shall be exercised during the seeding and raking, so that no change in grade is made and so that the seed is not raked from one spot to another. All seeded areas shall be mulched with a light covering of weed-free straw, hay or unrotted salt hay, in the amount of 140 pounds per 1,000 square feet, but all sloped areas shall be covered with cheesecloth or muslin laid in a continuous surface, properly supported in place, or erosion control blanket as required above.

C. MAINTENANCE

Maintenance includes watering of seeded area, cultivation, weeding, mowing, spraying, cleaning up, and edging. The Contractor will be responsible for the maintenance of the landscape work during the period while the landscape work is being done and until the work has been completed and accepted by the Authority.

1. Seeded Area.

- a) Keep the seed moist at all times for proper germination, and water when necessary to prevent drying out of burning of lawns.
- b) Reseed all areas which do not show a prompt catch of grass. Repeat until a complete coverage is obtained. Any depressions or irregularities in the surface shall be leveled off and reseeded.
- c) Do all necessary weeding.
- d) Seeded areas which become damaged by the Contractor=s operation shall be promptly regarded, limed, fertilized, and reseeded, as originally required.
- e) Lawns shall be cut at required intervals to maintain the grass at a maximum height of 2 1/2 inches.

2. Mulch. Furnish and apply all mulch necessary to produce a satisfactory growing condition.

D. COMPLETION

Final restoration of all unimproved areas shall not be considered complete, until all required landscaping has been replaced, a uniform perennial grass ground cover, planted in accordance with these Specifications, to a minimum depth 12 inches, has been established on all lawn and/or easement area and natural vegetation flourishes and predominates in all remaining disturbed areas.

6.04 ADJACENT AREAS

All areas adjacent to the disturbed areas of work shall be cleaned of all rubbish, debris and other materials, following the completion of the lawn and planting work.

6.05 CLEANUP

The Contractor shall clean up the project site and remove all surplus pipe materials, blocking and banding, excavated materials, bedding and backfill materials, cut trees and brush, broken pieces of pavement and concrete, rubbish and debris, etc. and shall be properly disposed of by the Contractor. All temporary structures shall be removed by the Contractor, and any areas of access shall be regraded as necessary and restored to their original condition prior to construction.

All cleanup work shall be completed to the satisfaction of the Authority.

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