

**STRASBURG BOROUGH  
AUTHORITY**

**WATER/SEWER  
SPECIFICATIONS**

**APRIL 2022**

# **STRASBURG BOROUGH AUTHORITY**

## **WATER/SEWER SPECIFICATIONS**

**March 2022**

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**SECTION 1 – CONSTRUCTION SUBMITTALS****PART 1 – GENERAL****1.01 SECTION INCLUDES**

- A. Submittal procedures.
- B. Construction progress schedules.
- C. Proposed products list.
- D. Shop drawings.
- E. Product data.
- F. Manufacturers' instructions.
- G. Shop Drawing Work.

**1.02 SUBMITTAL PROCEDURES**

- A. For a complete list of items required prior to construction, refer to the "Strasburg Borough Authority Capacity, Design, & Construction Approval Process Policy."
- B. When requested by AUTHORITY, submit three copies of complete schedule of all anticipated submittal dates.
- C. Transmit each submittal to AUTHORITY in accordance with schedule.
- D. Sequentially number the transmittals. Resubmittals to have original number with an alphabetic suffix.
- E. Identify Project, subCONTRACTOR or supplier; pertinent Drawing sheet and detail number(s), and specification Section number, as appropriate.
- F. Apply Design Consultant's stamp, signed or initialed certifying that review, verification of products required, field dimensions, adjacent construction work, and coordination of information, is in accordance with the requirements of the work. Submittals not containing Design Consultant's stamp shall be returned.
- G. Schedule submittals to expedite the Project and deliver to AUTHORITY. Coordinate submission of related items.
- H. Identify variations from Drawings and Product or system limitations which may be detrimental to successful performance of the completed Work.

- I. Revise and resubmit submittals as required, clearly identify all changes made since previous submittal.
- J. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

### 1.03 ACTION ON CONSTRUCTION SUBMITTALS

- A. AUTHORITY's Action: Where action and return is required or requested, AUTHORITY will review each submittal, mark with the action taken and return within a reasonable time period. Where submittal must be held for coordination, Design Consultant will be so advised by AUTHORITY.
- B. Submittals returned with "REVIEWED" action indicates that the information submitted was found to be in conformance with the design concept and in compliance with the requirements of the Drawings. DEVELOPER may proceed with performance of the work covered by the submittal.
- C. Submittals returned with "REVIEWED AS NOTED" action indicates that the information submitted was found to be in conformance with the design concept and in compliance with the requirements of the Drawings, provided the noted clarifications or corrections are completed. Submission of a corrected submittal indicating the changes noted by AUTHORITY is not required. DEVELOPER may proceed with performance of the work covered by the submittal.
- D. Submittals returned with "REVISE AND RESUBMIT" action indicate that: (1) information submitted is at least partially not in conformance with these Requirements, (2) information submitted is at least partially not in compliance with the Requirements, (3) submittal is incomplete and does not include all items required by the individual specification Sections, or (4) certifications or computations required by the individual specification Sections have not been included in the submittal. Submittal will be returned to Design Consultant noting the reasons for noncompliance. DEVELOPER shall not proceed with the performance of the work covered by submittal until corrected information is submitted and approved.
- E. Submittals returned with "NOT APPROVED" action indicates that AUTHORITY interprets the information submitted to be not in conformance with the design concept or not in compliance with these Requirements. Performance of the work shall not proceed until submittal is revised, resubmitted and reviewed.

**1.04 CONSTRUCTION PROGRESS SCHEDULES**

- A. If required by AUTHORITY, submit one copy of initial progress schedule to AUTHORITY for review and comment. Submit revisions when requested by the AUTHORITY, to reflect changes to the initially submitted schedule.

**1.05 PROPOSED PRODUCTS LIST**

- A. If requested by AUTHORITY, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product. Submit number of copies DEVELOPER requires, one copy to be retained by AUTHORITY, and an electronic copy for review by the AUTHORITY ENGINEER.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

**1.06 SHOP DRAWINGS**

- A. Submit the number of opaque reproductions which DEVELOPER requires, one copy which will be retained by AUTHORITY, and an electronic copy for review by the AUTHORITY ENGINEER. Each shop drawing must be marked with the name of the project and numbered consecutively.
- B. All work which is related to shop drawing approval shall not be initiated until approved shop drawings have been received from AUTHORITY.
- C. All work initiated by DEVELOPER prior to receipt of approved shop drawings shall be at the sole risk of DEVELOPER. Any and all rework, modifications or reinstallations necessitated by changes in the Work due to changes required by subsequently approved shop drawings will be done by DEVELOPER.

**1.07 MANUFACTURER'S INSTRUCTIONS**

- A. When specified in individual specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.
- B. Identify conflicts between manufacturers' instructions and Drawings.

**END OF SECTION**



**SECTION 2 – TRENCHING, BACKFILLING AND COMPACTION****PART 1 – GENERAL****1.01 SECTION INCLUDES**

- A. Excavating trenches for utilities.
- B. Backfilling and compaction.

**1.02 RELATED WORK**

- A. Boring and Jacking.

**1.03 REFERENCES**

- A. American Association of State Highway and Transportation Officials:
  - 1. AASHTO T 99, Standard Method of Test for Moisture-Density Relations of Soils Using a 5.5-lb. Rammer and a 12-inch Drop, most recent edition.
  - 2. AASHTO T 191, Standard Method of Test for Density of Soil In-Place by the Sand Cone Method, most recent edition.
- B. American Society for Testing and Materials:
  - 1. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort, most recent edition.
  - 2. ASTM D2167 – Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method, most recent edition.
  - 3. ASTM D2321 – Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe, most recent edition.
  - 4. ASTM D6938 – Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth), most recent edition.
- C. Occupational Safety and Health Administration:
  - 1. OSHA 29 CFR, Part 1926, Subpart P, Construction Standards for Excavation

- D. Commonwealth of Pennsylvania Department of Transportation (PennDOT)
  - 1. Publication 408 – Specifications
    - a. PDT Section 703 Aggregates.
- E. State Code: Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Transportation, Department of Transportation, Chapter 459, Occupancy of highways by Utilities, as supplemented or revised (Penn DOT Chapter 459).
- F. State Publication: Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Transportation, Department of Transportation, Chapter 203, Work Zone Traffic Control (Penn DOT Chapter 203).
- G. Strasburg Borough
  - 1. Roadway Requirements
  - 2. Blasting Requirements
- H. Strasburg Township
  - 1. Roadway Requirements
  - 2. Blasting Requirements

#### 1.04 DEFINITION

- A. Definitions:
  - 1. Subgrade: Trench bottom prepared as specified to receive pipe bedding, concrete cradle or concrete encasement of the bottom of excavations prepared to receive pipeline structures.
  - 2. Utility: Any buried pipe, duct, conduit, or cable
  - 3. Final Restoration Elevation: Elevation of bottom of final restoration operation such as bottom of topsoil depth or paving Subgrade.

#### 1.05 REGULATORY REQUIREMENTS

- 1. Work performed within State Highway rights-of-way shall be completed according to Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Department of Transportation, Chapter 459, Occupancy of Highways by Utilities and if applicable, the PennDOT Highway Occupancy Permit

secured by DEVELOPER. Work within the State Highway rights-of-ways shall be subject to inspection by representatives of PennDOT.

2. Work performed within Borough rights-of-way shall be completed according to Strasburg Borough's requirements.

#### 1.06 PROJECT CONDITIONS

##### A. Removal of Obstructions:

1. Remove, realign, or change the direction of above or below ground utilities and their appurtenant supports, if such is required in the opinion of AUTHORITY. Perform such work unless such work is done by the owner of the obstruction. However, uncover and sustain the obstruction at own expense prior to the final disposition of obstruction. Additional precautions concerning obstructions are as follows:
  - a. Do not interfere with persons, firms, corporations, or utilities employing protective measures, removing, changing, or replacing their property or structures, but allow said persons, firms, corporations or utilities to take such measures as they may consider necessary or advisable under the circumstances.
  - b. Break through and reconstruct, if necessary, the invert or arch of a sewer, culvert or conduit that may be encountered if the said structure is in such a position, in the judgment of AUTHORITY, as not to require its removal, realignment or complete reconstruction.

##### B. Environmental Requirements:

1. Do not perform trenching, backfilling or compacting when weather conditions or the condition of materials are such, in the opinion of AUTHORITY, that work cannot be performed satisfactorily.
2. Do not use frozen materials as backfill or wet materials containing moisture in excess of the amount necessary for satisfactory compaction.
3. Prior to use, moisten dry backfill material not having sufficient moisture to obtain satisfactory placement or compaction.
4. Plan work to provide adequate protection during storms with provisions available for preventing flood damage. Protect installed piping and other work against damage from uplift due to high ground water levels.

5. Accommodation of Drainage: Keep gutters, sewers, drains, and ditches open for surface drainage. No damming or ponding or water in gutters or other waterways will be permitted, except through approved pipes or properly constructed troughs. When so required, provide pipes or troughs of such sizes and lengths as required, and place the same as required. Perform grading in the vicinity of trenches so that the ground surface is properly pitched to prevent water running into the trenches.
  6. Pumping: Keep excavations free from standing water. Build dams and other devices necessary for this purpose and provide and operate pumps of sufficient capacity for dewatering the excavations. Provide for the disposal of the water removed from excavations in such manner as not to cause injury to the public health, to public or private property, to the work of others, to the portion of the work completed or in progress or produce an Impediment to the use of streets, roads, and highways.
  7. When it is necessary to haul soft or wet soil material over roadways, use suitably tight vehicles to prevent spillage. Clear away spillage of materials caused by hauling on roadways.
  8. Provide effective dust control by sprinkling water, use of calcium chloride or other method approved by AUTHORITY. Employ dust control when, where and in a manner required by AUTHORITY.
  9. Do not dispose of water in trenches by draining through completed portions of the work.
- C. Protection: Assume the risks attending and presence or proximity of overhead or underground public utility and private lines, pipes, conduits and support work for same, existing structures and property of whatever nature. Damages and expenses for direct or indirect injury to such structures or to any person or property by reason of them or by reason of injury to them; whether such structures are or are not shown on the Drawings, rests solely with DEVELOPER.
1. Outside Rights-of-Way: Take necessary precautions to protect trees, shrubs, lawns, and such landscaping from damage. Complete restoration work for damaged areas.
  2. Pipe Supports: Adequately support underground pipes or conduits exposed as a result of excavations. Provide adequate support along their entire exposed length. Install such supports in such manner that backfilling may be performed without dislodging such pipes or conduits. Place and carefully compact Aggregate Backfill around the supports and leave such supports in place as a guard against breakage due to backfill settlement.

3. Temporary Protective Construction:
  - a. Temporary Fence Barricade: Erect and maintain substantial temporary fences surrounding excavation to prevent unauthorized persons from entering such areas.
  - b. Barricades: Furnish and erect substantial barricades at crossings of trenches, or along trenches, to protect the traveling public.
  - c. Cover open excavation when work therein is suspended or left unattended, including the end of a workday. For such covers, use materials of sufficient strength and weight to prevent their removal by unauthorized persons.
  - d. Remove temporary protective construction at the completion of work.
- D. Structure Supports: Where passing buildings or any structure which by their construction or position might bring a great pressure upon the trenches, the right reserved by AUTHORITY to require that such buildings or structures be underpinned or supported and protected, or special sheeting be driven or that short lengths of trench be opened at one time. Failure of AUTHORITY to recommend said protection shall not relieve DEVELOPER of his responsibility to protect structures near the construction.
- E. Accommodation of Traffic: Do not obstruct streets, roads, and highways unless Strasburg Borough authorized in writing the complete closing of the street, road, or highway. Employ such measures as may be necessary, including flag persons, to keep the street, road, or highway open and safe for traffic. Maintain a straight and continuous passageway on sidewalks and over crosswalks, at least three feet wide and free from obstructions. No to obstruct fire hydrants.
- F. Explosive and Blasting:
  1. Blasting will be permitted only in areas permitted by Strasburg Borough or Strasburg Township and where the proximity of structures, underground facilities or public safety does not preclude the use of explosives. Blasting must comply with Borough or Township regulations.
  2. The use of explosives shall be governed by the "Regulations for the Storage, Handling and the Use of Explosives" of the Pennsylvania Department of Labor and Industry and any other applicable federal, state, or local codes that may have jurisdiction.

3. All blasts shall be properly matted and securely covered. DEVELOPER shall be solely responsible for injury to persons or property located within or beyond the area or scope of the project that may result from use of explosives.
  4. Blasting work shall be supervised by personnel licensed and experienced in this type of work.
  5. Explosives shall be stored in state-approved magazine off the job site and shall be delivered to the site in vehicles clearly marked to indicate cargo.
  6. Blasting within State Highway and railroad rights-of-way is not permitted unless authorized by PennDOT or the railroad. DEVELOPER shall be responsible for securing required permits.
  7. Notify utilities having structures or other installations above or below ground in proximity to the trenching work prior to use of explosives. Such notice must be given sufficiently in advance to enable the utilities to take such steps as they may deem necessary to protect their property from injury. Such notice shall not relieve DEVELOPER of responsibility of damage resulting from his use of explosives. The right is reserved to direct that rock within five (5) feet of pipe, conduit or other structures encountered in the trench be removed by methods other than blasting.
  8. Cease blasting operations when street paving adjacent to trench is damaged. Repair damaged street paving. Submit to AUTHORITY methods to be used in subsequent blasting. Do not proceed with blasting without written approval of AUTHORITY on methods to be used in subsequent blasting.
- G. Removal of Rock by Means Other Than Blasting: Where removal of rock by means other than blasting is required, in accordance with the requirements of State and local laws, rules and regulations, and AUTHORITY requirements, remove by the use of mechanical surface impact equipment, or by drilling and hydraulic rock splitting equipment, or by other methods.
- H. Responsibility for Condition of Excavation: Condition and results of excavation are solely the responsibility of DEVELOPER. Remove slides and cave-ins at whatever time and under whatever circumstance they occur.
- I. Excess Materials: No right of property in materials is granted to DEVELOPER for materials excavated on lands not owned by DEVELOPER. This provision does not relieve DEVELOPER of his responsibility to remove and dispose of surplus excavated materials.

- J. Borrow Material: When the required quantity of backfill material exceeds the quantity of suitable on site material, provide borrow material. If borrow material is needed, notify AUTHORITY sufficiently in advance to permit AUTHORITY to verify such need and to view the proposed borrow pit to determine the material suitability. Borrow excavation will be subject to AUTHORITY approval whose written consent shall be obtained prior to its use. DEVELOPER shall be responsible for all sampling and testing required by AUTHORITY to determine suitability.
- K. Change of Trench Location or Depth: AUTHORITY reserves the right to change the location of a trench from that indicated on the Drawings due to the presence of an obstruction, or for other causes.
- L. Advance Trenching: Where existing utilities or other suspected underground obstructions as indicated on the Drawings are within close proximity of proposed pipelines, uncover and verify the exact location of utilities and other underground obstructions far enough in advance of pipe laying to allow any changes in pipe alignment or grade required to bypass the obstructions to avoid removing sections of pipe already installed. If any sections of installed pipe must be removed and reinstalled as a result of not verifying utilities or other underground obstructions far enough in advance, DEVELOPER shall remove and reinstall the pipe.

#### 1.07 FIELD MEASUREMENTS

- A. Verify that survey benchmark, control point, and intended elevations for the Work are shown on the Drawing.

### **PART 2 – PRODUCTS**

#### 2.01 FILL MATERIAL

- A. Earth Backfill: On site excavated soil or soil-rock mixed materials free of topsoil, vegetation, lumber, metal, and refuse; and free of rock or similar hard objects larger than six inches in greatest dimensions. Rock to soil ratio shall not exceed one part rock to three parts soil.
- B. Aggregate Backfill: PennDOT 2A Modified Aggregate conforming to PennDOT Publication 408, Section 703.
- C. Pipe Bedding and initial Backfill:
  - 1. Pipe Bedding: AASHTO No. 8 Coarse Aggregate conforming to PennDOT Publication 408, Section 703.2.
  - 2. Initial Backfill: AASHTO No. 8 Coarse Aggregate conforming to PennDOT Publication 408, Section 703.2.

3. Concrete Cradle and Encasement: PennDOT Publication 408, Section 704, Type A, a 28-day minimum mix design compressive strength of 3,300 psi.
- D. Unsuitable Bearing Replacement: AASHTO No. 3 Coarse Aggregate conforming to PennDOT Publication 408, Section 703.2
- E. Underground Warning Tape: Required for all pipe.
  1. Printed polyethylene tape, three inches minimum width, color coded, one-inch minimum lettering, printed with name of utility buried below, and suitable for installation in all soil types.
  2. Magnetic.
  3. Provide for:
    - a. Sewage force main – green
    - b. Gravity sewer/lateral – green
    - c. Water line/service – blue

### **PART 3 – EXECUTION**

#### **3.01 PREPARATION**

- A. Identify required lines, levels, contours, and datum locations.
- B. Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.
- C. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- D. Maintain and protect above and below grade utilities which are to remain.

#### **3.02 EXCAVATING**

- A. Perform sheeting and shoring according to OSHA Standards.
- B. Perform soil erosion and sedimentation control work according to Erosion and Sedimentation Control Plan approved by Lancaster County Soil Conservation Office.



C. General:

1. Excavation shall be performed to the lines and grades indicated on the Drawings or directed by AUTHORITY.
2. Perform excavation and backfilling using machinery except where hand excavation and backfilling is required or is necessary to protect existing structures, utilities, or other private or public properties.
3. Begin excavation in trenches for sewer lines at the control point having the lower invert and proceed upward.
4. Saw cut existing pavement. Remove pavement according to Strasburg Borough requirements.
5. Remove rock to Subgrade at least twenty-five (25) feet in advance of pipe laying.
6. Do not interfere with 45 degree bearing splay of foundations.

D. Subgrade Preparation:

1. Do not excavate below depths indicated or specified except where unsuitable material is encountered at Subgrade.
2. Remove unsuitable material found below Subgrade to a depth determined by AUTHORITY and backfill with suitable material or as directed by AUTHORITY to required Subgrade.
3. Remove rocks or other hard matter protruding through trench bottom at Subgrade which could damage pipe or impede consistent backfilling or compaction. Backfill with AASHTO No. 8 Coarse Aggregate to required Subgrade. Compact in four (4) inch lifts.
4. Remove rock below Subgrade if shattered due to excessive drilling impact or splitting operations and in the opinion of AUTHORITY it is unfit for foundations. Backfill to Subgrade with Concrete or other material acceptable to AUTHORITY.

E. Excavated Material Storage:

1. Separate and stockpile in designated area, excavated materials suitable for use as backfill. Remove from the site, excess materials, and excavated materials not suitable for backfill.

2. In no case shall excavated materials be stockpiled outside of the construction easements or the permanent right-of-way if construction easements are not in place.
3. In streets, roads, and highways or in any other locations where working space is limited, remove the excavated materials from the first 100 feet of any opening, when required by AUTHORITY, as soon as such is excavated; store and return same for backfilling when required. In no case will DEVELOPER be allowed to cast excavated material beyond the curb or right-of-way lines on sidewalks or lawns.
4. At all times keep excavated materials at least five (5) feet back from edge of trench to facilitate access.

F. Trench Width:

1. From Subgrade elevation to an elevation at least twelve (12) inches above the top of the outside barrel of the pipe, excavate trench banks to vertical lines and not less than the minimum or more than the maximum widths specified in Table A. If sheeting is required, the Table A dimensions apply to the inside face of sheeting.

Table A

Minimum Trench Width (outside diameter of pipe at the barrel plus)	Maximum Trench Width (outside diameter of pipe at the barrel plus)
12 inches	16 inches

2. From a point twelve (12) inches above at the top of the outside barrel of the pipe, maintain trench banks as follows:
  - a. Vertical as possible for trenches in paved or unpaved roadways, with a maximum of forty (40) inches.
  - b. In open areas, trenches may be sloped at angles required to make trench stand; however, in no case shall angle exceed one-half horizontal to one vertical.
  - c. Top of trench shall not exceed limits of right-of-way or construction easement if such is in place.
  - d. Maintain trenches such that there is no conflict with State or OSHA regulations.

G. Length of Open Trench:

1. Complete trench excavation at least twenty-five (25) feet but not more than one hundred (100) feet in advance of pipe laying and keep trenches free from obstructions, except that at the end of a workday or at the discontinuance of work, the pipe laying may be completed to within five (5) feet of the end of the open trench.
2. DEVELOPER shall limit all trench openings to a distance commensurate with all rules of safety.
3. If the work is stopped either totally or partially, DEVELOPER shall refill the trench and temporarily repave over the same. The trench shall not be opened until he is ready to proceed with the construction of the pipeline.
4. AUTHORITY reserves the right to request trench refilling over completed pipe if in AUTHORITY's judgment such action is necessary.

3.03 PIPE BEDDING

- A. Place Pipe Bedding and Initial Backfill as specified herein unless indicated otherwise on the Drawing. Place material in trench for full width. Place on each side of pipe and fittings simultaneously.
- B. Pipe Bedding: Carefully place on undisturbed Subgrade or compacted Subgrade as approved by AUTHORITY, Pipe Bedding material from six (6) inches below outside of pipe barrel to pipe springline. Work Pipe Bedding material by hand under pipe haunching to provide adequate side support. Place in three (3) inch layers (uncompacted).
- C. Initial Backfill: From pipe springline to twelve (12) inches above outside of pipe barrel carefully place initial Backfill in four (4) inch layers (uncompacted). Place carefully so as not to disturb pipe.

3.04 BACKFILL

- A. Backfill trenches to contours and elevations indicated on the Drawing.
- B. Maintain optimum moisture content of fill materials to attain required compaction density.
- C. Do not use frozen backfill materials or place backfill on frozen subgrades or trench subgrades.

- D. Perform backfilling by methods which will result in thorough compaction of backfill material.
- E. Backfill to Final Restoration Elevation: Backfill from one (1) foot above the top of pipe to Finished Restoration Elevation using backfill materials specified below. Consolidate backfill materials evenly from center to side of trench to prevent arching.
  - 1. Within the Right-Of-Way Limits of Existing State Highways: Backfill material as specified below unless stated otherwise in the approved PennDOT Highway Occupancy Permit.
    - a. Paved Areas: Aggregate Backfill compacted in four (4) inch layers to the bottom of the temporary or permanent paving.
    - b. Unpaved Shoulders: Aggregate Backfill compacted in four (4) inch layers to existing grade.
    - c. Unpaved Areas: Aggregate Backfill compacted in four (4) inch layers to bottom of topsoil. Replace topsoil to approximate depth of existing as final refill operation and crown to such height as required by AUTHORITY. Maintain crowned surface to the satisfaction of AUTHORITY, during the warranty period.
  - 2. Existing and Proposed Borough Roadways and Private Driveways: Aggregate backfill compacted in four (4) inch layers to bottom of temporary or permanent paving.
  - 3. Unpaved Shoulders of Proposed and existing Borough Streets: Backfill compacted in six (6) inch layers to a point six (6) inches below the adjacent existing surface. Refill the remaining six (6) inches with compacted Aggregate Backfill.
  - 4. Unimproved Streets: Aggregate Backfill compacted in eight (8) inch layers to within six (6) inches of existing grade. Refill the remaining six (6) inches with compacted PennDOT 2A Aggregate.
  - 5. Stone Driveways: Backfill compacted in eight (8) inch layers to within six (6) inches of existing grade. Refill the remaining six (6) inches with compacted PennDOT 2A Aggregate.
- F. If there is a deficiency of backfill material, provide borrow material as required.

### 3.05 COMPACTION

- A. Solidly tamp each layer of backfill around the pipeline and above pipeline using proper tamping tools made specifically for this purpose. Compact each layer to the densities specified using ASTM D698 Standard Proctor Test Methods determined at maximum density at optimum moisture content as determined by AASHTO T 99.
  - 1. Within the Right-of-Way limits of existing State Highways and Borough Roadways.
    - a. Paved Areas: 100%
    - b. Unpaved Areas: 90% (Up to bottom elevation of final restoration material)
  - 2. Other Areas
    - a. Paved Areas: 95%
    - b. Stone Driveways: 95%
    - c. Lawns, Fields: 90% (Up to bottom elevation of final restoration material)
- B. Do not use rolling equipment or heavy tampers to consolidate backfill until at least two (2) feet of backfill is placed over the top of the pipe.
- C. The use of HYDRA-HAMMER for compacting backfill in trenches is prohibited.
- D. The use of puddling or jetting for compacting backfill in trenches is prohibited.
- E. Compaction Tests: During the course of backfilling and compacting, AUTHORITY may at various locations and depths of trenches request that DEVELOPER make field tests to verify that specified compactions are being achieved. Perform field density tests according to AASHTO T 191.
- F. If compaction tests indicate that Work does not meet specified requirements, remove Work, replace, compact and retest.

### 3.06 STREAM CROSSINGS

- A. Excavate trenches in stream crossings to the depth shown on the Drawing or otherwise require by AUTHORITY.
- B. Material excavated may be used as backfill unless specifically prohibited by any governing agency having jurisdiction.

- C. Make all necessary provisions for cofferdaming, dewatering and removal of excess excavated material.
- D. Maintain the flow in the stream at all times.
- E. Where rock is encountered in the stream crossings, do not use forms to construct the concrete encasement; place concrete on firm rock below the pipe and against firm rock on both sides of the pipe to provide a firm bond between the encasement and the rock.
- F. Install concrete encasement to a minimum of ten (10) feet back from the top edges of the stream banks.
- G. Construct stream crossing according to permit issued for the crossing.

### 3.07 CLEAN-UP AND MAINTENANCE

- A. General: During construction, the surfaces of all areas including, but not limited to, roads, streets and driveways shall be maintained on a daily basis to produce a safe, desirable and convenient condition. Streets shall be swept and flushed after backfilling and recleaned as dust, mud, stones, and debris caused by the Work, or related to the Work again accumulates.
- B. Remove surplus excavated materials, rubbish, and other construction debris from the site after backfilling is completed.
- C. Construction site shall be left clean at end of each working day to satisfaction of AUTHORITY.

**END OF SECTION**

## SECTION 3 – BORING AND JACKING

### PART 1 – GENERAL

#### 1.01 SECTION INCLUDES

- A. Construction of bored or jacked crossings.

#### 1.02 RELATED WORK

- A. Section 4 – Pipe and Fittings

#### 1.03 REFERENCES

- A. American Society for Testing and Materials:
  - 1. ASTM A53, Pipe, Street, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - 2. ASTM A 153; Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- B. Commonwealth of Pennsylvania Department of Transportation (PennDOT)
  - 1. Publication 408 – Specifications
    - a. PDT Section 703 Aggregates.
- C. State Code: Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Transportation, Department of Transportation, Chapter 459, Occupancy of Highways by Utilities, as supplemented or revised (PennDOT Chapter 459).
- D. State Publication: Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Transportation, Department of Transportation, Chapter 203, Work Zone Traffic Control (PennDOT Chapter 203).

#### 1.04 REGULATORY AGENCY REQUIREMENTS

- A. DEVELOPER shall be responsible for complying with requirements of owner of crossing or right-of-way or entity having jurisdiction. Work shall not commence until the proper notice to proceed has been issued by said owner or entity.
- B. DEVELOPER shall be responsible for making application and obtaining all permits required to complete work from owner of crossing or right-of-way or entity having jurisdiction. DEVELOPER shall contact AUTHORITY for additional requirements if permit is required to be in the AUTHORITYS name.

- C. Work performed within PennDOT right-of-ways shall comply with Pennsylvania Code, Title 67, Chapter 459 – Occupancy of Highways by Utilities and PennDOT Publication 408.

#### 1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Transport, handle and store materials and Products specified herein in a manner recommended by the respective manufacturers of such to prevent damage and defects.

#### 1.06 PROJECT CONDITIONS

- A. DEVELOPER shall keep boring pits dewatered at all times. When water is known or expected to be encountered, pumps of sufficient capacity to handle the flow shall be maintained at the site. When dewatering, close observation shall be maintained to detect any settlement or displacement of roadway embankment.

### **PART 2 – PRODUCTS**

#### 2.01 STEEL CASING PIPE

- A. Unless required otherwise by owner of crossing or right-of-way or by entity having jurisdiction, the following specifications shall be adhered to:
- B. Steel Pipe: ASTM A 53, or ASTM A 139, Grade B
  - 1. 35,000 psi minimum yield strength
  - 2. Full circumference welded joints
  - 3. Asphalt coated
  - 4. Minimum Wall Thickness: .375 inch
  - 5. The steel casing pipe diameter shall be at least six (6) inches larger than the outside diameter of the pipe bell.

#### 2.02 CARRIER PIPE AND FITTINGS

- A. As specified in Section 4 – Pipe and Fittings unless required otherwise by owner of crossing or right-of-way or by entity having jurisdiction.



## 2.03 MISCELLANEOUS MATERIALS

- A. Casing Spacers: Use casing spacers to center and support carrier pipe inside casing pipe. Provide spacers by Cascade Waterworks Mfg. Co. Model CCS.
  - 1. Shell: 2-piece bolt on style, stainless steel, 14-gauge minimum thickness.
  - 2. Liner: Shell shall be lined with a ribbed PVC extrusion with retaining section that overlaps the edge of the shell and prevents slippage.
  - 3. Runners: Ultra high molecular weight (UHMW) polymer and shall be attached to risers. Runners shall have low coefficient of friction, high resistance to abrasion and sliding wear and low deflection under compression.
  - 4. Hardware: 304 stainless steel.
- B. End Seals: Provide end seals to wrap around casing and carrier pipes following installation to provide barrier to backfill and seepage. Seals shall be fabricated of 1/8" thick minimum synthetic rubber. Secure end seals to casing using 304 stainless steel straps with worm mechanism for tightening. End seals shall be by Cascade Waterworks Mfg. Co. Model CCES.
- C. Grout (Sand/Cement)
  - 1. Portland Cement: ASTM C 150 Type II.
  - 2. Sand: ASTM C 33, fine aggregate.
  - 3. Water: Portable.
  - 4. Grout Quality: Mixture of one part Portland Cement, three parts fine aggregate and water.
- D. Sand: ASTM C 33, fine aggregate.

## PART 3 – EXECUTION

### 3.01 PREPARATION

- A. Trenching: Excavate approach cased crossings, pits and trenches using methods specified in Section 2 – Trenching, Backfilling and Compaction.
- B. Brace and Shore trenches to comply with OSHA requirements.

### 3.02 BORING

- A. Push the pipe into the fill with a boring auger rotating within the pipe to remove the soil. When augers, or similar devices are used for pipe emplacement, the front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger and cutting head from leading the pipe so that there will be no unsupported excavation ahead of the pipe. The auger and cutting head arrangements shall be removable from within the pipe in the event an obstruction is encountered.
- B. The over-cut by the cutting head shall not exceed the outside diameter of the pipe by more than one-half inch. The face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft or poor material.
- C. The use of water or other liquids to facilitate casing emplacement and soil removal is prohibited.
- D. Any method which employs simultaneous boring and jacking or drilling and jacking for pipes over eight (8) inches in diameter which does not have the above approved arrangement will not be permitted. For pipes eight (8) inches and less in diameter, auguring or boring without this arrangement may be considered for use only as approved by AUTHORITY.

### 3.03 JACKING

- A. Jacking shall be conducted without hand mining ahead of the pipe and without the use of any type of boring, auguring, or drilling equipment.
- B. Bracing and backstops shall be so designed and jacks of sufficient rating used to that the jacking can be progressed without stoppage except for adding lengths of pipe.
- C. Accurately place guide timbers on line and grade.
- D. The vertical face of the excavation shall be supported as necessary to prevent sloughing.
- E. Use poling boards and bulkheads as required if subgrade conditions in the heading are unstable.
- F. Jacking and excavation within the pipe shall proceed simultaneously with the ground being cut no more than two (2) inches above subgrade at the bottom.
- G. The use of water or other liquids to facilitate casing placement and spoil removal is prohibited.

- H. If voids develop or if jacked hole diameter is more than one (1) inch greater than the outside diameter of the encasing conduit place grout to fill voids in manner approved by the regulatory agencies.
- I. Check conduit alignment in a manner and at times required by AUTHORITY. Check alignment and grade at least once per shift as the work progresses.
- J. Completely bulkhead heading at interruptions in jacking operation.
- K. Completely weld joints around the circumference between sections of steel pipe encasing.

#### 3.04 INSTALLATION AND TESTING OF CARRIER PIPE

- A. Install carrier pipe one pipe length at a time. Push carrier pipe through steel casing pipe using casing spacers.
- B. Assemble pipe joints with retainer glands or restrained joint before pushing.
- C. Test carrier pipe as specified in Section 4 – Pipe and Fittings.

#### 3.05 CLOSING CASING PIPE

- A. After carrier pipe has been installed inside casing pipe and successfully tested, fill casing pipe with sand meeting PennDOT Form 408, Section 703, Specification for Type A Fine Aggregate.
- B. After filling with sand, close ends of casing pipe and end seals per manufacturer's recommendations.

**END OF SECTION**

## **SECTION 4 – PIPE AND FITTINGS**

### **PART 1 – GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Sanitary sewer pipe, force mains, fittings, and related appurtenances.
- B. Water system pipe, fittings, and related appurtenances.

#### **1.02 RELATED SECTIONS**

- A. Section 2 – Trenching, Backfilling and Compaction
- B. Section 3 – Boring and Jacking
- C. Section 5 – Manholes
- D. Section 6 – Disinfection of Water Facilities
- E. Section 7 – Cast-In-Place Concrete

#### **1.03 REFERENCES**

- A. American National Standards Institute
  - 1. ANSI A 21.10, Cast-Iron and Ductile-Iron Fittings, 2 through 48 inches, for Water and Other Liquids.
  - 2. ANSI A 21.11, Rubber Gasket Joints for Cast Iron and Ductile Pressure Pipe and Fittings.
  - 3. ANSI A 21.50, Thickness Design of Ductile-Iron Pipe.
  - 4. ANSI A 21.51, Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Water or Other Liquids.
- B. American Society for Testing and Materials
  - 1. ASTM A 307, Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Strength.
  - 2. ASTM D 1784, Rigid Poly, (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

3. ASTM D 1785, Poly (Vinyl Chloride) (PVC) Plastic Pipe Schedules 40, 80 and 120.
4. ASTM D 2467, Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
5. ASTM D 2564, Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
6. ASTM D 3034, Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
7. ASTM D 3212, Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
8. ASTM F 477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
9. ASTM F789, Type PS-46 Poly (Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings.
10. ASTM D 2321, Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.

C. American Water Works Association

1. AWWA C104, Cement-Mortar Lining for Ductile Iron Pipe and Fittings.
2. AWWA C110, Ductile-Iron and Gray-Iron Fittings.
3. AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C150, Thickness Design of Ductile-Iron Pipe.
5. AWWA C151, Ductile-Iron Pipe Centrifugally Cast.
6. AWWA C153, Ductile-Iron Compact Fittings, 3 inch through 24 inch and 54 inch through 64 inch.
7. AWWA C600, Installation of Ductile Iron Mains and their Appurtenances.

1.04 SUBMITTALS

- A. Make submissions required by Section 1 – Construction Submittals.

## 1.05 QUALITY ASSURANCE

### A. Design Criteria:

1. Use only one type and class of pipe in any continuous line of sewer between structures, unless otherwise indicated on the Drawings.
2. Use pipe and fittings designed to withstand imposed trench loadings and conditions at the various locations.

### B. Laboratory Tests:

1. The AUTHORITY reserves the right to require that laboratory tests also be conducted on materials that are shop tested. Furnish without compensation, labor, materials, and equipment necessary for collecting, packaging, and identifying representative samples of materials to be tested and the shipping of such samples to the Testing Laboratory.

## 1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- ### A.
- Transport, handle and store pipe materials and other Products specified herein in a manner recommended by the respective manufacturers to prevent damage and defects.

## 1.07 SITE CONDITIONS

### A. Environmental Requirements:

1. Keep trenches dewatered until pipe joints have been made and concrete cradle and encasement, if any, have cured.
2. Under no circumstances lay pipe in water or on bedding containing frost.
3. Do not lay pipe when weather conditions are unsuitable, as determined by AUTHORITY, for pipe laying work.

## PART 2 – PRODUCTS

## 2.01 PIPE AND FITTINGS

### A. Size:

1. All pipe diameters referenced or noted shall be inside diameters.
2. All water lines shall have a minimum diameter of 8 inches. Size shall be based on hydraulic design requirements.

B. Ductile Iron (DIP):

1. Manufacturers:
  - a. McWane
  - b. U.S. Pipe
2. Pipe: ANSI/AWWA C151/A21.51.
3. Wall Thickness Class: AWWA C150, Class 52 for buried pipe and Class 53 for flanged pipe.
4. Fittings: Ductile iron, ANSI/AWWA C153/A21.53 and ANSI/AWWA C110/A21.10. Mechanical joints shall conform to ANSI/AWWA C111/A21.11. Working pressure rated at 350 psi.
5. Joints:
  - a. Burled Joints
    1. Push-on: ANSI/AWWA C111/A21.11.
    2. Mechanical: ANSI/AWWA C111/A21.11.
  - b. Exposed/Interior Joints
    1. Flanged: ANSI A21.15 with ANSI B16.21 1/16-inch-thick cloth insertion rubber face gaskets. ANSI B18.2 nuts and bolts.
6. Pipe Lining: Ductile Iron pipe and fittings shall be coated inside in accordance with the following:
  - a. Sanitary Sewage Pipe and Fittings: Lining shall be Protecto 401 ceramic epoxy lining or equal and shall meet all quality requirements of ANSI A21.16 and AWWA C116. Lining thickness though 12-inch, shall not be less than 0.125 inches and over 12 inches shall not be less than 0.1875 inches and seal coated per ANSI/AWWA C116/A21.16.
  - b. Water Pipe and Fittings: Lining shall be double coated cement mortar with a minimum thickness of 0.125 inches and seal coated per ANSI/AWWA C104/A21.4.

7. Pipe and Fittings Coating: ANSI/AWWA C151/A21.51, factory coated inside and out with bituminous paint, minimum 1 mil dry thickness.
- C. Polyvinyl Chloride Pipe (PVC) – SDR 35:
1. Manufacturers:
    - a. North American Pipe
    - b. P.W. Eagle
  2. Pipe: Type PSM SDR-35, ASTM D 3034 (4"-15"), or Type PS-46, ASTM F 789 (4"-18").
  3. Fittings: Conforming to same applicable ASTM Specification requirements for pipe.
  4. Joints: ASTM D3212 push-on joint with ASTM F477 elastomeric gasket. Gasket shall be locked in groove of bell to prevent displacement when pipes are jointed.
- D. POLYVINYL CHLORIDE PIPE (PVC) – SDR21 FOR LOW PRESSURE SEWERS
1. Manufacturers
    - a. North American Pipe
    - b. P.W. Eagle
  2. Pipe: SDR21 PVC Pipe for 10" or smaller
  3. Thrust locks and anchors at every direction change, in accordance with manufacturer directions.

## 2.02 WATER SERVICE LINES AND APPURTENANCES

- A. Polyethylene Pipe (PE):
1. Manufacturer:
    - a. Cresline CE Blue
    - b. JM Eagle
    - c. EJ Prescott



2. AWWA C901, SDR 9, copper tube size made of PE 4710 type resin conforming to ASTM D 2737, NSF certified.
  3. Pressure Rating: 200 psi minimum.
  4. Fittings: Compression type equivalent to Mueller Insta-tite or 110 Series or Ford Pack-Joint.
    - a. Stainless steel inserts to be used in the compression fitting to prevent crimping.
- B. Copper Pipe:
1. ASTM B88, Type K copper tubing.
  2. Fittings: ANSI B16.26 compression type equivalent to Mueller Insta-Tite or 110 Series or Ford Pack-Joints.
- C. Corporation Stops
1. Manufacturers
    - a. Ford Meter Box Co., Model No. F 1000
    - b. Mueller Company, H15008
  2. AWWA C800, 100 psig working pressure, ball or ground key type, bronze body, double stem o-rings, AWWA threaded inlet connections, compression style or insta-tite outlet connections suitable for pipe or tubing used.
- D. Curb Stops:
1. Manufacturers
    - c. Ford Meter Box Co., B44-333, B44-444, or B11-777
    - d. Mueller Company, B25209
  2. AWWA C800, 300 psig working pressure, ball or curb type valve, bronze body and tee heard, double-stem o-rings, compression style inlet and outlet connections suitable for pipe or tubing used.
- E. Curb Boxes:
1. Manufacturers

- a. Bingham & Taylor, Series I2B9 or Series I4B
    - b. Tyler, Series 6500
  2. Cast iron construction, adjustable, two (2) piece screw type, 2 ½ inch or 4 ¼ inch shaft with inlaid cover and bolt down lid marked "WATER". Length of box and base shall be as required for the actual field conditions encountered. Interior and exterior of boxes shall be hot bituminous coated.
- F. Service Saddles:
  1. Manufacturers
    - a. Ford Meter Box Company, Style 202B
    - b. Mueller Company, DR25
  2. Double strap type suitable for use on new or existing water main material, self-sealing gaskets rated for minimum 250 psig working pressure, type 304 stainless steel or ASTM A 536 ductile iron saddle with type 304 stainless steel.
  3. Service saddles to be used for connections to plastic mains. Connections to cast iron and ductile iron mains shall be made via direct taps unless the tap is 2-inch, in which case a service saddle must be utilized.
- G. Meter Pits:
  1. ¾ inch Service Line
    - a. For ¾ inch service lines, the meter pit shall be a bottomless, single meter plastic pit setter meter box model PMBHH as manufactured by Ford.
    - b. Suitable subgrade shall be prepared, including a minimum of 12-inches of clean 2B modified stone. The bottom of the meter pit shall be open to the stone bedding or shall have holes drilled for water to drain to the stone bedding.
    - c. The meter box shall be constructed of rigid PVC material and include the following:
      1. Insulation pads
      2. Depth – 48 inches

3. Meter Size – 5/8"x3/4"
4. Meter Inlet – Angle ball valve
5. Meter Outlet – Cascading dual check valve
6. Lid – Locking lid to accept meter reader

2. 1 inch Service Line

- a. For 1 inch service lines, the meter pit shall be a bottomless, single meter plastic pit setter meter box model PMBHH as manufactured by Ford.
- b. Suitable subgrade shall be prepared, including a minimum of 12-inches of clean 2B modified stone. The bottom of the meter pit shall be open to the stone bedding or shall have holes drilled for water to drain to the stone bedding.
- c. The meter box shall be constructed of rigid PVC material and include the following:
  1. Insulation pads
  2. Depth – 48 inches
  3. Meter Size – 1"
  4. Meter Inlet – Angle ball valve
  5. Meter Outlet – Cascading dual check valve
  6. Lid – Locking lid to accept meter reader

3. 1 ½ and 2 inch Service Lines

- a. For 1 ½ and 2 inch service lines, the meter pit shall be a bottomless, single meter plastic pit setter meter box model PMBHH as manufactured by Ford.
- b. Suitable subgrade shall be prepared, including a minimum of 12-inches of clean 2B modified stone. The bottom of the meter pit shall be open to the stone bedding or shall have holes drilled for water to drain to the stone bedding.
- c. The meter box shall be constructed of rigid PVC material with appropriate brackets for the meter, valving and service line and include the following:
  1. Insulation pads
  2. Depth – 48 inches
  3. Meter Size – Match service size
  4. Meter Inlet – Angle ball valve
  5. Meter Outlet – Cascading dual check valve

6. Lid Frame
7. Lid – Locking lid to accept meter reader

## 2.03 VALVES AND APPURTENANCES

### A. Plug Valves (4 inches and larger):

1. Manufacturers
  - a. DeZurik, Series 100
  - b. Clow
2. General: Non lubricated eccentric type valves with resilient faced plugs rated for 175 psi working pressure. End connections shall be ANSI 125/150 lb standard.
3. Valve Body: ASTM A 126 Class B cast iron with 1/8-inch welded overlay seat of not less than 90% nickel. Seat area shall be raised with raised surface completely covered with weld to insure that plug face contacts only nickel.
4. Plug: ASTM A 126 Class B cast iron resilient faced with neoprene or hycar, suitable for use with sewage. The interference between plug face and body seat, with plug in closed position, shall be externally adjustable in the field with the valve in-line under pressure.
5. Valve Shaft Seals: Multiple V-ring type, externally adjustable and repackable without removing bonnet or actuator from valve while under pressure.
6. Furnish buried valves with 2-inch square operating nut and tee handle of sufficient length to properly operate valve.

### B. Gate Valves

1. Manufacturers
  - a. American Flow Control, Series 500
  - b. Mueller
2. General: AWWA C 509 resilient seat wedge type designed for 150 psi operating pressure.
  - a. Buried: Non-rising stem

- b. Interior: Outside stem and yoke
  - 3. Valve Body: ASTM A 126, Class B cast iron.
  - 4. Resilient Wedge: ASTM A 536 ductile iron crated with nitrite rubber.
  - 5. Stem: ASTM B 763 bronze with two (2) upper and one (1) lower nitrite rubber o-ring seals.
  - 6. End Connections:
    - a. Buried service: mechanical joint.
    - b. Interior: ANSI 125/150 lb. flanged.
  - 7. Provide square operating nut and valve box for buried service.
  - 8. Interior and Exterior Coating: AWWA C 550 fusion bonded epoxy coating, 8 mils minimum.
- C. Air Release Valves:
- 1. Manufacturer: Crispin, Model PL 10
  - 2. Use valves of appropriate size at high points vent air which may accumulate. Valve shall be designed for 150 psig working pressure.
  - 3. Construction: Cast iron body and cover, stainless steel floats and parts.
- D. Pressure Reducing Valves:
- 1. Manufacturer: Cla-Val, Model 90-01
- E. Valve Boxes
- 1. Manufacturers
    - a. Tyler Pipe, 6850 series
    - b. Bingham & Taylor, I5B series, screw type.
  - 2. All valves buried in the ground shall be provided with cast iron valve boxes of the Two Piece or Buffalo Type. The valve boxes shall have an adjustable two section screw-type telescoping column and a separate base. The valve box column shall have an inside diameter of 5¼ inches. Valve

boxes shall be furnished with a cover. Mark covers to read “SEWER”, “WATER”, or “FIRE” as appropriate. The valve boxes shall be hot coated inside and out with a tar or asphalt compound. For deep installations, provide screw-type extensions as required, designed for use with the valve box furnished. Set top of stem between 1-2 feet below grade.

## 2.04 PIPE COUPLINGS

### A. Flexible Pipe Coupling (for gravity sewers only):

1. Manufacturers
  - a. Fernco Joint Sealer Company
  - b. Indiana Seal Company
2. Clamped design with virgin PVC coupling and two (2) type 305 stainless steel bands.

### B. Steel Pipe Couplings (for pressure sewers):

1. Manufacturers
  - a. Dresser, Style 38
  - b. Smith-Blair, Style 411
2. Coupling shall consist of a middle ring, two (2) follower rings, two (2) gaskets and a sufficient number of bolts and nuts.
  - a. Middle Ring: ASTM A513 or ASTM A635 steel.
  - b. Followers: AISI C1012 or ASME SA 36.
  - c. Gasket: Resilient wedge-shaped suitable for use with raw sewage and sludge.
  - d. Bolts: AWWA C111/ANSI A21.11.

## 2.05 SADDLES

### A. Romac Style CB Sewer Saddle.

## 2.06 THRUST RESTRAINT

- A. DEVELOPER has option of either of the means specified below. Length of restraint specified by AUTHORITY.
  - 1. Concrete Thrust Blocks and Tie Rods: Details as shown on drawings. Concrete shall be as specified in Section 8 – Cast-In-Place Concrete, 3,000 psi compressive strength (at 28 days). Tie rods shall be constructed of suitable metal. Metal harness of tie rods shall be galvanized or otherwise rust proofed and shall be painted with bituminous coating after installation.
  - 2. Megalug Retainer Glands: Mechanical joint restraint consisting of follower gland which when actuated imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. ASTM A 536-80 ductile iron follower gland of dimensions such that it can be used with AWWA C153 mechanical joints. Restraining devices shall be of ductile iron, heat treated to a minimum hardness of 370 BHN. Twist-off nuts shall be used to insure proper actuating of the restraint device. Restraint device shall have a 250 psi minimum working pressure with 2:1 minimum safety factor. Megalug retainer gland equivalent to EBAA Iron, Inc.

## 2.07 FIRE HYDRANTS

- A. Manufacturers
  - 1. American Flow Control, Traffic Model B-62-B.
- B. General: AWWA C502, compression type (opening against the pressure/closing with pressure), traffic type with breakable safety flange and stem couplings.
- C. Construction: Cast iron or ductile iron body, cast iron base, bronze operating nut (open left), street operating rod, bronze hose and steamer nozzles with cast iron caps secured to barrel, and bronze drain system.
- D. Rated Working Pressure: 200 psig
- E. Inlet Connection: 6-inch, mechanical joint unless noted otherwise on Drawings.
- F. Nozzle Sizes:
  - 1. Hose: Two (2) 2-1/2 inch.
  - 2. Steamer: One (1) 4-1/2 inch.
- G. Color:

1. Body: Red

H. Threads: Threads shall be in accordance with National Standard Threads.

## 2.08 PIPING SPECIALTIES AND APPURTENANCES

### A. Tapping Sleeve and Valve Assemblies

1. Manufacturers

- a. Mueller Company
- b. American Flow Control
- c. U.S. Pipe and Foundry Company

2. Tapping Sleeve

- a. General: ASTM A 126, Grade B ductile from (4"-12") or ASTM A 526 ductile iron (14" and larger), mechanical joint end connection with ANSI/AWWA C111/A21.11 nuts and bolts. Outlet end connection shall be ANSI 125/150 lb. flanged for mating to tapping valve
- b. Exterior Coating: Fed. Spec. TT-V-51 or Military Spec. MIL C-450 asphaltic varnish or equal.

3. Tapping Valves

- a. General: AWWA C 509 resilient seat wedge type gate valve as specified herein in this Section under Gate Valves except valve shall be modified for passage and clearance of tapping machine cutlers.
- b. Mating Flange: Flange shall have a raised male face to ensure true alignment of valve and tapping machine.
- c. Outlet End Connection: Mechanical joint with ANSI/AWWA C111/A21.11 nuts and bolts for buried service.

### B. Steel Pipe Couplings

1. Manufacturers

- a. Smith-Blair, Style 411



- b. Dresser, Style 38
  - 2. Coupling shall consist of a sleeve, two (2) follower rings, two (2) gaskets and a sufficient number of bolts and nuts.
    - a. Sleeve: ASTM A53 or ASTM A512 or carbon steel.
    - b. Followers: ASTM A47 malleable iron.
    - c. Gasket: Grade 30 rubber.
    - d. Bolts: AWWA C111/ANSI A21.11.
- C. Flanged Adapters
  - 1. Manufacturers
    - a. EBAA Iron, MEGAFLANGE
    - b. Romac Alpha FC
  - 2. General: Use to connect plain end pipe to flanged equipment. Coupling shall consist of iron body, a follower ring, a gasket and o-ring, and a sufficient number of bolts and nuts.
    - a. Body: ASTM A 536 ductile iron. ANSI 150 lb. flange drilling bolt circle, bolt size and spacing.
    - b. Follower: ASTM A536 ductile iron.
    - c. Bolts: AWWA C111/ANSI A21.11.
    - d. Gasket: Grade 30 rubber
    - e. O-Ring: Grade 60 rubber.
- D. Repair Sleeve
  - 1. Manufacturer: Mueller Company Model H-785
- E. Casing Pipe (for bored crossings)
  - 1. Casing Pipe: ASTM A53 seamless steel, full circumference welded joints and of DIAMETER AS SHOWN ON Drawings unless required otherwise by governing agency having authoritative jurisdiction.

2. Casing Spacers: Use casing spacers to center and support carrier pipe inside casing pipe. Provide spacers by Cascade Waterworks Mfg. Co. Model CCS or equal.
  - a. Shell: 2-piece bolt on style, stainless steel, 14-gauge minimum thickness.
  - b. Liner: Shell shall be lined with a ribbed PVC extrusion with retaining section that overlaps the edge of the shell and prevents slippage.
  - c. Runners: Ultra high molecular weight (UHMW) polymer and shall be attached to risers. Runners shall have low coefficient of friction, high resistance to abrasion and sliding wear and low deflection under compression.
  - d. Hardware: T 304 stainless steel.
3. End Seals: Provide end seals to wrap around casing and carrier pipes following installation to provide barrier to backfill and seepage. Seals shall be fabricated of 1/8" thick minimum synthetic rubber. Secure end seals to casing using 304 stainless steel straps with worm mechanism for tightening. End seals shall be by Cascade Waterworks Mfg. Co. Model CCES.

F. Sewer Vent and Cleanout Protection

1. Unit shall have a cast iron body and Lid suitable for traffic loadings similar to a "Stratton Box".
2. Dimensions:
  - a. Length – 10 ½ inches (minimum)
  - b. Diameter – 5 ¼ inches (minimum)
3. Shaft shall have continuous extension on the bottom circumference.
4. Lid shall have the word "sewer" cast on the top.

## PART 3 – EXECUTION

### 3.01 EXAMINATION

- A. Carefully examine each section of pipe and each pipe fitting before laying in conformance with the inspection requirements of the appropriate referenced standard.
- B. Remove rejected pipe from the Project.

### 3.02 PREPARATION

- A. Clean piping interior and mating surfaces of bell, spigot, and gasket before laying. Maintain clean until completed work is accepted.
- B. Touch-up chipped, cracked, or abraded surfaces and finished joints with two coats of the particular coating material.
- C. Perform trenching for sewer pipe and place pipe bedding as specified in Section 2 – Trenching, Backfilling and Compacting.
- D. Dig bell holes sufficiently large to permit proper joint making and to ensure pipe is firmly bedded full length of its barrel.
- E. Excavate trenches in rock at least twenty-five (25) feet in advance of pipe laying. Protect pipe ends if blasting is allowed.

### 3.03 LAYING PIPE

- A. General Requirements:
  - 1. Lay pipe proceeding upgrade true to line and grades given. Lay bell and spigot pipe with bell end upgrade.
  - 2. Bed pipe using materials specified in Section 2 – Trenching, Backfilling and Compaction. Gravity sewer pipe bedding must conform to AASHTO-99 to a density of 90% proctor.
  - 3. Exercise care to ensure that each length abuts against the next in such manner that no shoulder or unevenness of any kind occurs along inside bottom half of pipeline.
  - 4. Center spigot end in bell or socket end of previously laid pipe, shove tight and secure.
  - 5. No wedging or blocking permitted in laying pipe unless by written permission of AUTHORITY.
  - 6. Before joints are made, bed each section of pipe full length of barrel with recesses excavated so pipe invert forms continuous grade with invert of

pipe previously laid. Do not bring succeeding pipe into position until the preceding length is embedded and securely in place.

7. Walking or working on completed pipeline, except as necessary in tamping and backfilling, not permitted until trench is backfilled one-foot deep over top of pipes.
8. Take up and relay pipe that is out of alignment or grade, or pipe having disturbed joints after laying.
9. Take up and replace with new, such in-place pipe sections found to be defective.
10. Take necessary precautions to prevent newly laid pipe from floating as a result water accumulation in the trench; or the collapse of the pipeline from any cause. Restore or replace pipe as necessary.
11. At the close of each day's work, and at such other times when pipe is not being laid, protect open end of pipe with a tight fitting stopper.
12. Cut pipe using only equipment specifically designed for that purpose such as an abrasive wheel, rotary wheel cutter, a guillotine pipe saw or a milling wheel saw. The use of chisels or hand saws will not be permitted. Grind smooth cut ends and rough edges. Bevel slightly, cut end for push-on connections.
13. Where cutting of pipe is necessary, minimum laying length shall be five (5) feet.

B. Specific Requirements:

1. Install ductile iron pipe, and fittings, and assemble joints according to AWWA C600.
2. Install PVC pipe and fittings and assemble joints according to ASTM D2855.

C. Meter Pits:

1. All service lines will require the use of a meter pit and continuous piping of the same material as utilized for the service line leading from the main.

D. Joints

1. Make pipe and fitting joints according to pipe manufacturer's specifications and to specifications previously specified for pipe.

2. Make joints watertight. Immediately repair detected leaks and defects. Methods of repair subject to AUTHORITY'S approval.

E. Alignment and Grade:

1. Lay and maintain all pipe at the required lines and grades as shown on the Drawings. Place fittings and valves at the required locations with joints centered, spigots forced home, and all valve stems plumb. Do not deviate from the required line and grade, except with the approval of AUTHORITY.
2. Deflect pipe joints where indicated on the drawings. Deflections shall not exceed pipe manufacturer's recommended maximum allowable deflection.
3. Do not change grade or alignment without AUTHORITY'S approval.

F. Drop Connections: Make drop connections where indicated on the Drawings, where drop in invert is two feet or more or as required by AUTHORITY. Construct drop connection using the same pipe material used to construct the main. Construct drop connection in accordance with design shown on Standards Detail Drawings.

G. Connections to Existing Manholes or Structures: As specified in Section 5 – Manholes.

### 3.04 THRUST RESTRAINTS

- A. General: Provide thrust restraint at all plugs, caps, tees, and bends (both horizontal and vertical) on pipelines 4 inches and larger.
- B. Concrete Reaction Backing: Place concrete reaction backing between undisturbed solid ground and the fitting to be anchored. The backing unless otherwise shown or directed, shall be located as to contain the resultant thrust force and so that the pipe and fitting joints will be accessible for repair.
- C. Install megalug retainer gland according to manufacturer's instructions.
- D. Temporary Thrust Restraint: Provide temporary thrust restraint at temporary caps or plugs. Submit details of temporary restraint to AUTHORITY for approval.

### 3.05 EMERGENCY REPAIRS

- A. CONTRACTOR shall be responsible for utilizing great care and superior Judgment when working on and around AUTHORITY'S system(s). CONTRACTOR shall provide emergency repair service (at no cost to

AUTHORITY) when a main break or leak results from CONTRACTOR'S actions. Emergency repair could include isolation of the affected main, excavation, clamping, possible disinfection, site restoration and other actions necessary to restore satisfactory service to the customers. CONTRACTOR shall notify AUTHORITY immediately when incidents and/or accidents occur that adversely affect service to AUTHORITY'S customers. AUTHORITY shall provide guidance towards resolving such situations, including approval of the emergency work and approval of any emergency main appurtenances, including but not limited to, repair saddles and clamps.

### 3.06 FIELD QUALITY CONTROL:

- A. General Requirements: Conduct tests specified herein so that each pipeline installed in the Project is tested to AUTHORITY'S satisfaction.
  - 1. Provide tools, materials (including water), apparatus and instruments necessary for pipeline testing. AUTHORITY will require payment for water used. Procedures for water usage must be approved by AUTHORITY in writing.
  - 2. Conduct tests in the presence of and to the satisfaction of AUTHORITY.

### 3.07 GRAVITY LINE TESTS

- A. Alignment: After the sewer mains have been laid and backfilled, a light will be flashed between manholes or manhole locations to determine whether the alignment of the sewer is true and whether any pipe has been displaced, broken or otherwise damaged subsequent to laying. This test will again be conducted before final acceptance of the sewer. Each section (manhole to manhole) of sewer shall show a good light circle throughout its length and any and all defects shall be corrected by DEVELOPER, to the satisfaction of AUTHORITY, before the work shall proceed and before acceptance of and/or payment therefore shall be made.
- B. Leakage Tests:
  - 1. Air Testing: DEVELOPER shall test each section of sewer between manholes and all laterals to the limit of this contract using low pressure air. Testing shall not be performed, until all backfilling has been completed. DEVELOPER may, at his option, test the section of sewer for his own purposes, prior to completion of backfilling; however, the requirements of this subsection shall not be deemed to be completed until the lines have been tested after the backfilling has been completed and trench settlement has been minimized.
  - 2. This test will be made by plugging all branch fittings and ends of lateral stubs to withstand internal pressure. The section of line being tested shall

also be securely plugged at each manhole. All stoppers shall be adequately braced when required.

3. Air shall slowly supply the plugged pipe line until the internal air pressure reaches 4.0 pounds per square inch (PSI) greater than the average back pressure of any groundwater that may submerge the pipe. At least two minutes shall be allowed for temperature stabilization before proceeding further.
4. The rate of air loss shall then be determined by measuring the time interval required for the internal pressure to decrease from 3.5 to 2.5 PSI.
5. The line shall be considered acceptable if the amount of time is not less than the following formula:

$$T = 0.0850DK/Q, \text{ where}$$

$$K = 0.000419DL, \text{ but not less than } 1.0$$

$$Q = \text{rate of loss of } 0.003 \text{ CFM per square foot of internal surface}$$

$$D = \text{Pipe diameter, inches}$$

$$L = \text{Length of pipe being tested, feet}$$

**MINIMUM HOLDING TIME REQUIRED FOR PRESSURE TO DROP FROM 3.5 TO 2.5  
PSIG FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.003**

Pipe Diameter (inches)	Minimum Time (min:sec)	Length for Minimum Time (feet)	Time for Longer Length (seconds)	Specific Time for Length							
				100 feet	150 feet	200 feet	250 feet	300 feet	350 feet	400 feet	450 feet
4	1:53	597	0.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:48	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:53	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384 L	25:59	38:28	51:17	64:06	76:55	89:44	102:34	115:23
39	18:25	61	18.054 L	30:57	45:09	60:11	75:14	90:16	105:19	120:22	135:24

4. If the above rates of leakage are exceeded, DEVELOPER shall determine source of leakage and make all necessary corrections and retest.

5. DEVELOPER shall submit to AUTHORITY for approval the detailed test procedure and list of test equipment he proposes to use prior to testing.

C. Infiltration:

1. After the air testing described in the preceding paragraph has been completed by DEVELOPER, regardless of any indications of the test results made by AUTHORITY, AUTHORITY reserves the right to perform field investigations, prior to final written acceptance of each sewer run by AUTHORITY and/or during the maintenance period required to establish the leakage of groundwater into the sewer and laterals constructed.
2. Should the leakage exceed 100 gallons per day per inch diameter per mile of pipe for any section, DEVELOPER shall, at the direction of AUTHORITY, perform any additional testing or corrective work required to reduce the infiltration in each manhole run from those lines installed by DEVELOPER to less than 100 gallons per day per inch diameter per mile of pipe. This leakage applies to each manhole run separately and should not be construed to mean total leakage in the total system. The scope of this corrective work shall include, but not be limited to, cleaning, televising and testing the sewer and laterals to the limits installed by DEVELOPER, to include testing and grouting of joints, excavation and replacement of faulty or damaged portions of the work, and all final restoration.

3.08 PRESSURE LINE TESTING

A. Alignment Test for Pressure Lines:

1. Prior to backfilling of pressure lines, the joint alignment shall be inspected to assure the maximum deflection present in each joint does not exceed the manufacturer's recommendations.
2. Assure lines which are a portion of a pump discharge system shall be inspected to assure the line is installed at a constant or increasing grade so as to eliminate the possibility for air accumulation at an intermediate high point.
3. Any and all defects shall be corrected by DEVELOPER to the satisfaction of AUTHORITY prior to backfilling. This shall be completed before the work shall proceed and before acceptance.

B. Leakage Test Requirements (applicable to Force Mains and Water Mains):

1. This test will be made by plugging a section of the main (as determined by the AUTHORITY) and all branch fittings to withstand internal pressure.



2. The CONTRACTOR shall slowly fill each valved section of main with water and apply the test pressure, based on the elevation of the lowest point of the line or section under test, corrected to the elevation of the test gauge by means of a pump connected to the pipe in a manner satisfactory to the AUTHORITY.
3. Expel air completely from the pipe and valves before applying the specified test pressure. If permanent air vents are not located within the section being tested, install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all air has been expelled, close the corporation cocks and apply the test pressure. At the conclusion of the test, remove the corporation cocks and plug the openings, or leave in place at the discretion of the AUTHORITY.
4. The main shall be hydrostatically tested at a pressure 1.5 times the normal working pressure with a minimum pressure of 150 PSI. The test pressure shall be held for a period of at least two (2) hours during which time the test pressure shall not vary more than 5 PSI.
5. The CONTRACTOR shall conduct a leakage test concurrently with the Hydrostatic Pressure Test. Leakage shall be defined as the quantity of water that must be supplied into the newly constructed force main, or any valved section thereof, to maintain the pressure within 5 PSI of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

Acceptance shall be determined on the basis of allowable leakage as specified below.

#### ALLOWABLE LEAKAGE PER 1,000 FEET OF MAIN (GPH)

Average Test Pressure PSI	Nominal Pipe Diameter - Inches							
	4	6	8	10	12	14	16	20
250		0.71	0.95	1.19	1.42	1.66	1.90	2.37
225		0.68	0.90	1.13	1.35	1.58	1.80	2.25
200		0.64	0.85	1.06	1.28	1.48	1.70	2.12
175		0.60	0.80	0.99	1.19	1.39	1.59	1.98
150		0.56	0.74	0.92	1.10	1.29	1.47	1.84
125		0.50	0.67	0.84	1.01	1.18	1.34	1.68
100		0.45	0.60	0.75	0.90	1.05	1.20	1.50

C. Testing Conditions:

1. Where any section of a main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least five days have elapsed after the concrete reaction backing was installed. If high early strength cement is used in the concrete reaction backing, the hydrostatic pressure test shall not be made until at least two days have elapsed.
2. AUTHORITY shall be present during the operating of valves required to fill mains for pressure and leakage test.
3. DEVELOPER shall advise AUTHORITY of any pressure test and leakage test at least 48 hours in advance. No testing will be authorized unless air temperature is 35°F or higher.
4. The pressure and leakage tests shall be witnessed by AUTHORITY.
5. DEVELOPER shall furnish laboratory calibrated test gauges and measuring devices for the leakage test.
6. The section under test shall be brought back to test pressure at one-half hour intervals during the testing. AUTHORITY will record both the makeup water amount and pressure at each one-half hour repressurization.

3.09 ACCEPTANCE: Observation of successful testing of sewers, force mains or water mains by AUTHORITY does not constitute acceptance of the system or any portion thereof. Upon completion of any determined portion of a total system, and successful testing thereof, the AUTHORITY, at its sole discretion, may consider acceptance or beneficial use of the facilities.

**END OF SECTION**

**SECTION 5 – MANHOLES****PART 1 – GENERAL****1.01 SECTION INCLUDES**

- A. Sanitary sewer manholes and related appurtenances.

**1.02 RELATED SECTIONS**

- A. Section 7 – Cast-in-place concrete
- B. Section 8 – Grout

**1.03 REFERENCES**

- A. American Society for Testing and Materials
  - 1. ASTM A48, Gray Iron Castings
  - 2. ASTM A276, Stainless and Heat-Resisting Steel Bars and Shapes
  - 3. ASTM A615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
  - 4. ASTM C361, Reinforced Concrete Low-Head Pressure Pipe
  - 5. ASTM C443, Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
  - 6. ASTM C478, Precast Reinforced Concrete Manhole Sections
  - 7. ASTM C923, Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes
  - 8. ASTM D2146, Propylene Plastic Molding and Extrusion Materials
  - 9. ASTM D2240, Test Method for Rubber Property-Durometer Hardness
  - 10. ASTM A307, Carbon steel externally threaded standard, spec. for
  - 11. ASTM C270, Mortar for Unit Masonry spec. for
- B. American Association of State Highway and Transportation Officials (AASHTO) Standards as referenced throughout these Requirements.

- C. American Water Works Association:
  - 1. AWWA C 302, AWWA Standard for Reinforced Concrete Water Pipe-Noncylinder Type, Not Prestressed.
- D. Federal Specifications:
  - 1. Fed. Spec. SS-S-210A, Sealing Compound, Preformed Plastic, for. Expansion Joints and Pipe Joints (Type 1 Rope Form).
- E. Commonwealth of Pennsylvania Department of Transportation (PADOT), Specifications Publication 408.

#### 1.04 DELIVERY, STORAGE AND HANDLING

- A. Transport and handle precast reinforced concrete manhole components and other Products specified herein in a manner recommended by the respective manufacturers of such to prevent damage and defects. Through-wall lifting holes not permitted in manhole component construction.
- B. Store precast reinforced concrete manhole components in accordance with manufacturer's recommendations to prevent joint damage and contamination. Exercise such care in storage of other specified Products as recommended by the respective manufacturers.

#### 1.05 PROJECT CONDITIONS

- A. Environmental Requirements:
  - 1. In no instance set or construct manhole busses on subgrade containing frost.
  - 2. To improve workability of preformed plastic sealing compound during cold weather, store such at temperature above 70 degrees F or artificially warm compound in a manner satisfactory to AUTHORITY.

### **PART 2 – PRODUCTS**

#### 2.01 BASIC MATERIALS

- A. Cast-In-Place Concrete Products: From work, Reinforcement, and Cast-In-Place Concrete conforming to requirements of Section 7 – Cast-In-Place Concrete.

B. Epoxy Bonding Compound:

1. Manufacturers:

- a. Sika Sikadur-32 Hi-Mod
- b. Five Star Products, Inc. FIVE STAR GROUT

2. Multi-purpose, high-modulus, high-strength 2-component, solvent free, moisture insensitive, epoxy bonding/grouting adhesive.

C. Non-Shrink Non-Metallic Grout

1. Manufacturers

- a. Master Builders, Inc., Masterflow 928
- b. U.S. Grout Corporation, Five Star Products

2. Ready mix, ASTM C1107 high precision, natural aggregate grout

D. Manhole Steps:

- 1. Aluminum Step: Aluminum Alloy AA Designation 6061-T6 3/4-inch minimum diameter and 12-inches minimum rung width with drop front to prevent side slipping. Coat that portion of aluminum step being embedded in concrete with heavy-boiled bituminous paint. Aluminum manhole steps No. 12653B by ALCOA.
- 2. Reinforced Plastic Step: Composed of a 1/2-inch Grade 60, ASTM A615 deformed steel reinforcing bar completely encapsulated in Grade 49108, ASTM D2146 polypropylene copolymer compound, Type II; M.A. Industries, Inc., Type PS2-PF or PS2-PFS.
- 3. Manhole step dimensions shall meet requirements of OSHA Standard 1910.27 for fixed ladders.

E. Manhole Frame and Cover:

1. Manufacturers:

- a. Modena Foundry, Pattern No. 541-S
- b. Washington Street Brass and Iron
- c. Neenah Foundry Company

2. General: Gray iron castings conforming to ASTM A48, Class No. 30, designed for AASHTO Highway Loading Class HS-20. Provide castings of uniform quality, free from blowholes, porosity, hard spots, shrinkage distortion or other defects.
  - a. Finish: Bearing surfaces machined to prevent rocking and rattling under traffic. Casting surfaces shotblast cleaned and coated with asphalt paint, non-tacky drying.
  - b. Identification: Cast the letters “SEWER” integrally in center of cover in 2-inch raised letters.
  - c. Frame Hold-down Bolts: Type 316 stainless steel, ASTM A276 bolts and washers.
  - d. Cover Gasket: One piece O-ring gasket factory installed in a machined rectangular or dovetail groove in the cover bearing surface.
    - 1) Gasket material of neoprene composition having good abrasion resistance, low compression set, Type D 40 durometer hardness determined in accordance with ASTM D 2240 and suited for use in sanitary sewer manholes.
    - 2) Gluing of gasket is not permitted.
  - e. Tensile Test Bar: Size B, cast separately, but poured from same iron as castings they represent.
- F. Watertight Manhole Frame and Cover: Gray Iron castings conforming to previously specified requirements for Manhole Frame and Cover except that cover shall contain four (4) hold-down bolts.
  1. Manufacturers:
    - a. Modena Foundry, Pattern No. 541-WT
    - b. Washington Street Brass and Iron
    - c. Neenah Foundry Company
  2. Cover Hold-down Bolts: 2-inch diameter minimum type 316 stainless steel, ASTM A276 bolts and washers: or manufacturer’s standard bronze bolts and washers. Drill and tap frame to accept cover hold down bolts.

3. Threaded Sleeves: Manhole factory fitted with stainless steel or bronze threaded sleeve to accept cover bolts.
- G. Preformed Plastic Sealing Compound:
1. Manufacturers:
    - a. K. T. Snyder Company, Inc.; RAM-NEK.
    - b. K. T. Snyder Company, Inc.; RUB'R-NEK.
    - c. Hamilton Kent Manufacturing Company; KENT-SEAL NO. 2.
  2. Fed. Spec. SS-S-210A, Type 1, Rope Form, of either bitumastic base compound or butyl rubber base compound and shipped protected in a removable two-piece wrapper. Size cross- section of rope form to provide squeeze-out of material around entire interior and exterior circumference when joint is completed.
- H. Rubber Compression Gasket: Composition conforming to ASTM C 361 of ASTM C 443.
- I. Expandable Sleeve Type Pipe Opening Seal: ASTM C923, consisting of a power sleeve, gasket and two (2) take-up clamps. Sleeve is mechanically expanded to compress gasket against receptacle hold in manhole wall. Provide seal equivalent to Press Seal Gasket Corp. PSX Positive Seal Gasketing System.
1. Power Sleeve: Type 304 stainless steel, 85,000 psi yield strength.
  2. Gasket: Compound Polyisoprene suitable for use with raw sewage.
  3. Take-Up Clamps: Type 304 stainless steel with stainless steel screw.
- J. Modular Mechanical Type Pipe Opening Seal: Seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely assembled with stainless steel bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely watertight seal between the pipe and the wall opening. The seal shall be constructed so as to provide electric insulation between the pipe and wall to reduce the occurrence of cathodic reaction between the two members. Wall penetration closures shall be "Link-Seal" as manufactured by Thunderline Corp.
- K. Manhole Adapters: Gasket type waterstops composed of elastomeric polyvinyl

chloride (PVC) such as manufactured by Fernco Joint Sealer Co.; CMA Concrete Manhole Adapter; CMA Waterstop distributed by The General Engineering Company, Frederick, Maryland.

L. Coatings:

1. Manufacturers

a. Koppers 300 M Epoxy

b. Pennsbury 32-B-4 Epoxy

2. Apply two (2) coats to outer surface of entire manhole to waterproof manhole.

2.02 PRECAST REINFORCED CONCRETE MANHOLE COMPONENTS

A. Materials and Construction: Conforming to requirements specified in ASTM C478 except as follows:

1. Concrete: Composition and compressive strength conforming to ASTM C478 except use Type II sulfate resistant Portland cement in manhole components and increase compressive strength to 4500 psi (at 28 days) in precast bases.
2. Casting and Curing: Wet cast and steam curing process in accordance with AWWA C302.
3. Manhole Steps: Factory installed in manhole components, prealigned vertically, spaced on equal centers, and located the minimum distance from ends of risers and top sections as indicated on Standard Detail drawings.
4. Manhole Component Seals: Manhole component joints factory formed for self-centering concrete to concrete bearing employing either a Rubber Compression Gasket or Preformed Plastic Sealing Compound.
5. Manhole Component Design: Base, tapered and straight riser section, and top section dimensions and diameters, not consistent with ASTM C 478, are as indicated on Standard Detail drawings.
6. Lifting Holes and Lugs: Through-wall holes shall not be permitted in manhole component construction.
7. PennDOT Compliance: In addition to above specifications, manholes for installation within PennDOT rights-of-way shall also conform to



PennDOT Publication 408 specifications.

- B. Precast Bases and Riser Sections: Design, materials and construction as specified previously.
- C. Pipe Openings: Custom preformed during manufacturing in each base and riser section requiring such, to accommodate type of pipe and pipe opening seal provided.
- D. Pipe Opening Seals: Option to install one of the following:
  - 1. Resilient Gasket Type Pipe Opening Seal:
    - a. Manufacturers:
      - 1) A Lok Products Corporation; A LOK Manhole Pipe Seal.
      - 2) Dual Seal Gaskets Inc.; DUAL SEAL II.
      - 3) GPT an EnPro Industries Company: Link-Seal
    - b. Cast integrally with manhole component conforming to requirements to requirements specified in ASTM C 923.
  - 2. Expandable Sleeve Type: ASTM C923, consisting of a power sleeve, gasket and two (2) take up clamps. Power sleeve is mechanically expanded to compress gasket against receptacle hole in manhole wall. Install at precast plant. Provide seal equivalent to Press Seal Gasket Corp. PSX Positive Seal Gasketing System.
    - a. Power Sleeve: Type 304 stainless steel, 85,000 psi yield strength.
    - b. Gasket: Compound Polyisoprene suitable for use with raw sewage.
    - c. Take Up Clamps: Type 304 stainless steel with stainless steel screw.
- E. Precast Top Sections: Designs as shown on Standard Detail Drawings of materials as specified previously herein this Section except additional and differing requirements as follows:
  - 1. Hold Down Bolt Inserts: Factory cast in top section no less than two 1/2-inch diameter threaded inserts or slotted inserts to accommodate manhole frame hold down bolts. Threaded inserts of 3-inch depth. Both insert types designed for an ultimate load in tension of 12,500 pounds. Inserts factory plugged for shipping. Coordinate insert location with manhole component manufacturer to assure proper location in top sections.

2. Flat Slab Tops: Thickness indicated on Drawings. Tops factory formed to properly accept and support required manhole frame and cover and formed to join riser section in a matching joint.
  3. Eccentric Cone Tops: Manufactured to same minimum wall thickness and with same area of circumferential steel reinforcement as riser sections.
- F. Precast Grade Rings: Leveling and adjusting units of 3-inches or 4-inches thickness of materials and constructions as specified previously. Factory cast grade rings with hold down bolt holes matching location of same in manhole frame. Design much provide for full bearing of manhole frame.
- G. Manhole Inserts: Manufactured of high density polyethylene material.
- H. PVC Coated Precast Reinforced Concrete Manhole Bases, Risers, Cones, or Flat Slab Tops:
1. Air release manholes and manholes to which force mains of low-pressure lines discharge to and the next two (2) manholes downstream shall be PVC coated as described below.
  2. PVC Liner system:
    - a. PVC Coated Manholes shall be as manufactured by A-Lok Products, Inc., or pre-approved equal. The interior plastic liner for the precise manholes shall be Dura Plated 100. The Dura Plate 100 liner, when installed, shall provide a continuous, impermeable lining which will shield the precast concrete manhole against deterioration caused by corrosive material. The PVC Coated Manholes shall also meet all of the requirements specified for standard concrete manholes.
    - b. The design of the liner shall insure that it will conform to the contour of the manhole and form a permanent mechanical bond to the concrete through the use of preformed horizontal ribs. The liner will be formed in such a manner that the joints between the manhole sections will be afforded protection through the use of a continuous PVC return into the joint for a minimum of s of an inch. Provisions will be made to allow the pipe openings to be sealed.
    - c. The liner shall be manufacture from Polyvinyl Chloride resin and shall be white in color. The compound will result in a semi-rigid material suitable for thermoforming to the contour of the manhole. The liner may be fabricated in panels with the panels

joined together by a slotted strip of EDPM rubber according to the manufacturer's specifications. All plastic liner sections shall be free of cracks, pinholes, or other defects adversely affecting the protective characteristics of the material and shall have a minimum thickness of 65 mils.

- d. The Dura Plate 100 liner will be installed during the recasting process in accordance with the specific instructions of the manufacturer.
- e. The manhole manufacturer shall provide installation instructions to CONTRACTOR prior to initial use of the Dura Plate 100 liner. The manhole will be installed using a joint sealing material as later specified.
- f. The joint sealing material shall be placed on the joint surfaces as recommended by the manufacturer, to provide a watertight seal by filling the annular cavity, while providing sufficient squeeze-out between the PVC returns to protect against corrosion.
- g. Flexible, corrosion-resistant, watertight connections between manhole castings and precise concrete cones of flattops shall be installed for all PVC coated manholes. This connection shall be accomplished by Water-Lok Connectors, as manufactured by A-Lok Products, Inc., or approved equal. The connector shall allow flexibility in reaching finished grade and permit up and down movement to accommodate free/thaw conditions close to the ground surface without compressing watertightness. This shall be accomplished by utilizing two independent sleeves by a system of neoprene o-rings. The top and bottom flanges of the Water-Lok Connector are sealed to their appropriate mating surfaces by a preformed butyl gasket material furnished with the assembly. The Bolt Fastening Assembly shall be an anti-floating assembly.
- h. All interior concrete surfaces not covered by the PVC liner, including the flow channel and grade rings, shall be coated with two coats of epoxy-amine. Coating of the base shall overlap the liner by a minimum of 2-inches.

## 2.03 DEVELOPER OPTIONS IN PRODUCTS

- A. Manhole Construction Options: Permitted option to construct one type of manhole in the Project of types listed herein, except where required otherwise on Drawings.
  - 1. All-precast reinforced concrete manhole components.

2. All-precast reinforced concrete manhole components except manhole base. Base of cast-in-place concrete.
3. Precast reinforced concrete grade rings used as frame and cover leveling units in either of above manhole construction.

## **PART 3 – EXECUTION**

### **3.01 EXAMINATION**

- A. Inspect precast reinforced concrete manhole components in accordance with requirements of ASTM C 478 regarding repairable defects and defects subject to rejection by AUTHORITY.
- B. All material found during the progress of the Work, either before or after installation, to have cracks, flaws or other defects will be rejected by AUTHORITY. All defective materials furnished by DEVELOPER shall be promptly removed from the site.

### **3.02 PREPARATION**

- A. Keep pipe and manhole interiors cleared of debris as construction progresses.
- B. Earthwork: Perform earthwork as previously specified in Section 2- Trenching, Backfilling and Compacting.

### **3.03 MANHOLE INSTALLATION**

- A. Cast-In-Place Concrete Manhole Base: Construct in accordance with design and dimensions indicated of Drawings. When necessary to construct wider or deeper manhole bases the indicated or specified, build such bases as required by AUTHORITY.
  1. Form and pour concrete in accordance with requirements of Section 7 – Cast-In-Place Concrete. Additional requirements as follows:
    - a. Vibrate poured concrete using mechanical vibrator of a type and design approved by AUTHORITY. Use vibrators of type capable of transmitting vibration to concrete in frequencies of not less than five thousand impulses per minute.
    - b. Form and pour joint monolithically in manhole base top to match joint of adjoining precast riser section. Use template as obtained from precast concrete manhole component manufacturer.

2. Install sewer pipe in cast-in-place manhole bases prior to pouring the concrete.
  - a. Apply Epoxy Bonding Compound in accordance with manufacturer's instructions to pipe at base connection prior to pouring the concrete.
  - b. Install Manhole Adapter on pipes entering and leaving manhole base prior to pouring concrete. Install Manhole Adapter according to manufacturer's written instructions.
- B. Precast Concrete Bases:
  1. Install precast bases on aggregate subbase. Materials and thickness as shown on the Standard Detail drawings.
  2. When pipe opening seal materials create an annular space on interior and exterior of manhole wall pipe openings after pipe connection is made, fill such annular spaces with preformed plastic sealing compound.
    - a. Tightly caulk sealing compound into annular spaces in a manner to completely fill the spaces and render the installation watertight.
    - b. Following sealing compound installation, trowel compound surface smooth and flush with interior face of manhole.
- C. Length of Pipe Connections into Manholes:
  1. Use full pipe section when connecting into manholes through resilient gasket type pipe opening seals.
- D. Concrete Channel Fill: Field pour concrete channel fill for each manhole base.
  1. Form inverts directly in concrete channel fill.
  2. Accurately shape invert to a semi-circular bottom conforming to inside of connecting pipes, and steel trowel finish to a smooth dense surface.
  3. Make changes in size and grade annually.
  4. Make changes in direction of entering sewer and branches to a true curve of as large a radius as manhole size will permit.
  5. Make slopes gradual outside the invert channels.

6. Use 3000 psi Type II concrete as specified in Section 7 – Cast-In-Place Concrete, unless indicated otherwise on Drawings.
- E. Manhole Wall Erection: Provide precast reinforced concrete straight riser, tapered riser and top sections necessary to construct complete manholes. Fit the different manhole components together to permit watertight jointing and true vertical alignment of manhole steps.
1. Install sealing compound in accordance with manufacturer's recommendations and join sections also in accordance with written instructions of manhole component manufacturer.
    - a. Prime joint surfaces if required by preformed sealing compound manufacturer.
    - b. If sealing compound is installed in advance of section joining, leave exposed half of two-piece protective wrapper in place until just prior to section joining.
    - c. Use preformed sealing compound as the sole element utilized in sealing section joints from internal and external hydrostatic pressure.
    - d. To improve workability of Preformed Plastic Sealing Compound during cold weather, store such at temperature above 70°F or artificially warm compound in a manner satisfactory to AUTHORITY.
    - e. During warm weather stiffen Preformed Plastic Sealing Compound by placing under cold water or by other means as recommended by the compound manufacturer.
    - f. Following manhole section installation, trowel sealing compound surface smooth and flush with interior face of manhole.
    - g. Make pipe connections into manhole walls as specified previously for pipes connecting into manhole bases.
    - h. Remove all excessive plastic sealing compound after all manhole sections have been set.
- F. Lifting Recess Sealing: Seal with properly designed tapered rubber plugs. Drive plugs into recesses in such manner to render them completely water and airtight. Sealing of lifting recesses with grout not permitted.

- G. Frame and Cover Installation: Where required, make final adjustment of frame to elevation using Precast Grade Rings.
1. Set Precast Grade Rings in Non-shrink Non-Metallic Grout. Grout thickness should not exceed ¾-inch maximum and 3/8-inch minimum. Wet, but do not saturate Precast Grade Rings immediately before laying.
  2. Parge the inside and outside of the grade rings to a minimum thickness of ½ inch using Non-shrink Non-Metallic Grout.
  3. Bolt manhole frames only following grout curing period. Install manhole frames on ½-inch thick Preformed Plastic Sealing Compound on bearing surface of manhole frame. Remove excess sealing compound as it is squeezed out after manhole frame is bolted in place.
  4. Use bolts of sufficient length to properly pass-through leveling units, if any, engage full depth of manhole top section inserts and allowing enough threaded end to pass through manhole frame to properly tighten nut and washer. Tighten manhole frame bolts after grout has cured.
- H. Waterproofing: Coat entire outer surface of all manhole components including parged grade rings with two (2) coats of Bitumastic Coating.
- I. Drop Manholes: Construct in accordance with Standard Detail Drawing. Use same type pipe and fittings in drop connections as used in sewer line from which drop connection is made.
- J. Plugging Pipe Openings: Plug pipe openings in manholes where such openings are required for future pipe connections. Use manufactured units specifically designed for the purpose. Plugs shall be designed to allow for future removal without damage to manhole.

### 3.04 PIPE CONNECTIONS TO EXISTING MANHOLES

- A. Make connection to existing manhole by core drilling pipe opening in wall at invert elevation to match existing unless directed otherwise by AUTHORITY.
- B. Remove existing bench as needed to make new connection. Reconstruct bench and form new flow channel after new pipe has been inserted.
- C. Seal pipe to wall opening using either the Expandable Sleeve Type or Modular Mechanical Type Pipe Opening Seal.

### 3.05 CONSTRUCTION OF NEW MANHOLES OVER EXISTING SEWER MAINS

- A. Where new manholes are constructed on top of existing sewer mains, DEVELOPER shall have the option to use cast-in-place concrete manhole bases or precast concrete bases. Construct according to Standard Detail drawing and as follows:
1. Replace broken or damaged pipe resulting from Work with new pipe. New pipe shall be of materials as previously specified. Use couplings compatible with new and existing pipe for making final connections.
  2. Connect new pipe to new manhole bases using materials and methods previously specified. Form smooth channel to conduct flow into main channel.
  3. Maintain flow of existing sewer during construction and until concrete is properly cured in the case of cast-in-place work and formed inverts.
  4. Saw cut existing pipe to be removed. Chipping or breaking pipe with a hammer shall not be permitted.

### 3.06 FIELD QUALITY CONTROL

- A. General: Test each manhole constructed by one of the methods specified herein. If the manhole is constructed on an existing sewer where flow must be maintained, the test may be waived, at the sole discretion of AUTHORITY.
1. Conduct tests in presence of and to complete satisfaction of AUTHORITY.
  2. Should a manhole not satisfactorily pass testing, AUTHORITY may direct DEVELOPER to discontinue manhole construction in the Project until such manhole does test satisfactorily.
  3. Provide tools, materials (including water), equipment and instruments necessary to conduct manhole testing specified herein.
  4. Prior to testing manholes, thoroughly clean such and seal openings, both to complete satisfaction of AUTHORITY. Seal openings using properly sized plugs.
  5. Perform testing with frames installed. The joint between the manhole and the manhole frame shall be included in the test.
  6. DEVELOPER may elect to make a test prior to backfilling for his own purposes; however, the tests of the manholes for acceptable, shall be conducted after the backfilling has been completed.



B. Vacuum Testing.

1. Manholes, vaults, and similar structures constructed may be tested by the Vacuum Test. This test shall be performed in accordance with ASTM C 1244.
2. Testing prior to backfilling is highly recommended to facilitate corrective measures in case of test failure.
3. The CONTRACTOR shall plug all pipe openings, taking care to securely brace the plugs and inflate the compression band to 40 psi to bring about a seal between the vacuum tester base and the manhole frame.
4. A vacuum to 10 inches of mercury (10" Hg) shall be drawn and the valve closed.
5. Manholes and similar structures shall be considered acceptable if the vacuum remains at 10" Hg or drops to 9" Hg in a time greater than 1 minute.

C. Exfiltration Test Procedure:

1. Water Test Procedure will not be permitted when the air temperature is expected to fall below 35°F, or as directed by AUTHORITY.
2. Completely fill manhole with water. The AUTHORITY will charge for water used for testing based either on a minimum amount or an actual meter reading.
3. Allow water filled manhole to stand twelve hours prior to testing to allow absorbing in materials.
4. At commencement of test, fill manhole to top of manhole frame.
5. During a consecutive four-hour period keep an accurate record of the amount of water to be added because of exfiltration.
6. Consider manhole acceptable when exfiltration rate does not exceed a rate of 0.0189 gallons a day per inch of manhole diameter per vertical foot of manhole.

D. Repair and Retest:

1. Determine source or sources of leaks in manholes failing acceptable limits.

2. Repair or replace defective materials and workmanship, as is the case, and conduct such additional Manhole Acceptance Tests and such subsequent repairs and retesting as required until manholes meet test requirements.
3. Materials and methods used to make manhole repairs must meet with AUTHORITY's approval prior to use.

E. Visual Inspection:

1. A visual inspection of all manhole repairs and rehabilitation shall be performed by the AUTHORITY. The CONTRACTOR shall provide labor and materials required for inspection. There shall be no signs of infiltration, spalling, loss of adhesion, cracks, or any other defects in the CONTRACTOR's work.
2. Acceptance is also dependent satisfactory results of field compressive strength testing, if performed.
3. All manholes that have been rehabilitated in accordance with Section 332002 shall be re-inspected prior to Final Acceptance, but no less than 12 weeks after Conditional Acceptance. The AUTHORITY shall schedule this re-inspection with the CONTRACTOR, providing a minimum of 2 weeks' notice.
4. Re-inspection shall include a visual confirmation that no infiltration, spalling, loss of adhesion, cracks or any other defects have formed in the work performed since Conditional Acceptance. Any defects found shall be corrected by the CONTRACTOR in accordance with the manufacturer's recommendation at no additional cost to the County.
5. Re-inspection shall include at least 20% of the manholes rehabilitated. The AUTHORITY will select the manholes to be re-inspected, the CONTRACTOR shall provide all labor and materials required for re-inspection, including traffic control.
  - a. If more than 10% of the manholes re-inspected fail a visual inspection, an additional 20% of the manholes rehabilitated shall be re-inspected. If more than 10% of the second group of manholes re-inspected fail, all manholes rehabilitated shall be re-inspected.
  - b. The CONTRACTOR shall pay the AUTHORITY's expense in addition to all other expenses, for re-inspection of manholes rehabilitated beyond the first 20%. The AUTHORITY's

expense shall be the same dollar amount as the liquidated damages identified on page P-1 of the Contract Documents.

**END OF SECTION**

**SECTION 6 – DISINFECTION OF WATER FACILITIES****PART 1 – GENERAL****1.01 SECTION INCLUDES**

- A. Disinfection procedures of water mains and related facilities.

**1.02 QUALITY ASSURANCE**

- A. Bacteriological Tests

- 1. AWWA Standard C651-14.

- a. Number of Samples Required: Two samples, taken a minimum of 24 hours apart, or as directed otherwise by AUTHORITY.

- B. Reference Standards:

- 1. American Water Works Association:

- a. AWWA B300, Hypochlorites.
    - b. AWWA B301, Liquid Chlorine.
    - c. AWWA C651, Disinfecting Water Mains.
    - e. AWWA Manual M12, Simplified Procedure for Water Examination.

**1.03 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. AUTHORITY staff shall transport, handle and store disinfection products as specified herein in the manner recommended by the respective manufacturers to prevent contamination and deterioration of products.
- B. When handling disinfection products, due caution is advised. Utilize procedures in the manner recommended by the manufacturer.

**1.04 JOB CONDITIONS**

- A. Environmental Requirements:

- 1. Testing and disinfection of water mains will not be performed if the air temperature is expected to fall below 35°F or as directed by AUTHORITY.

2. Keep interior of pipe clean. Close open end of pipe with a watertight plug anytime pipelaying is not in progress.

## **PART 2 – PRODUCTS**

### **2.01 MATERIALS**

- A. Hypochlorites: AWWA Standard B300.
- B. Liquid Chlorine: AWWA Standard B301.

## **PART 3 – EXECUTION**

### **3.01 CHLORINATION, FLUSHING, AND DECHLORINATION**

- A.
  - A. Chlorination and disinfection of water-distribution piping shall be in conformance with ANSI/AWWA C651-14. Only the Tablet/Granule and the Continuous Feed methods shall be acceptable.
  - B. Flushing: AUTHORITY shall be notified at least 72 hours prior to any desired flushing. AUTHORITY shall complete all flushing as required in these testing procedures and where necessary to conform to typical water quality requirements. CONTRACTOR/DEVELOPER shall be charged for AUTHORITY staff time to flush. Potable water shall be used for disinfection, hydrostatic pressure testing, and flushing. Drainage shall take place away from the construction or work area. Adequate drainage must be provided during flushing. If applicable, the valve(s) isolating the main from existing system shall be locked out and tagged out to prevent unintentional release of the elevated chlorine residual water used for disinfection. Valves and hydrants shall only be operated by AUTHORITY staff.
  - C. Dechlorination: When dichlorination is required, it is recommended that any high-velocity flushing be completed prior to disinfection. Dechlorination equipment may not be capable of handling high flows with high levels of chlorine.
  - D. Tablet Method:
    1. Place calcium hypochlorite granules or tablets in the water main during installation and then filling the main with potable water to create a chlorine solution. This method may be used only if the pipes and appurtenances are kept clean and dry during construction. This method shall NOT be used on solvent-welded plastic or on screwed-joint steel

pipe because of the danger of fire or explosion from the reaction of the joint compounds with calcium hypochlorite.

2. Calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-ft intervals. The quantity of the granules at each location shall be as shown in Table 1 below.

**Table 1 Weight of calcium hypochlorite granules to be placed at beginning of main and at each 500-ft (150-m) interval**

Pipe Diameter ( <i>d</i> )		Calcium Hypochlorite Granules	
<i>in.</i>	<i>(mm)</i>	<i>oz</i>	<i>(g)</i>
4	(100)	1.7	(48)
6	(150)	3.8	(108)
8	(200)	6.7	(190)
10	(250)	10.5	(298)
12	(300)	15.1	(428)
14 and larger	(350 and larger)	$D^2 \times 15.1$	$D^2 \times 428$

Where *D* is the inside pipe diameter, in feet  $D = d/12$

3. Calcium hypochlorite tablets (5-grams) shall be placed in the upstream end of each section of pipe to be disinfected, including branch lines. Also, at least one tablet shall be placed in each hydrant branch and in other appurtenances. The number of 5-g tablets required for each pipe section shall be  $0.0012 d^2 L$  rounded to the next higher integer, where *d* is the inside pipe diameter, in inches, and *L* is the length of the pipe section, in feet. Table 2 below shows the number of tablets required for commonly used sizes of pipe. Calcium hypochlorite tablets shall be attached by an adhesive meeting the requirements of NSF/ANSI 61. There shall be adhesive only on the broadside of the tablet attached to the surface of the pipe. Attach tablets inside and at the top of the main. If the tablets are attached before the pipe section is placed in the trench, their positions shall be marked on the pipe exterior to indicate that the pipe has been installed with tablets at the top.

**Table 2 Number of 5-g calcium hypochlorite tablets required for dose of 25 mg/L\***

Pipe Diameter		Length of Pipe Section, <i>ft (m)</i>				
		13 (4.0) or less	18 (5.5)	20 (6.1)	30 (9.1)	40 (12.2)
<i>in.</i>	<i>(mm)</i>	Number of 5-g Calcium Hypochlorite Tablets				
4	(100)	1	1	1	1	1
6	(150)	1	1	1	2	2
8	(200)	1	2	2	3	4
10	(250)	2	3	3	4	5
12	(300)	3	4	4	6	7
16	(400)	4	6	7	10	13

\*Based on 3.25-g available chlorine per tablet

4. When installation has been completed, the main shall be filled with water such that the full pipe velocity is no greater than 1ft/sec. Fill rate must be carefully controlled to ensure tablets do not come loose from pipe. Precautions shall be taken to ensure that air pockets are eliminated.
5. The chlorinated water shall remain in place for at least 24 hours. If the water temperature is less than 41 degrees Fahrenheit, the water shall remain in the pipe for at least 48 hours. A detectable free chlorine residual (greater than 0.2 mg/L) shall be found at each sampling point after the 24- or 48- hour period.

#### E. Continuous-Feed Method of Chlorination

1. The continuous-feed method consists of completely filling the main with potable water, removing air pockets, then flushing the completed main to remove particulates, and refilling the main with potable water that has been chlorinated to 25mg/L. After a 24-hour holding period in the main there shall be a free chlorine residual of not less than 10mg/L.
2. Before the main is chlorinated, it shall be filled with potable water to eliminate air pockets and flushed to remove particulates. The flushing velocity in the main shall be greater than or equal to 3.0ft/sec. Table 3 below shows the rates of flow required to produce a velocity of 3ft/sec in commonly used pipes.

**Table 3 Required flow and openings (either taps or hydrants) to flush pipelines at 3.0 ft/sec (0.91 m/sec) (40 psi [276 kPa] residual pressure in water main)\***

Pipe Diameter		Flow Required to Produce 3.0 ft/sec (approx.) Velocity in Main		Size of Tap Used, in. (mm)			Number of Hydrant Outlets	
				1 (25)	1½ (38)	2 (51)		
<i>in.</i>	<i>(mm)</i>	<i>gpm</i>	<i>(L/sec)</i>	Number of Taps Required on Pipe†			2½-in. (64-mm)	4½-in. (114 mm)
4	(100)	120	(7.4)	1	—	—	1	1
6	(150)	260	(16.7)	—	1	—	1	1
8	(200)	470	(29.7)	—	2	—	1	1
10	(250)	730	(46.3)	—	3	2	1	1
12	(300)	1,060	(66.7)	—	—	3	2	1
16	(400)	1,880	(118.6)	—	—	5	2	1

\*With a 40-psi (276-kPa) pressure in the main with the hydrant flowing to atmosphere, a 2½-in. (64-mm) hydrant outlet will discharge approximately 1,000 gpm (63.1 L/sec); and a 4½-in. (114-mm) hydrant outlet will discharge approximately 2,500 gpm (160 L/sec).

†Number of taps on pipe based on 3.0-ft/sec discharge through 5 ft (1.5 m) of galvanized iron (GI) pipe with one 90° elbow.

3. To chlorinate the main, water shall be supplied through a backflow preventing device. Main shall be filled at a constant, measured rate into the newly installed main. The main shall undergo hydrostatic testing prior to disinfection.
4. At a point not more than 10ft downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will not have less than 25mg/L free chlorine. Table 4 below provides the amount of chlorine required for each 100 ft of pipe for various pipe diameters. Solutions with a minimum 1 percent chlorine concentration may be prepared with sodium hypochlorite or calcium hypochlorite. The latter solution required 1 lb of calcium hypochlorite in 8 gal of water.

**Table 4 Chlorine required to produce an initial 25-mg/L concentration in 100 ft (30.5 m) of pipe by diameter**

Pipe Diameter		100% Chlorine		1% Chlorine Solution	
<i>in.</i>	<i>(mm)</i>	<i>lb</i>	<i>(g)</i>	<i>gal</i>	<i>(L)</i>
4	(100)	0.013	(5.9)	0.16	(0.6)
6	(150)	0.030	(13.6)	0.36	(1.4)
8	(200)	0.054	(24.5)	0.65	(2.5)
10	(250)	0.085	(38.6)	1.02	(3.9)
12	(300)	0.120	(54.4)	1.44	(5.4)
16	(400)	0.217	(98.4)	2.60	(9.8)



5. Chlorine application shall not cease until the entire main is filled with chlorinated water. The chlorinated water shall be retained in the main for a least 24 hours, during which time valves and hydrants in treated section shall be operated to ensure disinfection of the appurtenances. At the end of this 24-hr period, the treated water in all portions of the main shall have a residual of at least 10mg/L.

F. Bacteriological Testing

1. After hydrostatic testing and chlorination have been completed, purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired.
2. Flushing shall be completed by the AUTHORITY and occur until the residual free chlorine level is less than 4.0mg/L and greater than 0.2 mg/L. AUTHORITY shall be notified at least 72 hours prior to desired flushing.
3. Bacteriological samples shall be taken by the AUTHORITY in accordance with AWWA C651. AUTHORITY shall submit water samples in appropriate bottles. A sample shall mean a representative amount of water in a laboratory approved container that is analyzed for both the presence of total coliform and the presence of e.coli. The presence of either constituent shall be considered a failed sample. Two consecutive passing samples are required, in accordance with PA DEP requirements. Samples shall be taken at least 24 hours apart. CONTRACTOR shall be responsible for repeating the chlorination process and the AUTHORITY repeating the flushing process until two consecutive passed samples are achieved. The AUTHORITY shall be notified at least 48 hours prior to desired sampling.
4. Disinfection, flushing, and bacteriological processes shall be repeated until all new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired all pass bacteriological testing in accordance with PA DEP requirements.
5. Prepare reports of purging and disinfecting activities.

**END OF SECTION**

**SECTION 7 – CAST-IN-PLACE CONCRETE****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Cast-in-place concrete work for:
  - 1. Pipe thrust restraint
  - 2. Restoration of disturbed/damaged concrete curbs and sidewalks
  - 5. Miscellaneous concrete specified in other Sections.

**1.02 RELATED WORK****1.03 REFERENCES**

- A. American Concrete Institute (ACI)
  - 1. 301 – Specifications for Structural Concrete for Buildings
  - 2. 305- Hot Weather Concreting
  - 3. 306 – Cold Weather Concreting
  - 4. 318 – Building Code Requirements for reinforced concrete
  - 5. 347 – Recommended practice for concrete formwork
- B. American Society for Testing and Materials (ASTM)
  - 1. A615 – Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
  - 2. C31 – Making and Curing Concrete Test Specimens in the Field
  - 3. C39 – Compressive Strength of Cylindrical Concrete Specimens
  - 4. C94 – Ready-Mixed Concrete
  - 5. C143 – Slump of Portland Cement Concrete
  - 6. C173 – Air Content of Freshly Mixed Concrete by the Volume Method
- C. Pennsylvania Department of Transportation (PennDOT) Publication 408, latest edition

1. Section 704 – Cement Concrete
2. Section 711 – Concrete Curing Material and Admixtures
3. Section 1001 – Cement Concrete Structures

#### 1.04 PROJECT REQUIREMENTS

- A. DEVELOPER shall be responsible for replacing or restoring all concrete damaged or disturbed in performing work of the Project to match original conditions in addition to those requirements specified herein this Section.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Concrete: Class A cement concrete as specified in PennDOT Publication 408, Section 704.1 (b), 3300 psi minimum compressive strength at 28 days.
- B. Concrete Admixtures: Curing Materials and Admixtures: As specified in PennDOT Publication 408, Section 711.
- C. Liquid Membrane-Forming Curing Compound: As specified in PennDOT Publication 408, Section 711.
- D. Reinforcing Bars: 60 ksi yield grade, ASTM A615, deformed billet steel bars.
- E. Curb and Sidewalk Restoration Materials: Materials shall comply with Strasburg Borough Specifications.
- F. Epoxy Bonding Compound: Use product equivalent to A.C. Horn AEpoxyte Binder of Sika Chemical Sikadur 32 Hi-Mod.
- G. Form coatings: Provide commercial formulation form-coating compounds that will not bond with, nor affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work.

- B. Verify that excavation is completed to required depth, and that subgrade has been properly compacted.

### 3.02 PREPARATION

- A. Accurately place and adequately support embedded items and joint materials in pour.
- B. Prepare existing hardened concrete to bond to new concrete.
  - 1. Roughen and clean existing concrete surface of foreign matter.
  - 2. Apply Epoxy Bonding Compound over existing prepared concrete according to manufacturer's instructions.
- C. Sprinkle sufficient water over subgrade to prevent water loss from concrete.

### 3.03 FORMING

- A. Construct forms according to ACI 347 to required dimensions, plumb and straight.
  - 1. Securely brace and shore forms to prevent displacement, bowing and pillowing, and to safely support imposed concrete load.
  - 2. Fabricate forms for easy removal without harming or prying against concrete surfaces.
- B. Provide openings in concrete formwork of the correct size and in the proper location to accommodate piping and other construction work items. Accurately place and securely support items to be built into forms.
- C. Where soil conditions will permit excavation to accurate sizes without bracing, and where cave-ins can be prevented during the concrete pour, earth forms may be used. Earth forms shall be wetted, but not muddy before concrete is placed.

### 3.04 REINFORCING

- A. Place reinforcing steel accurately and securely brace against displacement using reinforcing accessories according to ACI 318.
- B. Splice bars according to ACI 318.

### 3.05 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301.

- B. Notify AUTHORITY minimum 24 hours prior to commencing concrete pour.
- C. Ensure that reinforcement, formed expansion and construction joints and embedded items are not disturbed during concrete placement.
- D. Place concrete continuously between predetermined expansion, control, and construction joints.
- E. Do not interrupt successive placement; do not permit cold joints to occur.
- F. Consolidate concrete by vibration, spading, rodding or other manual methods.
- G. Perform concrete work in cold and hot weather according to ACI 306 and ACI 305, respectively.

### 3.06 FINISHING

- A. Finish concrete to match original conditions or as directed by AUTHORITY.

### 3.07 CURING

- A. Cure concrete with Liquid Membrane-Forming Curing Compound. Apply curing compound in accordance with PennDOT Publication 408, Section 1001.3.

### 3.08 CURB AND SIDEWALK RESTORATION

- A. Restore curbs and sidewalks damaged by construction to conform to Strasburg Borough Specifications.
- B. Saw cut and reconstruct sidewalks to the first expansion joint on either side of the damaged section.
- C. Saw cut and reconstruct curbs to a minimum of one (1) foot beyond each side of damaged section. Match original lines and grades.

**END OF SECTION**

**SECTION 8 – GROUT****PART 1 – GENERAL****1.01 SECTION INCLUDES**

- A. Cement grout for:
  - 1. Manholes
  - 2. Miscellaneous grout requirements

**1.02 RELATED WORK**

- A. Section 5 – Manholes
- B. Section 7 – Cast-In-Place Concrete
- C. Individual grouting requirements

**1.03 REFERENCES**

- A. American Society for Testing and Materials:
  - 1. ASTM C 191, Test Method for Time of Setting of Hydraulic Cement by Vicat Needle.
  - 2. ASTM C 596, Test Method for Drying Shrinkage of Mortar Containing Portland Cement.
  - 3. ASTM C 827, Test Method for Early Volume Change of Cementitious Mixtures.

**1.04 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Prevent moisture damage and contamination of materials.
- B. Store materials in undamaged condition with seals and labels intact as packaged by the manufacturer.

**1.05 SITE CONDITIONS**

- A. Protect against high and low temperatures and bad weather in accordance with American Concrete Institute standards for placement of concrete.

**PART 2 – PRODUCTS****2.01 MATERIALS**

- A. Non-Shrink Non-Metallic Grout: Factory Premixed material containing no corrosive irons, aluminums, chemicals, or gypsums.
  - 1. Grouts containing water reducers, accelerators, or fluidifiers shall have no drying shrinkage greater than the equivalent cement and water mix as tested per ASTM C 596.
  - 2. Grout shall be nonshrink before initial set and show no expansion after set as tested per ASTM C 827.
  - 3. Initial set of grout not less than 60 minutes per ASTM C 191 Test.
  - 4. Use Type I (Normal) cement for grout applications not in contact with sewage.
  - 5. Use Type II (Sulfate Resistant) cement for grout applications in contact with sewage.
  - 6. Acceptable Manufacturer: U.S. Grout Corporation; FIVE STAR.

**2.02 CHEMICAL GROUP**

- A. General: An intimate mixture of dry acrylamide and dry, N, N-methylenebisacrylamide, in such proportions that dilute aqueous solutions, when properly catalyzed, will form stiff gels.
  - 1. The grout must make a true solution at concentrations as high as three pounds per gallon of water.
  - 2. The viscosity of the chemical solution shall have a viscosity of less than 2 cps, which remains constant until gelation occurs.
  - 3. The reaction time shall be controllable from 10 seconds to 1 hour.
  - 4. The reaction shall produce a continuous and irreversible gel at chemical concentrations as low as 0.4 pounds per gallon of water.
- B. Catalyst: The catalyst for the chemical grout shall be ammonium persulfate. The material shall normally be used in combination with an activator, but it may be used in combination with a buffer for high-temperature work. Use of a catalyst containing Dimethyl Amino Propionitrile (DMAPN) is prohibited.

- C. Activator: Triethanolamine or other compounds of equivalent properties.
- D. Inhibitor: Under some conditions, it may be necessary or desirable to control the chemical reaction by inhibition. The inhibitor used shall be Potassium Ferricyanide.
- E. Portland Cement: ASTM C150, Type II.
- F. Fine Aggregate: ASTM C 33 gradation.
- G. Waterproof Cement Grout: A mixture of Portland cement, finely graded mineral fillers, and a chemical additive equal to Drycon, a product of IPA Systems, Inc., or BASF MasterSeal 581.
- H. Joint Sealant Compound: Federal Specification SS-S-00210, preformed, flexible, self-adhering, cold applied.

## 2.03 GROUT QUALITY

- A. Non-Shrink Grout: Use ready-mix type requiring only the addition of water. Do not add other materials. Water requirement proportions shall conform to manufacturer's specifications for the desired mix consistence.

## PART 3 – EXECUTION

### 3.01 PREPARATION

- A. Forming:
  - 1. Use forming procedures that allow proper and complete placement of grout.
  - 2. Anchor support elements so no movement is possible.
  - 3. Remove supports only after grout has hardened.
  - 4. Pre-treat with forming oils wood forms that may absorb moisture.
- B. Preparation of Surface:
  - 1. Non-Shrink Grout: Prepare in accordance with manufacturer's printed instructions.



### 3.02 MIXING

#### A. Time:

1. Non-Shrink Grout: In accordance with manufacturer's printed instructions.

### 3.03 PLACING

- #### A. Non-Shrink Non-Metallic Grout:
- Perform grout placement in accordance with the recommendations of ACI and the manufacturer's published specifications for mixing and placing. Place Non-Shrink Non-Metallic grout only where indicated on Drawings.

### 3.04 MANHOLE SEALING

#### A. Manhole Grouting Repair

1. Drill a hole at each identifiable leakage point from the inside of the manhole, extending through the side wall of the manhole. Insert a metal rod through the hole to determine if there is an exterior void space.
2. Fill any void space found with hydraulic grout mix consisting of one part Portland cement, maximum of three parts sand, and water just sufficient to allow the mix to be pumped into the void space until refusal is recorded by a rise in pressure on a pump pressure gauge. Ensure the hole through the manhole wall is kept open and free of hydraulic grout. Plug hole and allow one hour for the hydraulic grout to set.
3. Upon completion of hydraulic void grouting, pump chemical grout until refusal at a minimum pressure of 3.0 psig through probe type injection equipment. Deposit sealant from the interior surface of the set hydraulic grout through the drilled hole to the inside periphery of the manhole. Mix, apply, and cure chemical grout according to manufacturer's instructions.
4. Upon setting of the chemical grout, remove excess material protruding into the inside of the manhole.
5. When authorized by AUTHORITY in writing, parging the interior of manholes when two coats of waterproof cement grout can be done in lieu of hole drilling and hydraulic grouting specified. Prior to parging manhole, surfaces shall be cleaned by high velocity water jet or other means to remove all grease, sludge, sewage and dirt.

**B. Sealing Manhole Cover Frames**

1. On manholes being grouted and sealed, remove the frame and cover and clean the bottom of the frame of any mortar or other materials stuck to the casting. Remove any loose materials from the manhole structure.
2. Apply joint sealant compound to the top of the manhole and replace the frame and covers squeezing the compound into crevices. Trowel any compound that squeezes into the manhole flush with the interior surface.

**END OF SECTION**

## **SECTION 9 – GREASE TRAPS**

### **PART 1 – GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Grease Traps

#### **1.02 RELATED SECTIONS**

- A. Section 2 – Trenching, Backfilling and Compaction
- B. Section 5 – Manholes

#### **1.03 REFERENCES**

- 1. ASTM A48, Gray Iron Castings
- 2. ASTM A615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
- 3. ASTM C478, Precast Reinforced Concrete Manhole Sections

#### **1.04 SUBMITTALS**

- 1. Make submissions required by Section 1 Construction Submittals

### **PART 2 – PRODUCTS**

#### **2.01 REQUIREMENTS**

- A. All connections to the sewer system which discharge wastewater containing oils and/or greases shall be provided with a grease trap. Requirement shall include food processing and/or production establishments serving food, as well as those involving equipment or materials from which oils or greases could enter the wastewater generated from the property.
- B. Volume of grease trap shall be determined by DEVELOPER with minimum volume being 500 gallons. AUTHORITY reserves right to require a greater volume or multiple units.
- C. Grease trap shall be baffled and provided with direct access for cleanout of each compartment. Unit shall be installed outside in an area with easy and continuous access for a tanker unit to remove waste from the unit.

**2.02 GREASE TRAP**

- A. Unit shall be precast concrete meeting all requirements of Section 5. – Manholes and the Standard Detail Drawing and shall be suitable to withstand traffic loads.
- B. Access covers shall be gasketed to prevent the inflow of groundwater, surface water or rain from entering the unit. Where required, covers shall be suitable to withstand traffic loads. Should usage in the area of installation be modified to a traffic area from a non-traffic area, the covers shall be changed to withstand traffic loads.

**2.03 PIPE MATERIALS**

- A. Connection of the grease trap to the AUTHORITY's system shall comply with Section 4 Piping and Appurtenances.

**PART 3 – EXECUTION****3.01 INSTALLATION**

- A. Grease trap and all connecting piping and appurtenances shall conform to the requirements of Section 2 – Excavating, Backfilling and Compaction and Section 4 – Pipe and Fittings.
- B. Installation shall be in accordance with Standard Detail Drawing.

**END OF SECTION**